Morris County, NJ

Hazard Mitigation Plan Update 2025

Created in consultation with Tidal Basin Government Consulting

TABLE OF CONTENTS

SECTION 1: INTRODUCTION AND PLANNING PROCESS

1.1 INTRODUCTION

Hazard mitigation is defined as any action taken before, during, or after a disaster to permanently eliminate or reduce the long-term risk to human life and property. Hazard mitigation is crucial to a comprehensive emergency management program, working alongside preparedness, response and recovery efforts. This plan will help participating jurisdictions lower their risk to natural hazards and enhance their resilience by identifying local policies and actions to reduce losses.

The 2025 Morris County Hazard Mitigation Plan update provides a framework to enhance the general well-being, safety and resilience of residents and communities across Morris County. This plan considers the impact of natural hazards across the planning area, reviews current levels of capability relevant to hazard mitigation, and identifies a comprehensive hazard mitigation strategy to buy down levels of risk.

1.2 PLAN GOALS AND OBJECTIVES

The planning process included a review and update of the prior mitigation goals and objectives as a basis for the planning process and selection of appropriate mitigation actions addressing all hazards of concern. Upon consideration, participating jurisdictions opted not to change the goals from the 2020 plan update. The goals are:

Goal 1. Reduce the impacts of hazards on people, property, the environment and the economy.

Goal 2. Improve education and outreach efforts regarding potential impacts of hazards and the identification of specific measures that can be taken to reduce their impact.

Goal 3. Improve data collection, use and sharing to reduce the impact of hazards.

Goal 4. Improve capabilities, coordination and opportunities at municipal and county levels to plan and implement hazard mitigation projects, programs and activities.

Goal 5. Pursue opportunities to mitigate repetitive loss properties and other appropriate hazard mitigation projects, programs and activities.

1.3 ORGANIZATION OF THE HAZARD MITIGATION PLAN

The Morris County HMP update is organized as follows:

Section 1. Introduction and Planning Process: Overview of participants, planning process and information regarding adoption of the HMP by Morris County and each participating jurisdiction. Description of the HMP methodology and development process; Local Planning Committee and stakeholder involvement efforts; and a description of how this HMP will be incorporated into existing programs.

Section 2. Profile and Capability Assessment: Overview of Morris County, including: (1) physical setting, (2) land use, (3) land use trends, (4) population and demographics, (5) general building stock and (6) critical facilities and lifelines. 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.

Section 3. Hazard Identification and Risk Assessment: Documentation of the hazard identification and hazard risk ranking process, hazard profiles, and findings of the vulnerability assessment (estimates of the impact of hazard events on life, safety, health, general building stock, critical facilities, the economy); description of the status of local data; and planned steps to improve local data to support mitigation planning.

Section 4. Mitigation Strategy: Information regarding the mitigation goals and objectives in response to priority hazards of concern and the process by which Morris County and local mitigation strategies have been developed or updated.

Section 5. Plan Maintenance Procedures: System established to continue to monitor, evaluate, maintain, and update the HMP.

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

Appendices include the following:

Appendix A - Plan Adoption: Resolutions from the County and each jurisdiction included as each formally adopts the HMP update.

Appendix B - Process Documentation: Matrix to give a broad overview and records of the key elements of the planning process, including planning meetings, the community survey and the plan review process.

Appendix C - Local Planning Committee: A list of participants on the Local Planning Team for the plan update.

Appendix D - Stakeholders: A list of stakeholder organizations and methods of participation.

Appendix E - Community Participation: A chart showing community participation in core planning activities for the plan update.

Appendix F – Municipal Summaries: Morris County-produced Municipal Summaries providing additional demographic, economic, employment, education and land use data for each participating jurisdiction.

1.4 PLANNING PROCESS OVERVIEW

1.4.1 UPDATE FOCUS AREAS

The Morris 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 local and regional agencies and staff, as well as stakeholders, federal and state agencies, and the residents of the County. The Local Planning Committee (LPC) solicited information from local agencies and individuals with specific knowledge of certain hazards and past historical events, as well as considering planning and zoning codes, ordinances, and other recent planning decisions. The hazard mitigation strategies identified in this HMP have been developed through an extensive planning process involving local, county and regional agencies, County residents and stakeholders.

- Documenting progress of each participating jurisdiction.
- Incorporating hazard information into the hazard identification and risk assessment (HIRA).
- Evaluating and strengthening the hazard mitigation strategy.
- Prioritizing engagement with traditionally underrepresented populations.
- Emphasizing climate change's influence on hazards and their impacts.
- Refining information in the 2020 plan for improved clarity and efficiency.
- Ensuring that relevant information in all sections was updated.
- Ensuring that the plan reflects any changes in community priorities.

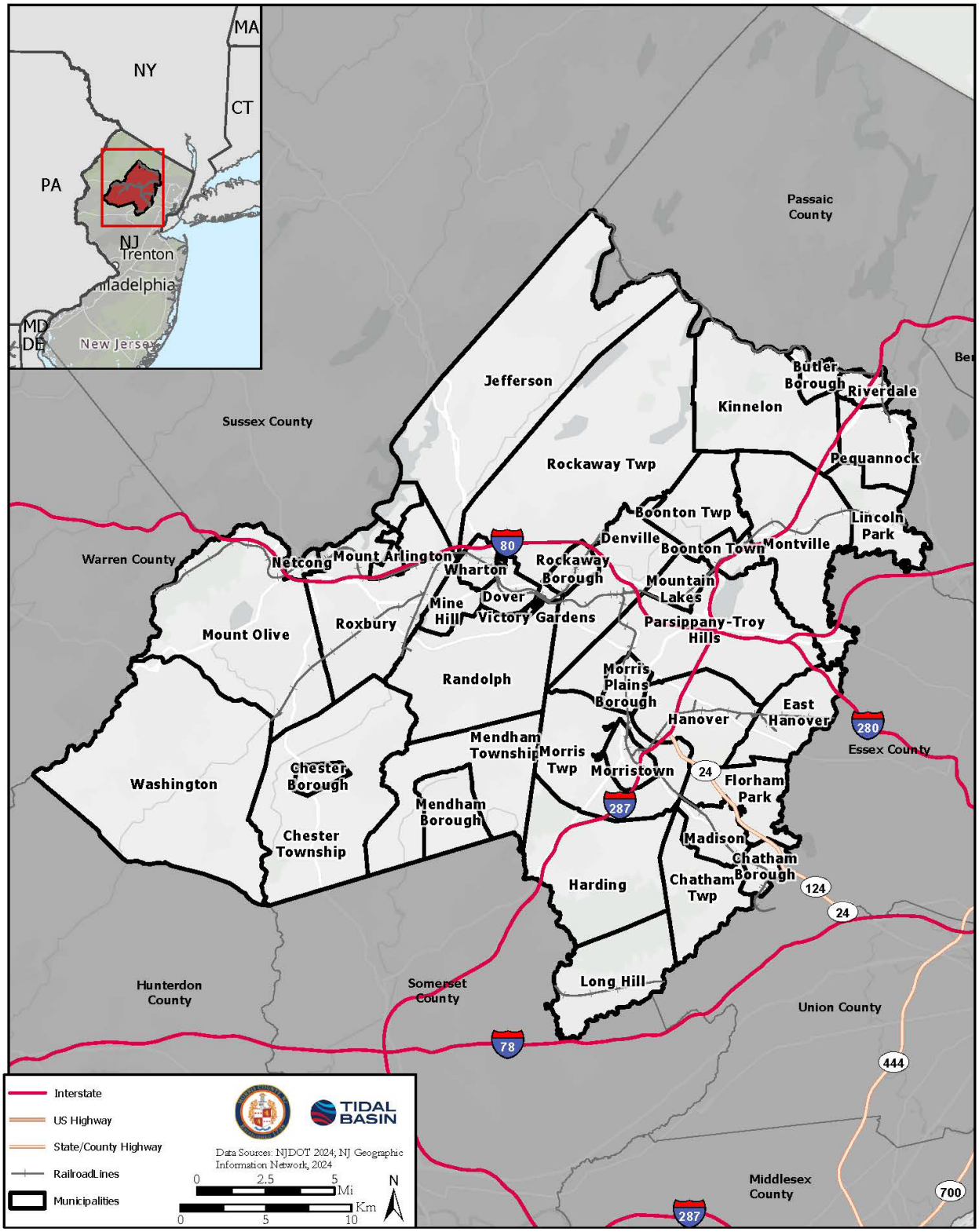
1.4.2 DEFINING THE PLANNING AREA

Table 1 shows all jurisdictions participating in the plan update.

Table 1. Participating Jurisdictions

Jurisdictions		
	Morris County	
Boonton, Town	Jefferson, Township	Mount Olive, Township
Boonton, Township	Kinnelon, Borough	Mountain Lakes, Borough
Butler, Borough	Lincoln Park, Borough	Netcong, Borough
Chatham, Borough	Long Hill, Township	Parsippany Troy Hills, Township
Chatham, Township	Madison, Borough	Pequannock, Township
Chester, Borough	Mendham, Borough	Randolph, Township
Chester, Township	Mendham, Township	Riverdale, Borough
Denville, Township	Mine Hill, Township	Rockaway, Borough
Dover, Town	Montville, Township	Rockaway, Township
East Hanover, Township	Morris Plains, Borough	Roxbury, Township
Florham Park, Borough	Morris, Township	Victory Gardens, Borough
Hanover, Township	Morristown, Town	Washington, Township
Harding, Township	Mount Arlington, Borough	Wharton, Borough

Figure 1. Morris County, NJ



1.4.3 LOCAL PLANNING COMMITTEE

In April 2023, the Morris County Office of Emergency Management (OEM) initiated the planning process, inviting municipalities to join and designate points of contact (POC) for the Planning Committee. Municipalities received the Planning Partner Expectations and were requested to declare their intent to participate through a Letter of Intent to Participate (LOIP). They were also asked to identify a primary and secondary planning POC for the Planning Committee and represent the interests of their respective community. In addition, each municipality's Floodplain Administrator (FPA) was identified in the LOIP and encouraged to actively participate in the planning process.

Morris County developed a Local Planning Committee (LPC) to provide guidance and direction to the planning effort. As the primary liaison for all participating jurisdictions and interest groups, the LPC played a pivotal role in facilitating the development of the HMP. The committee's efforts were focused on creating a plan that would receive political support and acceptance from the planning area's constituency. All municipalities participating in the plan update provided a primary point of contact (POC), alternate POC and their Floodplain Administrator to represent each community on the LPC. The LPC's responsibilities included:

- Participation in meetings and the planning process.
- Understanding risks and how they impact each community and the county.
- Formulating at least one new or continuing hazard mitigation action for the updated hazard mitigation strategy.
- Reviewing and commenting on draft plan documents.
- Adopting the plan once it receives the "Approved Pending Adoption" designation from the Federal Emergency Management Agency (FEMA).

The LPC held three meetings during the planning process:

- **Meeting 1** served as the kickoff meeting to the process and was held remotely via Microsoft Teams. During this meeting, the LPC discussed the HMP, reviewed process requirements and began the process on status reporting on community capabilities and 2020 mitigation action progress.
- **Meeting 2** focused on the preliminary results of the hazard identification and risk assessment (HIRA) update. Results were presented, and the LPC provided feedback on each hazard which was included in the final draft. Following this meeting, a full draft of the HIRA was provided to the LPC for review and comment. This meeting was held on-site in Morris County.
- **Meeting 3** focused on developing and updating the hazard mitigation strategy for each participating jurisdiction. The LPC discussed types of mitigation actions, requirements for each action, and the process for including new mitigation actions in the updated mitigation strategy. This meeting was held remotely. Additional follow-up meetings were held with any community that requested one

Following Meeting 3, additional follow-up meetings were held with any community that requested one to provide community-specific support to identify and develop mitigation actions. A list of LPC members is included in Appendix C.

1.4.4 PUBLIC AND STAKEHOLDER OUTREACH

Public engagement is a key component to the HMP's success. Public outreach was accomplished both at the beginning and the end of the process. An electronic survey regarding hazard mitigation was released on September 25, 2023, utilizing the web-based Microsoft Forms survey tool. The survey period ran until Friday, October 13, 2023. The survey was advertised by the county and jurisdictions within. A full accounting of advertising for the public survey is included in the Planning Process Appendix to this plan. Comments received were reviewed and integrated as appropriate.

Efforts were made by Morris County and participating jurisdictions to focus on including traditionally underserved populations (TUP) into the planning effort. To this end, the LPC identified key TUPs and focused on advocacy groups and organizations that support these populations. Two large-scale meetings were held with these advocacy groups, and an amended survey was sent out to collect input on hazards and how they impact different TUPs. This process ran from April 1 to April 19, 2024. Comments received were reviewed and integrated as appropriate.

After completing the draft plan, it was opened for public review from March 31 through April 11, 2025. The plan was posted for online access, and a survey was developed to collect comments. Proofs of publication are located in the Planning Process Appendix. Comments received were reviewed and integrated as appropriate.

Stakeholders are the individuals, agencies, and jurisdictions that have a vested interest in the recommendations of the HMP, including all planning partners. Participating jurisdictions were asked to identify relevant stakeholders and work with them in their own communities to update information. This HMP update includes information and input provided by these stakeholders where appropriate. A list of stakeholder organizations is included in Appendix C.

1.4.5 REVIEWING COMMUNITY CAPABILITIES

Participating jurisdictions were provided the opportunity to review, update and add to the community capabilities identified in the previous plan; these capabilities were used as a baseline to identify areas upon which to build for the hazard mitigation strategy. Communities reported on capabilities in the following target areas:

- Plans
- Building codes, permitting, and inspections
- Land use planning and ordinances
- Administration
- Staff
- Technical capabilities
- Funding resources
- Programmatic and organizational capabilities

The outcome of the capability assessment surveys can be found in each community-specific annex in this document.

1.4.6 CONDUCTING A RISK ASSESSMENT

A risk assessment is a calculation of the threat, vulnerability, and consequence of natural hazards that impact the participating jurisdictions in the planning area. The following hazards were identified and assessed during the plan update process:

- Drought
- Earthquake
- Extreme Temperature (heat and cold)
- Flood (including urban flooding)
- Geological Hazards (landslide, subsidence, and sinkholes)
- Hazardous Materials (Fixed Sites and In Transit)
- Severe Weather (Hurricanes, Tropical Storms, High Winds, Tornadoes, Thunderstorms, Hail, Lightning)
- Severe Winter Storm (Heavy Snow, Blizzards, Ice Storms)
- Wildfire

Following an initial evaluation of hazard risk, the LPC discussed the results during the second planning meeting and added comment and context to the final assessment. Due to the length of the planning process, the risk assessment was re-reviewed and updated in December 2024 to ensure the latest information was incorporated. Further information on the risk assessment process can be found in Section 3.

1.4.7 DEVELOPING A HAZARD MITIGATION STRATEGY

The hazard mitigation strategy was structured in two phases. Initially, communities were provided a list of the hazard mitigation actions from the 2020 HMP. Communities were asked to assess their progress, employing a four-option status indicator to report updates:

- Not started
- In progress
- Completed
- Deleted

Communities were also asked to provide background information on each action where applicable, identifying:

- If an action was *completed*, when was it completed? Has the community seen any benefits from the project?
- If an action has *not been started*, why not?
- If an action is *in progress*, how much progress has been made? When is the project slated for completion?
- If an action is *deleted*, why?

This evaluation process enabled communities to establish a foundation of ongoing initiatives for the revised hazard mitigation strategy. After completing the HIRA, the LPC focus shifted to developing new hazard mitigation actions to enhance the 2025 strategy. Communities received instructions on creating these new actions, and what supporting information would be necessary for each action included in the plan. Customized planning support meetings were available for communities that requested additional engagement in developing mitigation strategies. These efforts are reflected in Section 4 of this plan.

1.4.8 KEEPING THE PLAN CURRENT

To ensure the plan remains a living document, the group discussed and confirmed plan maintenance procedures, which are located in Section 5. The plan maintenance process includes:

- Plan monitoring – tracking the implementation of the plan over time.
- Plan evaluation – assessing the effectiveness of the plan at achieving its stated purpose and goals.
- Plan updating – reviewing and revising the plan over its five (5)-year life cycle.
- Plan implementation in conjunction with other planning mechanisms.
- Continued public involvement.

1.4.9 REVIEW AND ADOPTION

Following the development of the complete plan draft, the plan was released for review and comment.

- LPC Review Period (July 22, 2024 – August 2, 2024)
- Public Review Period (March 31 – April 11, 2025)

Once the plan receives the Federal Emergency Management Agency's (FEMA) "Approved Pending Adoption" designation, Morris County and participating jurisdictions will be able to formally adopt the plan. The plan will remain in effect for five (5) years once approved. Adoptions are included as appendices to this document.

1.4.10 MAPPING AND ANALYSIS

Maps and analysis from the previous plan were reviewed at the outset of the planning process and the need for updates was assessed based on changes to base data. At the time, discussion with Morris County OEM and Morris County GIS revealed that due to the recency of analysis and mapping from the previous plan and relatively little change to data since, updates were not needed.

Maps and analysis were re-assessed halfway through the planning process; data updates were identified and mapping and analysis was updated as appropriate. Where items were not updated, data is considered comparable to the data used in the previous plan and is not expected to yield any new results. This plan reflects the best available data to identify where risks exist, how they are understood, and how they may ultimately be mitigated by the county and its participating jurisdictions as they move forward.

1.4.11 PROJECT TIMELINE

The following shows a general timeline for project activities during the planning process.

Timeframe	Activity
May 2023	Introductory letter sent to counties regarding the HMP; letters of intent to participate requested
June 2023	In-person and virtual kickoff meetings held; focused on kicking off the planning process Community status reporting tools sent
September 2023	Meeting #2 held; focused on hazard identification and risk assessment Community survey released
October 2023	Community survey extended
January 2024	Meeting #3 held; focused on updating hazard mitigation strategies
February 2024	Voluntary community-specific planning meetings held Community mitigation strategy updates requested
July 2024	Draft HMP sent to communities for review
October 2024	Draft HMP sent to communities for review
February 2025	Full HMP draft - LPC draft review opportunity
March 2025	Full HMP draft - Public draft review opportunity
April 2025	Full HMP draft - stakeholder review opportunity

SECTION 2: COUNTY PROFILE

2.1 INTRODUCTION

This profile describes the general information of the County (physical setting, population and demographics, general building stock, and land use and population trends) and critical facilities located within Morris County. Specific profile information is presented and analyzed to develop an understanding of the study area, including the economic, structural, and population assets at risk and the particular concerns that may be present related to hazards analyzed.

2.2 GENERAL INFORMATION

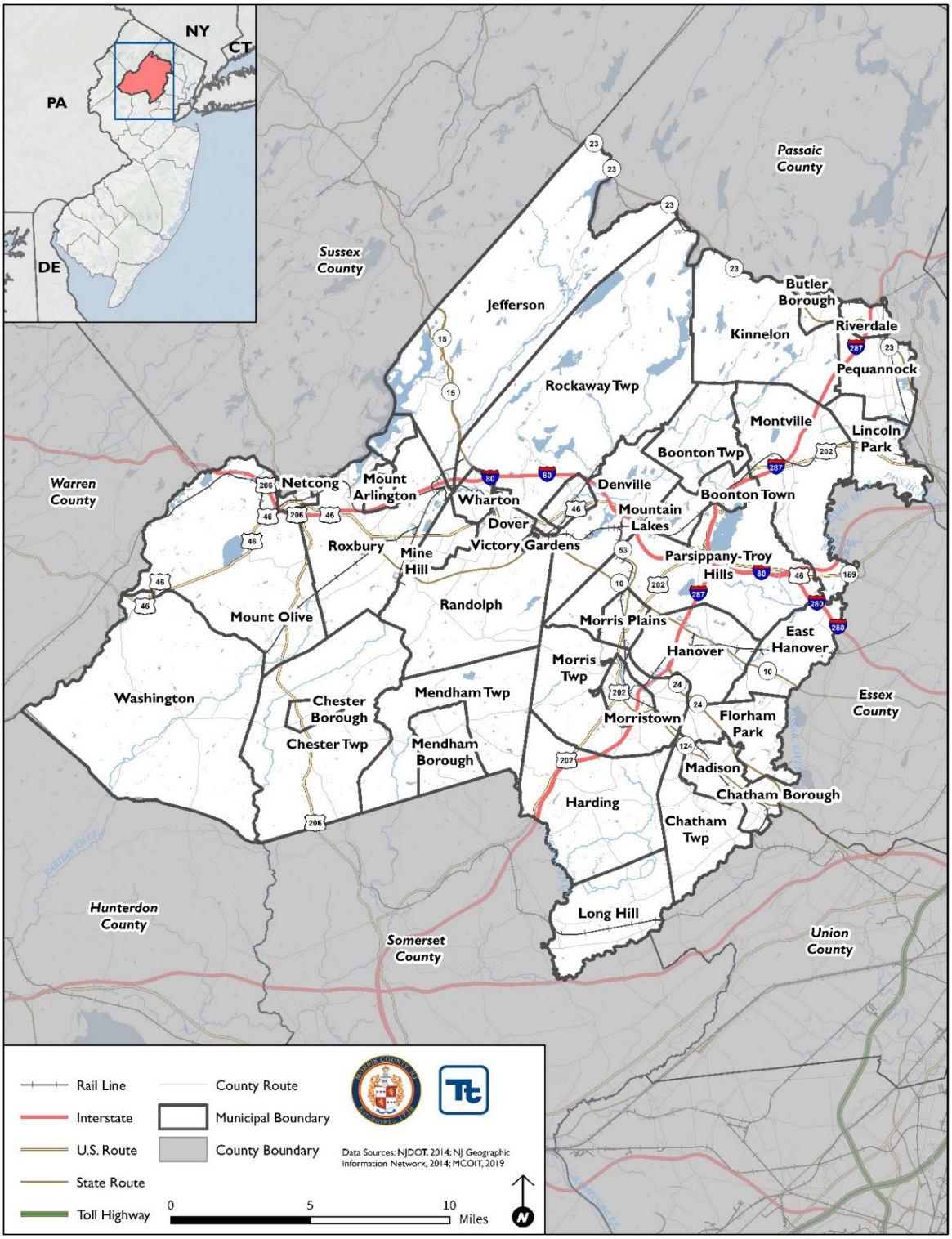
Morris County is one of the fastest growing counties in the New York-New Jersey-Connecticut metropolitan region. It is located amid rolling hills, broad valleys, and lakes approximately 30 miles northwest of New York City. Today, Morris County is the seventh largest county in New Jersey and home to major shopping centers, large residential areas, and colleges and universities. The county contains thirty-nine municipalities.

2.2.1 PHYSICAL SETTING

2.2.1.1 LOCATION

Morris County is located in the north-central section of New Jersey and encompasses a total area of approximately 482 square miles. The County is bordered by Passaic County to the northeast, Essex County to the east, Union County to the southeast, Somerset County to the south, Hunterdon County to the southwest, Warren County to the west, and Sussex County to the north/northwest. Most of the County's borders are riverine borders. The northern boundary is characterized by the Pequannock River. The Pompton River and the eastern branch of the Passaic River serves as the eastern border for the County. The western border is formed by the Musconetcong River.

Figure 2. Overview Map of Morris County



Source: 2020 Morris County Hazard Mitigation Plan

2.2.2 HYDROGRAPHY AND HYDROLOGY

Numerous ponds, lakes, creeks, and rivers make up the waterscape of Morris County, including the Musconetcong River, North and South Branch Raritan River, Northern and Southern Tributary, Passaic River, Peapack River, Pequannock River, Pinch Brook, Pompton River, Primrose Brook, Ramapo River, Rockaway River, Silver Brook, Spring Garden Brook, Stephensburg Brook, Stonehouse Brook, Stony Brook, Susquehanna Brook, Tanglewood Brook, Tanners Brook, Troy Brook, Watnong Brook, Weldon Brook, West Brook, West Ditch, Western Tributary, Whippany River, White Meadow Brook, and Wills Brook.

The rivers and streams within Morris County flow generally southwestward, following the trends of the Highlands. Exceptions to this are the east flowing Pequannock River, the Rockaway River which flows south out of Berkshire Valley and then east through a gap in the eastern Highlands, and the Passaic River which rises in southern Mendham Township, flows north through the Watchung Valley and turns eastward at Montville towards the Great Notch, Little Falls and Paterson.

2.2.2.1 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 into it.

Drainage basins generally refer to large watersheds that encompass the watersheds of many smaller rivers and streams. Morris County is encompassed by three major watershed basins: Delaware, Raritan and Passaic. Each are made up of smaller watersheds. Details regarding these water basins and watersheds are described below.

2.2.2.1.1 Delaware River Basin

The Delaware River Basin rises in the Catskill Mountains in New York State and travels 330 miles through 13,500 square miles of rural and urban landscapes and empties into the Atlantic Ocean. In Morris County, this Basin only has a small percentage of area. The Musconetcong Watershed is the only watershed in Morris County that is part of this Basin.

2.2.2.1.2 Passaic River Basin

The Passaic River Basin drains approximately 935 square miles of northern New Jersey and southern New York State. The Basin is divided into three regions, Highlands, Central Basin, and Lower Valley due to the amount and character of flooding within the Basin. The Highlands section of the Passaic River Basin drains approximately 489 square miles and most of the major tributaries to the Passaic River drain from the Highlands. These tributaries include the Whippany, Rockaway, Pequannock, Wanaque, Ramapo, and Pompton Rivers. These waterbodies are characterized by flash floods due to narrow and steep sided valleys.

2.2.2.1.3 Raritan River Basin

The Raritan River basin is the largest drainage area located entirely in New Jersey. The Basin contains portions of Morris, Hunterdon, Somerset, Mercer, Union, Middlesex, and Monmouth Counties. Approximately 1,100 square miles of the State's land drain into the Raritan Bay via the Raritan River and its tributaries while an additional 122 square miles is drained by the Shrewsberry and Navesink Rivers which empty into Sandy Hook Bay.

2.2.2.2 WATERSHED MANAGEMENT AREAS

The New Jersey Department of Environmental Protection (NJDEP) divided New Jersey into five water regions: the Northeast, Raritan, Northwest, Lower Delaware and Atlantic Coastal. Each water region is then divided into three

to five watershed management areas (WMAs), for a total of 20 WMAs. Each WMA encompasses a particular group of major rivers and each consists of numerous smaller watersheds. Morris County is located within the Raritan, Northwest and Northeast water regions. Additionally, the County is located in five of the 20 WMAs, which are described below.

2.2.2.2.1 WMA 1: Upper Delaware

WMA 1 is also known as the Upper Delaware River Watershed and encompasses 746 square miles in the mountainous northwestern corner of the State. WMA 1 includes portions of Sussex, Morris, Hunterdon Counties and all of Warren County. In total, it contains 54 municipalities in New Jersey.

2.2.2.2.2 WMA 3: Pompton, Pequannock, Wanaque, Ramapo

WMA 3 is located within the water-rich Highlands Province of New Jersey. The Pequannock, Wanaque and Ramapo Rivers all flow into the Pompton River WMA 3 contains some of the State's major water supply reservoir systems including the Wanaque Reservoir, the largest surface water reservoir in New Jersey.

2.2.2.2.3 WMA 4: Lower Passaic, Saddle River

WMA 4 includes the Lower Passaic River (from the Pompton River confluence downstream to the Newark Bay) and its tributaries, including the Saddle River. The WMA 4 drainage area is approximately 180 square miles and lies within portions of Passaic, Essex, Hudson, Morris and Bergen Counties. Two watersheds makeup WMA 4: the Lower Passaic River Watershed and Saddle River Watershed.

2.2.2.2.4 WMA 6: Upper and Mid Passaic, Whippany, Rockaway

WMA 6 represents the area drained by waters from the upper reaches of the Passaic River Basin including the Passaic River from its headwaters in Morris County to its confluence with the Pompton River. WMA 6 is characterized by extensive suburban development and reliance upon groundwater sources for water supply.

2.2.2.2.5 WMA 8: North and South Branch Raritan

WMA 8 includes the North and South Branches of the Raritan River and their tributaries. Large portions of Somerset, Hunterdon, and Morris Counties are included in this land area. Land use in the North Branch Raritan River Watershed is primarily rural, woodland and agricultural with scattered areas of commercial and residential but there is intense development along the major road corridors. Land use in the South Branch Raritan River Watershed is mostly agricultural, but suburban-industrial development is increasing at a rapid rate.

2.2.3 TOPOGRAPHY AND GEOLOGY

Hills and valleys run east-west, with rocky outcroppings as high as 1,000 feet above sea level in the County. Morris County is located within two physiographic provinces: the Highlands Province from to the north and west and the Piedmont Province to the east and southeast.

The Highlands portion of the county is characterized by a series of discontinuous rounded ridges separated by deep and narrow valleys. In general, this area of the County is located high above sea level. Landforms within the Highlands include generally northeast trending ridges and valleys gradually dropping in elevation from west to east. A 200 to 400-foot border escarpment on the eastern edge, traversing the County from the Borough of Kinnelon through Morristown and separates the Highlands from the adjacent Piedmont. Morris County is mostly encompassed by the Highlands Province and consists mainly of Precambrian gneissic bedrock underlain by limestone, sandstone, or shale bedrock in the area’s valley regions.

The Piedmont portions of Morris County are characterized by low rolling plains divided by higher ridges. In the area of the County where the Highlands Province meets the Piedmont Province, the land is approximately 300 to

400 feet above sea level. The land then slopes downward towards the south and eastern portions of the county. In the Piedmont Province area of the County, the ground mainly consists of soft red shale also known as Brunswick shale or sandstone bedrock.

2.2.4 CLIMATE

The climate of Morris County is mostly a temperate continental climate with some moderate maritime influences. Winter climate is controlled by polar continental air masses; summer climate by tropical air masses moving up over the United States from the Gulf of Mexico. The average annual precipitation is 46.17 inches. The average annual snowfall is 28.0 inches. The average temperature is 48.9°F, which is lower than the New Jersey average temperature of 51.9°F.

2.2.5 LAND USE, LAND COVER, AND LAND USE TRENDS

Local zoning and planning authority are provided for under the New Jersey Municipal Land Use Law, which gives municipalities zoning and planning authority. The DMA 2000 requires that communities consider land use trends, which can impact the need for, and priority of, mitigation options over time. Land use trends significantly impact exposure and vulnerability to various hazards. For example, significant development in a hazard area increases the building stock and population exposed to that hazard.

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

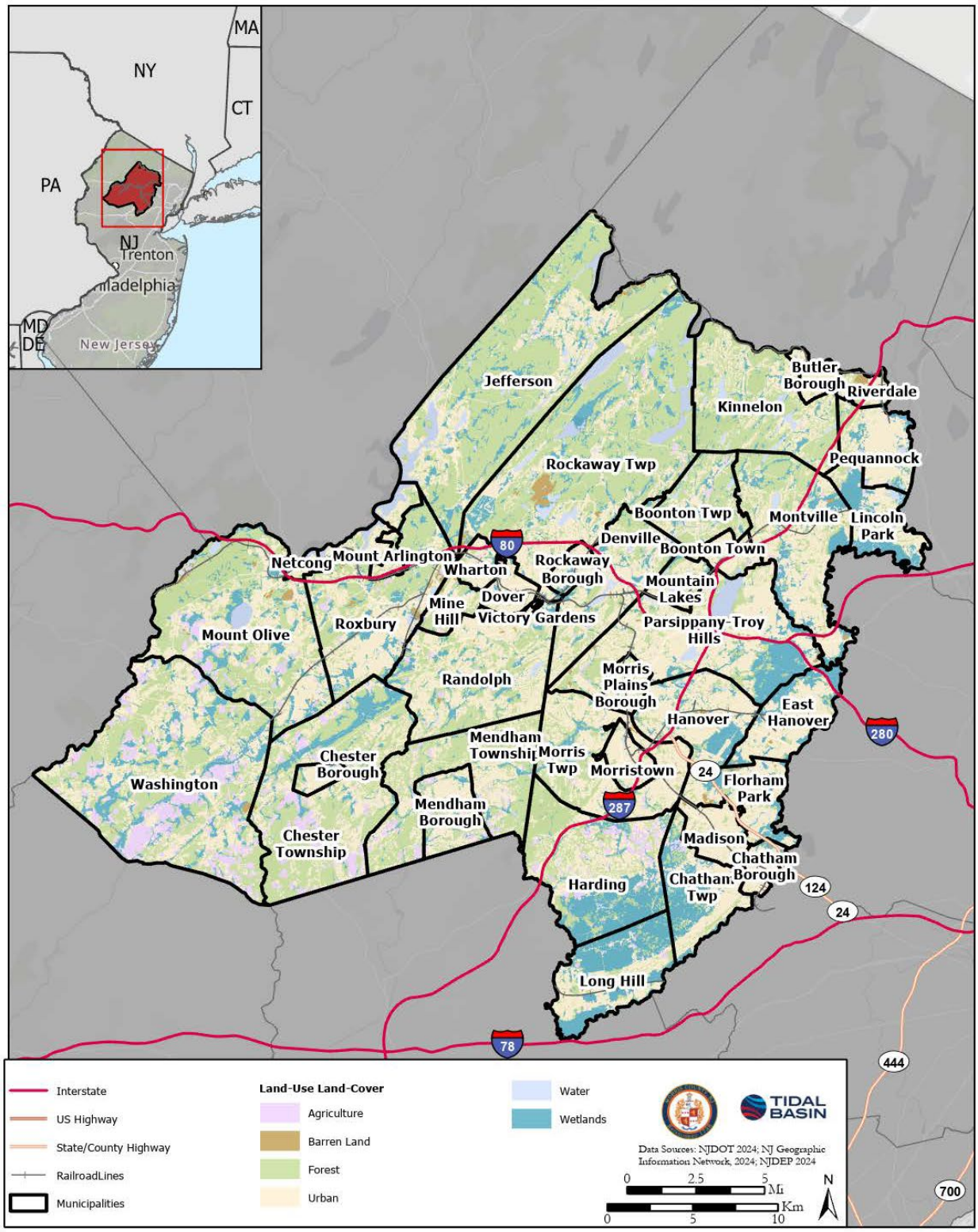
Morris County is one of the largest counties in the State and has a diverse landscape; the majority of the County is either forested or developed. Since 1986, the County has experienced a decrease in agricultural, barren, forest and wetlands. Table 2 provides a land use summary for Morris County.

Table 2. Land Use Summary for Morris County, 1986-2020

	1986	1995	2002	2007	2012	2015	2020	% Change 1986/2020
Total Acreage	**308,085.6**	**308,117.5**	**308,117.5**	**308,117.5**	**308,117.5**	**308,117.5**	**324,475.1**	**+5.3%**
Agriculture	18,318.6	14,831.8	13,303.3	13,353.8	11,748.5	11,752.2	11,821.7	-35.47%
Barren Land	2,986.1	3,000.6	3,425.0	3,237.8	2,539.8	2,550.6	2,462.5	-17.53%
Forest	129,856.4	126,294.3	124,011.3	122,566.3	118,818.8	118,857.4	130,785.3	+0.72%
Urban	103,557.1	108,652.0	113,061.0	114,487.2	120,748.0	120,747.8	122,972.3	+18.75%
Water	10,143.4	10,277.6	10,501.7	11,018.9	11,346.2	11,195.1	13,242.0	+30.55%
Wetlands	43,224.0	45,061.2	43,815.2	43,453.6	42,916.2	43,014.3	43,191.3	-0.08%

Source: Morris County 2020

Figure 3. Land Use in Morris County



2.2.6 AGRICULTURE

As of the 2021 tax assessment, Morris County showcases a substantial 30,605 acres of assessed farmland, making up 13% of the county's overall land area. Many of the farms within Morris County operate farm markets or stands, establishing vital direct connections with their customer base. Leading the farmland charge is Washington Township, accounting for an impressive 35.6%, followed by Chester Township (10.5%) and Mount Olive Township (9%). The county's landscape is predominantly urban and forested, covering nearly 80% of its total area. Nevertheless, a significant 11,600 acres are devoted to agricultural purposes according to the Morris County Farmland Preservation Plan.

2.2.7 OPEN SPACE AND PARKLAND

The Morris County Park Commission includes 38 facilities: historic sites, golf courses, outdoor educational and recreational facilities, arboreta, conservation areas, 150 miles of trails, and ice-skating arena. The Commission is the largest park system in New Jersey (based on acreage) with more than 18,900 acres of passive and active recreational opportunities throughout the County. This includes golf, hiking, ice skating, sledding, ice fishing, fishing, boating, swimming, cross-country skiing, snowshoeing, biking, recreational fields, environmental education and special programming throughout the year. The largest wildlife preserves in the County are the Mahlon Dickerson Reverse in Jefferson Township and Silas Condict Park in Kinnelon. Table 3 identifies the Morris County and New Jersey State parks located throughout the County.

Table 3. County, State and Federal Parks in Morris County

Park	Acreage	Municipality
Allamuchy Mountain and Stephens State Park	2,440	Mount Olive Township
Bamboo Brook Outdoor Education Center	687	Chester Township
Cooper Gristmill	14	Chester Township
Craigmeur Recreation Complex	69.55	Jefferson Township and Rockaway Township
Elizabeth D. Kay Environmental Center	822	Chester Township
Fosterfields Living Historical Farm	213.4	Morris Township
Frelinghuysen Arboretum	127	Morris Township
Great Swamp National Wildife Refuge	7,800	Chatham, Harding and Long Hill
Hacklebarney State Park	978	Chester Township
Hedden Park	420	Dover, Mine Hill, and Randolph
Historic Speedwell	7.5	Morristown
James Andrews Memorial Park	588.89	Randolph Township
Lee's Park Marina	12.82	Mount Arlington Borough
Lewis Morris Park	2,196	Harding, Mendham and Morris Townships
Loantaka Brook Reservation	883	Morristown
Mahlon Dickerson Reservation	3,494	Jefferson Township
Mennen Sports Arena	N/A	Morris Township
Morristown National Historic Park	1,705.69	Morristown
Mount Hope Historical Park	444	Rockaway Township
Mount Paul Memorial Park	298	Chester Township
Old Troy Park	96	Parsippany-Troy Hills Township
Passaic River Park	825.49	Chatham and Long Hill Townships
Patriots' Path	291.9	Throughout the County
Pyramid Mountain Natural Historic Area	1,675	Kinnelon Borough and Montville Township
Schooley's Mountain Park	823	Washington Township
Seaton Hackney Farm	38	Morris Township
Silas Condict Park	1,513	Kinnelon Borough
Tourne Park	561	Denville Township

Park	Acreage	Municipality
Traction Line Recreation Trail	15	Madison Borough, Morristown and Morris Township
Willowwood Arboretum	136	Chester Township

Source: Morris County Park Commission, National Park Service, VisitNJ.org

2.2.8 URBAN LAND

Urban land includes most of what normally would be considered developed land. Residential areas, commercial areas, services and institutions, industrial areas, and those developed for transportation and utilities are the primary land uses included in urban land. There are several other open land categories that are included with urban land. Developed recreation areas, whether a part of a park, educational facility, or private concern (e.g. golf courses), are also considered a part of urban land. Also included are areas such as large, landscaped lawns in corporate businesses and service centers, parks, and residential areas.

2.2.9 ZONING

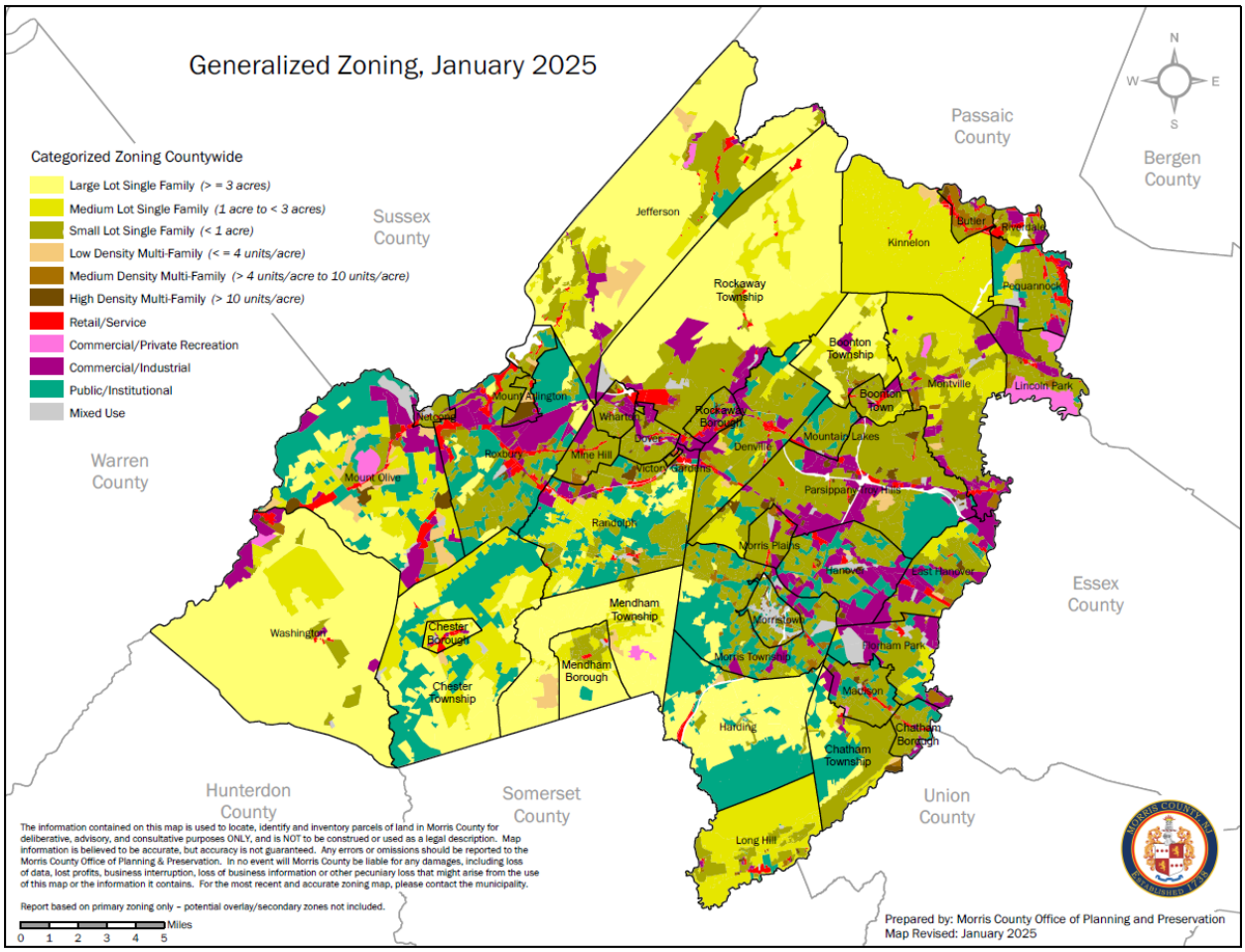
Zoning is the division of land into districts with specific regulations governing the use of land and buildings within each district. These regulations, established by local governments, determine what types of buildings can be constructed, how they can be used, and how they can be expanded. Zoning also influences the density of development, building heights, lot sizes, and other aspects of land use.

Table 4 shows generalized zoning compiled by the Morris County Office of Planning Preservation, current as of January 2025. The highest percentage of zoned land in the county is designated large-lot single family, with residential zones comprising 74.3% of total land deisgnation.

Table 4. Generalized Zoning, Morris County, January 2025

Type	Sq Mi	Acres	Percentage
Large Lot Single Family (> = 3 acres)	149.5	95,686	31.5%
Medium Lot Single Family (1 acre to < 3 acres)	78.7	50,342	16.6%
Small Lot Single Family (< 1 acre)	107.0	68,495	22.5%
Low Density Multi-Family (< = 4 units/acre)	7.1	4,530	1.5%
Medium Density Multi-Family (> 4 units/acre to 10 units/acre)	6.3	4,028	1.3%
High Density Multi-Family (> 10 units/acre)	4.3	2,761	0.9%
Retail/Service	10.6	6,797	2.2%
Commercial/Private Recreation	3.6	2,304	0.8%
Commercial/Industrial	36.9	23,624	7.8%
Public/Institutional	66.1	42,279	13.9%
Mixed Use	5.2	3,310	1.1%
TOTAL	**475.2**	**304,157**	**100.0%**

Figure 4. Generalized Zoning in Morris County



2.3 POPULATION AND DEMOGRAPHICS

Knowledge of the composition of the population, how it has changed in the past and how it may change in the future is needed to make informed decisions. Information about population is a critical part of planning because it directly relates to needs such as housing, industry, stores, public facilities and services, and transportation.

The population of Morris County was estimated at 511,151 in 2022 according to the U.S. Census Population Estimates. Table 4 presents the population statistics for Morris County based on the 2020 decennial census and 2018-2022 ACS 5-Year Estimates. Figure 4 shows the distribution of the general population density (persons per square mile) in 2021 by Census block.

Table 5. General Population Statistics for Morris County

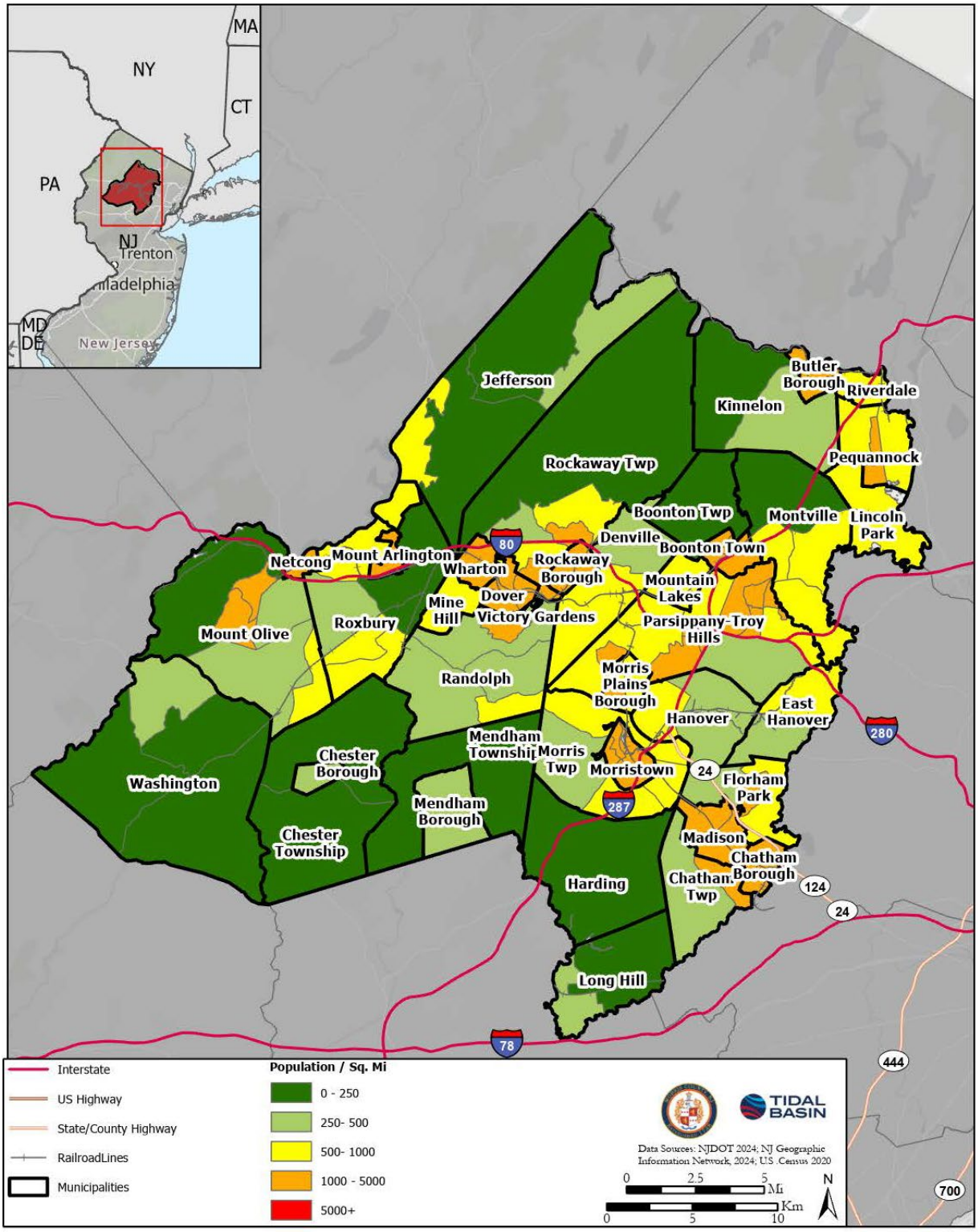
	2010 Census	2020 Census	2018-2022 ACS						
Municipality	Total	Total	Total	Pop. 65+	% Pop. 65+	Pop. Under 5	% Under 5	Below Poverty Level*	% Below Poverty Level
Town of Boonton	8,347	8,815	8,781	1,265	14.41%	409	4.66%	520	5.92%
Township of Boonton	4,263	4,380	4,377	918	20.97%	217	4.96%	77	1.76%
Borough of Butler	7,539	8,047	8,045	1,364	16.95%	246	3.06%	587	7.30%
Chatham Borough	8,962	9,212	9,199	982	10.68%	736	8.00%	196	2.13%
Chatham Township	10,452	10,983	10,930	1,778	16.27%	441	4.03%	181	1.66%
Chester Borough	1,649	1,514	1,480	307	20.74%	87	5.88%	94	6.35%
Chester Township	7,838	7,713	7,725	1,330	17.22%	234	3.03%	202	2.61%
Denville Township	16,635	17,107	17,084	3,565	20.87%	906	5.30%	610	3.57%
Town of Dover	18,157	18,460	18,426	2,427	13.17%	736	3.99%	2,388	12.96%
Township of East Hanover	11,157	11,105	11,102	2,638	23.76%	643	5.79%	249	2.24%
Borough of Florham Park	11,696	12,585	12,790	2,674	20.91%	449	3.51%	451	3.53%
Township of Hanover	13,712	14,677	14,602	3,100	21.23%	550	3.77%	303	2.08%
Township of Harding	3,838	3,871	3,868	1270	32.83%	37	0.96%	176	4.55%
Township of Jefferson	21,314	20,538	20,555	3617	17.60%	896	4.36%	1,194	5.81%
Borough of Kinnelon	10,248	9,966	9,986	1,522	15.24%	435	4.36%	235	2.35%
Borough of Lincoln Park	10,521	10,915	10,884	2,094	19.24%	561	5.15%	212	1.95%
Township of Long Hill	8,702	8,629	8,630	1,800	20.86%	623	7.22%	389	4.51%
Borough of Madison	15,845	16,937	16,521	2,252	13.63%	895	5.42%	525	3.18%
Borough of Mendham	4,981	4,981	4,968	975	19.63%	239	4.81%	98	1.97%
Township of Mendham	5,869	6,016	6,005	989	16.47%	223	3.71%	99	1.65%
Township of Mine Hill	3,651	3,651	3,990	605	15.16%	258	6.47%	234	5.86%
Township of Montville	21,528	22,450	22,364	4,679	20.92%	1020	4.56%	617	2.76%
Borough of Morris Plains	5,532	6,153	6,104	1,153	18.89%	273	4.47%	153	2.51%
Township of Morris	22,306	33,974	23,094	4,390	19.01%	1,313	5.69%	1,146	4.96%
Town of Morristown	18,411	20,180	21,026	2,792	13.28%	1,107	5.26%	2,202	10.47%
Borough of Mount Arlington	5,050	5,909	5,863	1,201	20.48%	339	5.78%	230	3.92%
Township of Mount Olive	28,117	28,886	28,876	3,740	12.95%	1729	5.99%	1,467	5.08%
Borough of Mountain Lakes	4,160	4,472	4,499	502	11.16%	160	3.56%	59	1.31%

	2010 Census	2020 Census	2018-2022 ACS						
Netcong Borough	3,232	3,375	3,484	504	14.47%	195	5.60%	329	9.44%
Township of Parsippany-Troy Hills	53,238	56,162	55,970	10,128	18.10%	2,388	4.27%	2,300	4.11%
Township of Pequannock	15,540	15,571	15,561	4,531	29.12%	553	3.55%	861	5.53%
Township of Randolph	25,734	26,504	26,451	2,370	8.96%	1,662	6.28%	1,154	4.36%
Borough of Riverdale	3,559	4,107	4,081	829	20.31%	209	5.12%	309	7.57%
Borough of Rockaway	6,438	6,598	6,589	953	14.46%	261	3.96%	459	6.97%
Township of Rockaway	24,156	25,341	25,539	4,439	17.38%	1,401	5.49%	1,109	4.34%
Township of Roxbury	23,324	22,950	23,101	4,098	17.74%	1019	4.41%	1,166	5.05%
Borough of Victory Gardens	1,520	1,582	1,761	135	7.67%	107	6.08%	402	22.83%
Township of Washington	18,533	18,197	18,188	3,509	19.29%	793	4.36%	534	2.94%
Borough of Wharton	6,522	7,241	7,217	1041	14.42%	654	9.06%	1,282	17.76%
Morris County (Total)	**472,276**	**509,285**	**511,151**	**94,221**	**18.43%**	**25,585**	**5.01%**	**20,727**	**4.05%**

Source: U.S. Census Bureau: American Census Survey (ACS) 2010, 2020, and 2018-2022

Figure 5 shows the distribution of the general population in Morris County by census tract.

Figure 5. Distribution of General Population in Morris County by Census Tract



2.3.1 VULNERABLE POPULATIONS

Research has shown that some populations, while they may not have more hazard exposure, may experience exacerbated impacts and prolonged recovery if/when impacted. This is due to many factors, including their physical and financial ability to react or respond during a hazard. Identifying concentrations of vulnerable populations can assist communities in targeting preparedness and response actions. For the purposes of this planning process, vulnerable populations in Morris County include children, elderly, low-income, the physically and intellectually disabled, non-English speakers, and the medically or chemically dependent.

2.3.1.1 AGE

Children are deemed vulnerable owing to their dependence on others for secure access to resources in emergencies. The elderly, facing a greater likelihood of lacking both the physical and economic means essential for responding to hazardous events, are at an elevated risk of enduring health-related consequences that impede swift recovery. Individuals residing independently may encounter increased challenges in evacuating their residences. Moreover, the elderly are more prone to residing in senior care and living facilities emergency preparedness is contingent upon the discretion of facility operators. These facilities, characterized by close living quarters and an elderly demographic potentially susceptible to weakened immune systems or pre-existing health conditions, are particularly vulnerable to hazards such as pandemics. The confluence of these factors underscores the heightened vulnerability of senior care and living facilities during events of this nature.

According to the 2018-2022 ACS 5-Year Estimates, 25,585 (5.1%) of the County's population is under the age of 5 and 94,221 people (18.43%) of the County's total population were age 65 and older.

2.3.1.2 INCOME

Of the total population, economically disadvantaged populations are more vulnerable because they are likely to evaluate their risk and make decisions based on the major economic impact to their family (e.g., evacuation). Based on the 2018-2022 ACS, per capita income in Morris County was estimated at $67,555, and the median household income for Morris County is $130,808 (in 2022 dollars). Eleven percent of households receive an income between $50,000 and $74,999 per year, a drop from the 2013-2017 survey of 1%, and 29.4% of households receive over $200,000 annually, an increase of 4.9%.

According to the Census' 2022 poverty thresholds, the weighted average thresholds for a family of four in 2022 was $29,950; for a family of three, $23,280; for a family of two, $18,900, and for unrelated individuals, $14,880. The 2022 ACS data identified approximately 12,306 households as having an annual income of less than $24,999 and are therefore below the poverty level in Morris County (household = family of 4; 2022 poverty level, $27,750). Figure 3-5 shows the distribution of low-income persons.

2.3.1.3 DISABLED

A disability is any condition of the body or mind (impairment) that makes it more difficult for the person with the condition to do certain activities and interact with the world around them (participation restrictions). (Center for Disease Control, 2020). These impairments may increase the level of difficulty that individuals face during an emergency. Cognitive impairments may reduce an individual's capacity to receive, process, and respond to emergency information or warnings. Individuals with a physical or sensory disability may face issues of mobility, sight, hearing, or reliance on specialized medical equipment. According to the 2018-2022 ACS, 8.9% percent of residents of Morris County are living with a disability.

2.3.1.4 NON-ENGLISH SPEAKERS

Individuals who are not fluent or have a working proficiency in English may have difficulty understanding hazard-related information. Cultural differences can also add complexity to how information is being conveyed to populations with limited English proficiency (Centers for Disease Control, 2015). According to the 2022 ACS, 25.4% of county residents over the age of 5 primarily speak a language other than English at home. This is up from 25.2% reported in the 2018 ACS. Of the county's population, 10.4% percent speak Spanish, 8.5% speak other Indo-European languages, 5.5% speak Asian and Pacific Island Languages, and 1.0% speak other languages. Figure 3 5 below shows the geographic distribution of individuals who speak English less than "very well."

The Borough of Victory Gardens (78.6%), the Town of Dover (73.4%) and the Borough of Wharton (56.2%) have the largest proportion of households that speak a language other than English. The primary non-English language spoken in these homes is Spanish.

2.3.2 POPULATION TRENDS

Population trends can provide a basis for making decisions on the type of mitigation approaches to consider and the locations in which these approaches should be applied. This information can also be used to support planning decisions regarding future development in vulnerable areas.

From 1880 to 2022, the County experienced a constant growth in population. The largest increase was seen between the years 1950 to 1960, when the County experienced a 59.2% (97,249 persons) population increase. The smallest increase was seen between the years 1980 and 1990, when Morris County experienced a 3.4% (13,723 persons) population increase. displays the change in population from 1880 to 2022 in Morris County.

Table 6. Morris County Population Trends, 1880 to 2022

Year	Population	Change in Population	Percent (%) Population Change
1880	50,861	NA	NA
1890	54,101	3,240	6.4%
1900	65,156	11,055	20.4%
1910	74,704	9,548	14.7%
1920	82,694	7,990	10.7%
1930	110,445	27,751	33.6%
1940	125,732	15,287	13.8%
1950	164,371	38,639	30.7%
1960	261,620	97,249	59.2%
1970	383,454	121,834	46.6%
1980	407,630	24,176	6.3%
1990	421,353	13,723	3.4%
2000	470,212	48,859	11.6%
2010	492,276	22,064	4.7%
2017	498,847	6,571	1.3%
2022	511,151	12,304	2.4%

Source: NJ Department of Labor 2001; U.S. Census Bureau, 2018-2022 ACS

As shown in Table 7, a majority of the County's municipalities experienced a decrease in population between 2020 and the 2018-2022 ACS estimates, with the Township of Morris experiencing the greatest decrease in population during this time per capita. The Township of Mine Hill experienced the largest increase in population per capita.

Table 7. Changes in Population by Municipality, 2000-2022

Municipality	2000 Census	2010 Census	2020 Census	2018 - 2022 ACS	Change in Population (2000-2022)	Percent Change in Population (2020-2022)
Town of Boonton	8,496	8,347	8,815	8,781	285	3.35%
Township of Boonton	4,287	4,263	4,380	4,377	90	2.10%
Borough of Butler	7,420	7,539	8,047	8,045	625	8.42%
Chatham Borough	8,460	8,962	9,212	9,199	739	8.74%
Chatham Township	10,086	10,452	10,983	10,930	844	8.37%
Chester Borough	1,635	1,649	1,514	1,480	-155	-9.48%
Chester Township	7,282	7,838	7,713	7,725	443	6.08%
Denville Township	15,824	16,635	17,107	17,084	1,260	7.96%
Town of Dover	18,188	18,157	18,460	18,426	238	1.31%
Township of East Hanover	11,393	11,157	11,105	11,102	-291	-2.55%
Borough of Florham Park	8,857	11,696	12,585	12,790	3,933	44.41%
Township of Hanover	12,898	13,712	14,677	14,602	1,704	13.21%
Township of Harding	3,180	3,838	3,871	3,868	688	21.64%
Township of Jefferson	19,717	21,314	20,538	20,555	838	4.25%
Borough of Kinnelon	9,365	10,248	9,966	9,986	621	6.63%
Borough of Lincoln Park	10,930	10,521	10,915	10,884	-46	-0.42%
Township of Long Hill	8,777	8,702	8,629	8,630	-147	-1.67%
Borough of Madison	16,530	15,845	16,937	16,521	-9	-0.05%
Borough of Mendham	5,097	4,981	4,981	4,968	-129	-2.53%
Township of Mendham	5,400	5,869	6,016	6,005	605	11.20%
Township of Mine Hill	3,679	3,651	3,651	3,990	311	8.45%
Township of Montville	20,839	21,528	22,450	22,364	1,525	7.32%
Borough of Morris Plains	5,236	5,532	6,153	6,104	868	16.58%
Township of Morris	21,796	22,306	33,974	23,094	1,298	5.96%
Town of Morristown	18,544	18,411	20,180	21,026	2,482	13.38%
Borough of Mount Arlington	4,663	5,050	5,909	5,863	1,200	25.73%
Township of Mount Olive	24,193	28,117	28,886	28,876	4,683	19.36%
Borough of Mountain Lakes	4,256	4,160	4,472	4,499	243	5.71%
Netcong Borough	2,580	3,232	3,375	3,484	904	35.04%

Municipality	2000 Census	2010 Census	2020 Census	2018 - 2022 ACS	Change in Population (2000-2022)	Percent Change in Population (2020-2022)
Township of Parsippany-Troy Hills	50,649	53,238	56,162	55,970	5,321	10.51%
Township of Pequannock	13,888	15,540	15,571	15,561	1,673	12.05%
Township of Randolph	24,847	25,736	26,504	26,451	1,604	6.46%
Borough of Riverdale	2,498	3,559	4,107	4,081	1,583	63.37%
Borough of Rockaway	6,473	6,438	6,598	6,589	116	1.79%
Township of Rockaway	22,930	24,156	25,341	25,539	2,609	11.38%
Township of Roxbury	23,883	23,324	22,950	23,101	-782	-3.27%
Borough of Victory Gardens	1,546	1,520	1,582	1,761	215	13.91%
Township of Washington	17,592	18,533	18,197	18,188	596	3.39%
Borough of Wharton	6,298	6,522	7,241	7,217	919	14.59%

Source: U.S. Census Bureau, Census 2010, 2013-2017, 2018-2022 ACS

Over the last 15 years, new regulations, new economic realities and changing conditions influenced the rate of population growth in Morris County and will continue to influence population growth moving forward. Enactment of the Highlands Act in 2004 and subsequent adoption of related NJDEP regulations is one of the reasons for the modest rate of population growth, although nearly half of New Jersey's counties have been experiencing population decline. Within Morris County most jurisdictions experienced only modest population increases from 2010 to 2022, with the exception of a couple of jurisdictions like Riverdale (62.09% increase) in the north and the Borough of Florham Park (42.9% increase) in the southeastern part of the County.

Looking ahead, based on a forecast by the North Jersey Transportation Planning Authority, Morris County is projected to experience significant population growth. By 2050, the County is anticipated to have a population of 528,760, signifying an increase of 6.1% over the 2015 population. Parsippany-Troy Hills is anticipated to see the largest growth, and Victory Gardens is projected to see the smallest. Most municipalities are expected to grow from 5-10% through 2050, with a countywide growth rate of 0.2% annually.

Table 8. Project Changes in Population by Municipality, 2020-2050

Municipality	2020 Population	2050 Forecast	Projected Population Change	Projected % Population Change
Town of Boonton	8,815	9,200	385	4.37%
Township of Boonton	4,380	4,700	320	7.31%
Borough of Butler	8,047	8,200	153	1.90%
Chatham Borough	9,228	9,700	472	5.11%
Chatham Township	10,983	11,500	517	4.71%

Municipality	2020 Population	2050 Forecast	Projected Population Change	Projected % Population Change
Chester Borough	1,681	1,900	219	13.03%
Chester Township	7,722	8,000	278	3.60%
Denville Township	17,107	18,500	1,393	8.14%
Town of Dover	18,460	20,000	1,540	8.34%
Township of East Hanover	11,105	12,000	895	8.06%
Borough of Florham Park	12,585	14,000	1,415	11.24%
Township of Hanover	14,677	15,500	823	5.61%
Township of Harding	3,871	4,100	229	5.92%
Township of Jefferson	20,538	21,500	962	4.68%
Borough of Kinnelon	9,966	10,400	434	4.35%
Borough of Lincoln Park	10,915	11,300	385	3.53%
Township of Long Hill	8,629	9,300	671	7.78%
Borough of Madison	16,937	18,000	1,063	6.28%
Borough of Mendham	4,981	5,400	419	8.41%
Township of Mendham	6,014	6,500	486	8.08%
Township of Mine Hill	4,015	4,500	485	12.08%
Township of Montville	22,447	24,000	1,553	6.92%
Borough of Morris Plains	6,146	6,700	554	9.01%
Township of Morris	22,974	24,500	1,526	6.64%
Town of Morristown	20,173	22,500	2,327	11.54%
Borough of Mount Arlington	5,912	6,300	388	6.56%
Township of Mount Olive	28,886	30,500	1,614	5.59%
Borough of Mountain Lakes	3,375	3,700	325	9.63%
Netcong Borough	56,162	59,500	3,338	5.94%
Township of Parsippany-Troy Hills	15,571	16,500	929	5.97%
Township of Pequannock	26,504	28,000	1,496	5.64%
Township of Randolph	4,109	4,300	191	4.65%
Borough of Riverdale	6,598	7,000	402	6.09%
Borough of Rockaway	25,344	26,500	1,156	4.56%
Township of Rockaway	22,948	24,500	1,552	6.76%
Township of Roxbury	1,583	1,700	117	7.39%
Borough of Victory Gardens	18,192	19,000	808	4.44%
Township of Washington	8,815	9,200	385	4.37%

Municipality	2020 Population	2050 Forecast	Projected Population Change	Projected % Population Change
Borough of Wharton	4,380	4,700	320	7.31%

Source: NJTPA

2.4 GENERAL BUILDING STOCK

Morris County's residential structures primarily consist of single-family homes, which are the most common type of housing. There are also significant numbers of multi-family units, including apartments and condominiums, reflecting a diverse housing market catering to various demographic groups. The 2020 U.S. Census data identified an estimated 197,722 households (198,761 housing units) in Morris County. This is a modest increase in households from 2010 (7%), and an increase in housing units of 5%. The U.S. Census defines household as all the persons who occupy a housing unit, and a housing unit as a house, an apartment, a mobile home, a group of rooms, or a single room that is occupied (or if vacant, is intended for occupancy) as separate living quarters. Therefore, you may have more than one household per housing unit.

In terms of age, the building stock in Morris County includes both historic homes and modern constructions. Many of the homes were built during the mid-20th century, particularly between 1950 and 1979, indicating a period of substantial growth and development. There are also newer buildings from the 21st century, showing ongoing development and urban expansion.

Commercial buildings in Morris County include a mix of retail spaces, office buildings, and industrial properties, supporting a robust local economy. These structures are often situated in business districts and industrial parks, contributing to the economic vitality of the region.

Overall, the building stock in Morris County reflects a balance between preserving historical architecture and accommodating modern growth, providing a comprehensive mix of residential, commercial, and industrial buildings that support a dynamic and diverse community.

Figure 6, Figure 7 and Figure 8 show the density distribution of residential, commercial and industrial buildings in Morris County by Census block; replacement cost value of structures per unit area, including building contents. The densities are shown in units of $1,000 ($K) per square mile. Viewing exposure distribution maps can assist communities in visualizing areas of high exposure and in evaluating aspects of the study area in relation to the specific hazard risks.

Figure 6. Distribution of Building Stock and Value Density in Morris County by Census Block

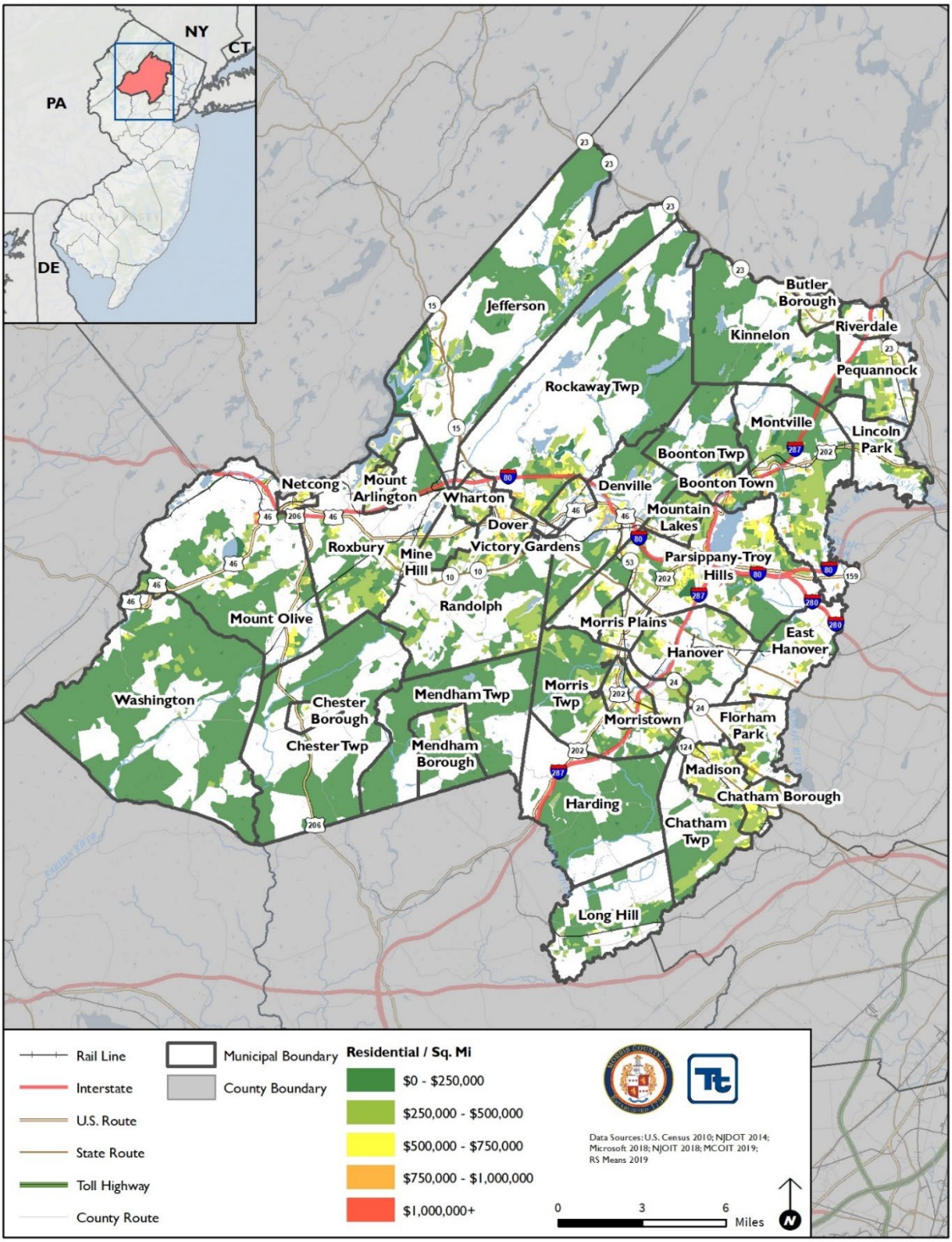


Figure 7. Distribution of Commercial Building Stock and Exposure Density in Morris County by Census Block

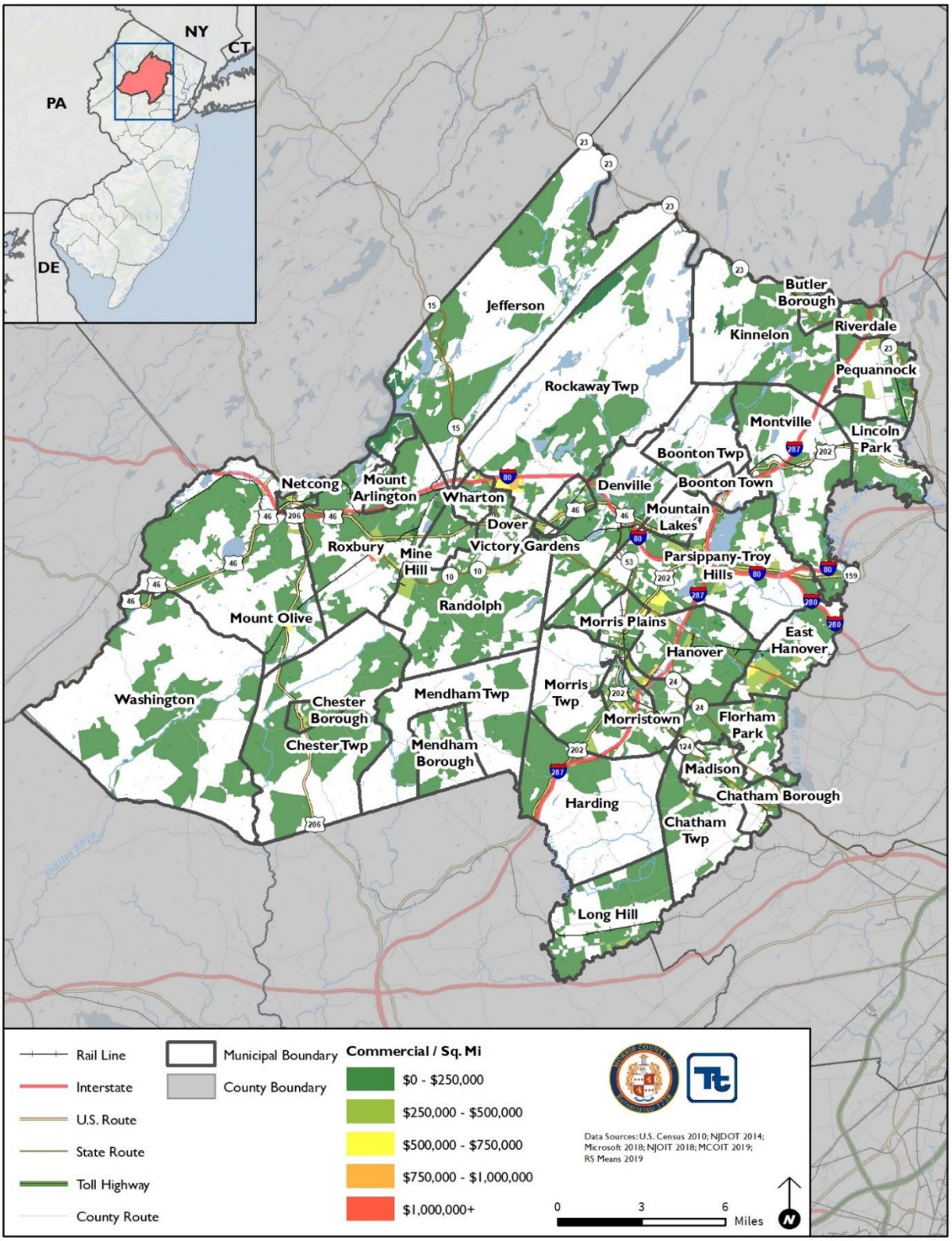
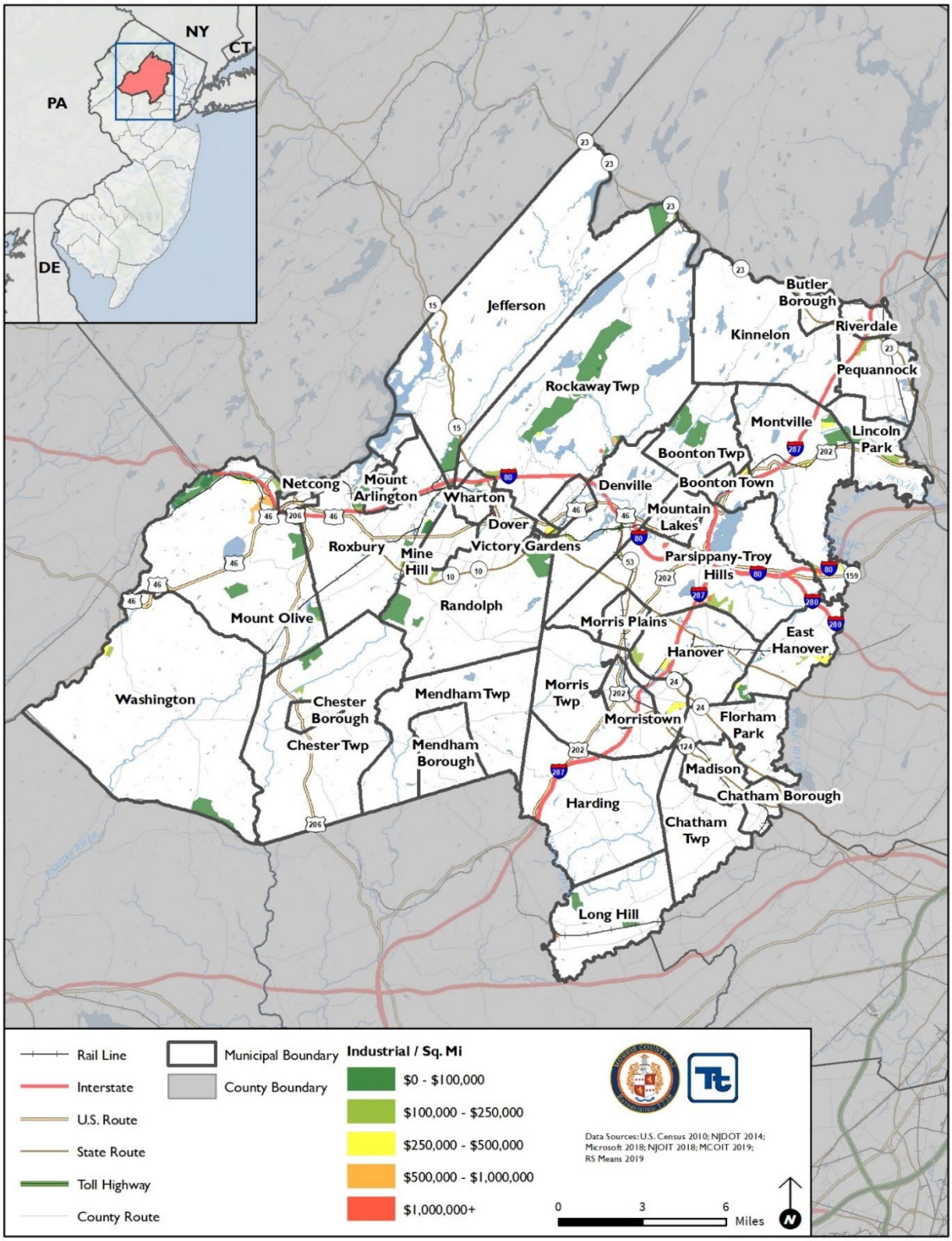


Figure 8. Distribution of Industrial Building Stock and Value Density in Morris County by Census Block



2.5 ECONOMY

As discussed in the FEMA Local Mitigation Handbook, after a natural hazard event, economic resiliency drives recovery. An understanding of the major employers and economic sectors in the County whose losses or inoperability would impact the community and its ability to recover from a disaster is essential. The following provides information regarding the economy in Morris County.

2.5.1 BUSINESS

The economy of Morris County employs approximately 268K people. The largest industries in Morris County, are Professional, Scientific, & Technical Services (34,792 people), Health Care & Social Assistance (31,652 people), and Manufacturing (29,778 people), and the highest paying industries are Finance & Insurance ($130,495), Management of Companies & Enterprises ($120,799), and Finance & Insurance, & Real Estate & Rental & Leasing ($115,110). In 2022, the area's robust economy had a Gross Regional Product (GRP) of $68.5 billion. The healthcare and wellness industry stand out as one of the County's fastest-growing sectors, showcasing a noteworthy $3.8 billion annual GRP and a remarkable 3.2% job growth in 2020.

The history of Morris County's economic development is rooted in agriculture, but since the 1950s and the passage of the National Highway Act of 1956, the County became a home for many corporate headquarters who had moved out of New York City or added satellite offices in Morris County due to an expansion of population growth following World War II. Since then, Morris County's economy can be classified as a mix between growing business and technology sectors and a slowly shrinking agricultural sector.

In addition, the U.S. Military Picatinny Arsenal, located in northern Morris County is one of the County's major employers.

2.5.2 AGRICULTURE

Agriculture is an important part of Morris County's economy and a major contributor to New Jersey's and the United States' farming industry. The 2022 U.S. Census of Agriculture indicates that Morris County ranked 11th in the State for total market value of agricultural products sold with over $33 million in sales. This is a 37.5% increase from 2017 ($24 million in sales). The 2022 average sales per farm was $72,031, a 21% increase from the 2017 Census which was an average of $59,389. According to the United States Department of Agriculture (USDA) the top commodities, by sales, in Morris County for 2022 include: nursery, greenhouse, floriculture, and sod at $16.9 million in sales; fruits, tree nuts, and berries at $6.3 million in sales; vegetables, melons, potatoes, and sweet potatoes at $6.3 million in sales.

2.5.3 DEVELOPMENT TRENDS AND NEW DEVELOPMENT

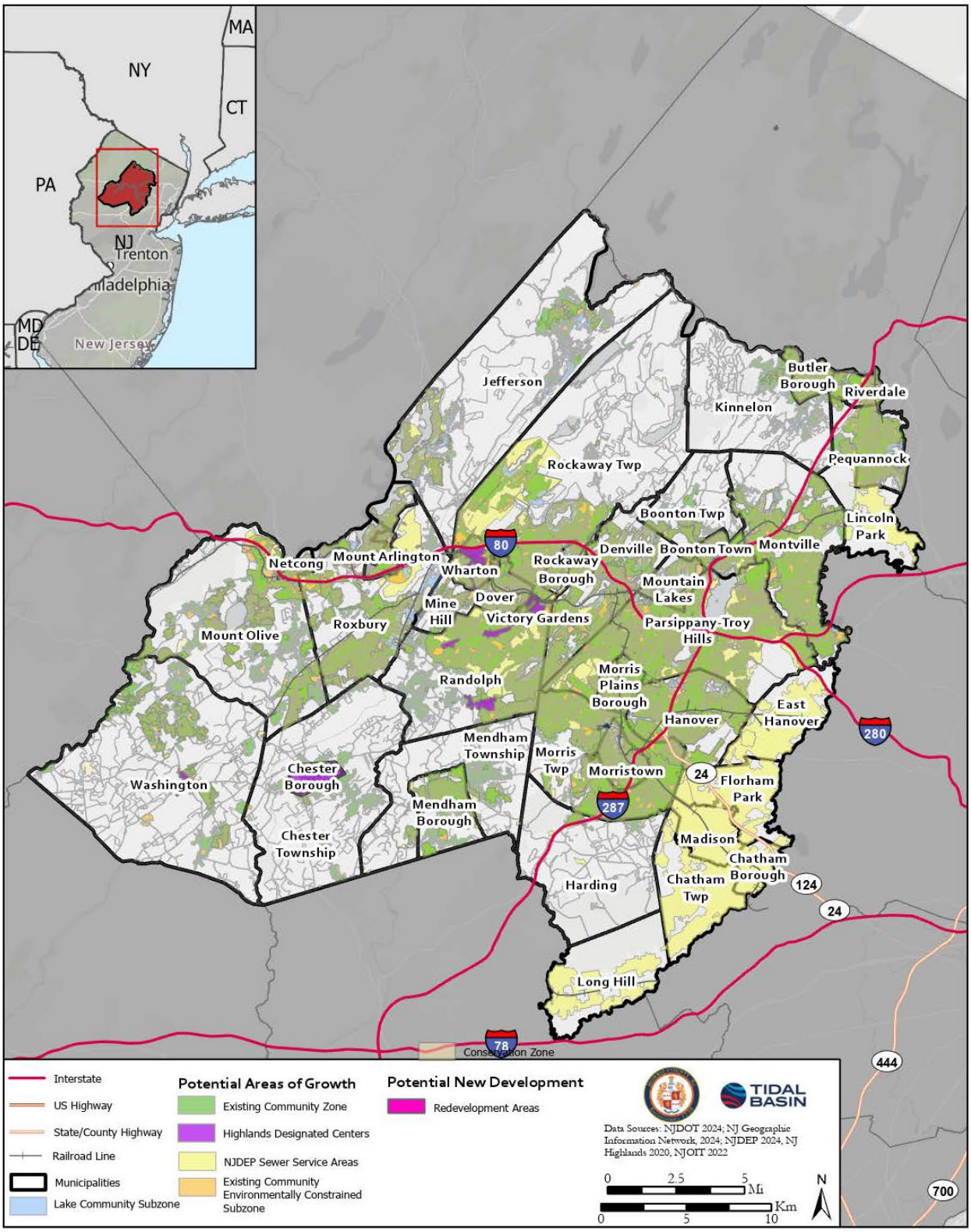
An understanding of population and development trends can assist in planning for future development and ensuring that appropriate mitigation, planning, and preparedness measures are in place to protect human health and community infrastructure. The DMA 2000 requires that communities consider land use trends, which can impact the need for, and priority of, mitigation options over time. Land use and development trends significantly impact exposure and vulnerability to various hazards. For example, significant development in a hazard area increases the building stock and population exposed to that hazard.

New Jersey's Highlands stretch about 60 miles, from Phillipsburg in the southwest to Oakland in the northeast. They lie within portions of seven northwest New Jersey counties — Bergen, Hunterdon, Morris, Passaic, Somerset, Sussex, and Warren — and include 88 municipalities within the legislated region. The NJ Highlands provides nearly two-thirds of New Jersey's population, 6.2 million people, with clean drinking water. A large sector of the State's

industrial base also relies on abundant clean water from the Highlands. The New Jersey Highlands Act was passed in 2004, which established the Highlands Council, a regional planning agency that looks to protect the valuable water resources and ensure smart planning practices for highlands counties and municipalities. The New Jersey Highlands is part of the Federally designated Highlands region, which encompasses parts of New Jersey, New York, Connecticut, and Pennsylvania.. The presence of the New Jersey Highlands Region in the majority of Morris County is unique and has significant implications. The most obvious impact is the concentration of future development in designated urban areas (inside the Highlands Region) like Morristown, Dover, or Parsippany-Troy Hills Township and additional less-regulated development outside of the Highlands in the easternmost parts of the County, like parts of Hanover Township and East Hanover Township. The three westernmost Townships, Mount Olive, Washington, and Chester are almost exclusively located in the Highlands' Preservation Area. The Preservation Area in the Highlands is where development is most strictly regulated. The remainder of the Highlands Region in Morris County is located in the Planning Area where development potential is greater and provides an avenue for enhanced development through Transfer of Development Rights (TDR) and smart growth programs.

The New Jersey Highlands Council has identified areas of existing development as well as areas of potential growth that may provide insight as to where potential new development may occur in Morris County. These areas include the Existing Community Zone (both in-fill of new development and re-development) and Designated Centers. Figure 9 illustrates the potential new development identified by each jurisdiction, as well as Highlands Existing Community Zones, Designated Centers and Sewer Service Areas which are areas of potential future growth in Morris County. The New Jersey Highlands Council assists with planning and considers hazard areas such as floodplains when evaluating new and re-development in the region. In addition, the NJDEP Sewer Service Areas are also shown. These areas show the planned method of wastewater disposal for specific areas, i.e., whether the wastewater will be collected to a regional treatment facility or treated on site and disposed of through a surface water discharge of groundwater discharge.

Figure 9. Areas of Potential Growth and Potential New Development Identified by Each Jurisdiction



2.5.3.1 RESIDENTIAL DEVELOPMENT, 2020-2025

Morris County has seen a 2.7% population growth rate between April 2020 and July 2024, reflecting modest but steady growth. In 2024, the Morris County Planning Board reviewed 244 development applications, led by Parsippany-Troy Hills with 34 submissions. 16 new multifamily housing projects proposed in 2024 totalled 923 units. Three major developments alone accounted for 598 units, with only 11% designated age-restricted/assisted living; in 2023, 60% of developments met this designation. Since 2015, 16,722 multifamily units have been reviewed, with concentrations in towns near transit systems and highways including Morristown, Parsippany and Randolph. In suburban towns such as Morris Township, Florham Park, Denville and Morris Plans, communities have seen mostly residential infill or low-rise multifamily homes.

Table 9. Morris County Growth Patterns: 2020-2025 Municipality Overview

Municipality	Estimated Growth/Population Trend	2024 Planning Activity and Key Development Trends
Boonton (Town)	Modest growth	Historic urban center. Infill and affordable housing projects underway.
Boonton Township	Stable	Rural zoning preserved. Some limited subdivision activity.
Butler Borough	Stable	Infill and housing rehabilitation activity; modest development.
Chatham Borough	Stable	Transit-oriented potential; mostly built-out. Focus on downtown vibrancy.
Chatham Township	Modest growth	Infill development and redevelopment of older housing stock.
Chester Borough	Minimal growth	Historic preservation and rural feel maintained.
Chester Township	Low-density, stable	Agricultural and conservation land-use dominant.
Denville Township	Modest growth	Transit-oriented infill around train station. Moderate multifamily; lakeside residential activity.
Dover (Town)	Minimal growth	Downtown revitalization with 90-unit mixed-income project. Transit-adjacent development emerging.
East Hanover Township	Modest growth	Redevelopment of corporate parcels. New 200+ unit multifamily projects with affordability components.
Florham Park Borough	Fastest-growing borough	Some multifamily development and retail redevelopment. Popular among families and young professionals.
Hanover Township	Steady growth	Active multifamily planning near employment centers and major highways.
Harding Township	Stable, very low density	Strict zoning; rural character prioritized.
Jefferson Township	Slight growth	Scenic, recreational community with single-family development.
Kinnelon Borough	Slow, stable growth	Low-density residential; environmental protections restrict growth.
Lincoln Park Borough	Minor decline or flat	Some affordable housing planning; little large-scale growth.
Long Hill Township	Stable growth	20 applications in 2024; active planning interest. Infill and redevelopment projects in pipeline.
Madison Borough	Stable population	Notable entry into affordable housing with green-certified multifamily development.
Mendham Borough	Stable	Historic district with limited growth and redevelopment.

Municipality	Estimated Growth/Population Trend	2024 Planning Activity and Key Development Trends
Mendham Township	Low-density, preservation-minded	Some minor subdivision activity; rural residential zoning maintained.
Mine Hill Township	Stable	Primarily residential; low development pressure.
Montville Township	Slight growth	Multiple site plans submitted. Infill near Towaco station; low-density residential remains dominant.
Morris Township	Slow, stable growth	Affordable housing plan in progress. Corporate campus reuse and new residential subdivisions.
Morristown (Town)	Steady growth (~0.7–1% annually)	Leading in proposed multifamily housing. Transit-oriented, mixed-use projects near train station and downtown.
Mount Arlington Borough	Stable	Recreational and lakefront development. Limited new housing activity.
Mount Olive Township	Slow, steady growth	Adaptive reuse of former office parks. Commercial redevelopment noted.
Mountain Lakes Borough	Very slow growth	Historic, preservation-focused town. No significant development.
Netcong Borough	Stable or declining slightly	Limited development. Small-scale infill possible; compact downtown.
Parsippany–Troy Hills	Largest in county; modest growth	High development activity; major multifamily and warehouse-to-residential redevelopment projects. 280-unit luxury apartments among proposals.
Pequannock Township	Modest growth	Occasional small-scale residential development.
Randolph Township	Moderate growth (~0.3% annually)	Major inclusionary zoning project (Liberty Village). Affordable housing driving new development.
Rockaway Borough	Flat population	Downtown investment interest; no major residential activity reported.
Rockaway Township	Moderate growth	Steady suburban housing development. Some commercial redevelopment interest.
Roxbury Township	Slight growth	Minimal multifamily. Steady single-family residential and limited infill.
Victory Gardens	Smallest municipality; flat	Limited land area for growth; high housing density already.
Washington Township	Stable, minor growth	Predominantly residential; subdivision activity continues.
Wharton Borough	Stable	Post-industrial small town with limited growth; minor infill likely.

2.5.3.2 COMMERCIAL DEVELOPMENT, 2020-2025

Warehouse and office redevelopment declined sharply in 2024. Parsippany accounted for nearly half with several notable projects like the former BASF site in Mount Olive. Numerous former corporate campuses are also being converted to mixed-use or residential use.

Highways like I-80, I-287, Route 46, and Route 15 are clear zones of industrial and logistical activity, shown as clusters of zoning parcels designed for warehouse and light-industrial use. Key redevelopments, such as Morris Commerce Center (Montville), Morris Plains warehouse campus, and East Hanover's formerly corporate parcels, align with these corridors.

Countywide, Parsippany, East Hanover, Morris Plains, Roxbury and Montville stand out for significant industrial and commercial development and redevelopment. Many smaller boroughs and townships are maintaining their character with limited industrial/commercial additions. Overall, Morris County continues to trend toward converting older parks to logistics, warehousing and light industrial uses, spurred by evolving workspace demands and high demand for modern industrial space.

Table 10. Morris County Commercial and Industrial Development: 2020-2025 Municipality Overview

Municipality	Estimated Growth/Population Trend
Parsippany-Troy Hills	Large-scale warehouse redevelopment in 2024 (~500,000 sq ft in four projects), reduction from peak 2023 (2.66 M sq ft) → strong shift of aging office campuses to industrial and mixed-use.
Denville Township	Small infill industrial or commercial uses near transit corridors; no large warehouse proposals.
Dover (Town)	Commercial revitalization in downtown corridors but no major industrial expansion reported.
East Hanover Township	Redevelopment of Novartis campus into 800K+ sq ft of industrial / light industrial space, along with multifamily components.
Florham Park Borough	Corporate HQ presence continues (e.g. BASF). Some smaller-scale redevelopment in retail/commercial corridors, but minimal industrial growth.
Madison Borough	Focus on residential and mixed-use; limited commercial redevelopment; no significant industrial activity identified.
Montville Township	Development of Morris Commerce Center (110K sq ft light industrial flex park) to meet small-bay demand; fills a regional market gap.
Morris Plains Borough	New half-million sq ft warehouse campus (Lincoln Logistics Morris Plains) transforming former J&J office site.
Morris Township	Adaptive reuse of corporate sites to mixed-use including light industrial and retail; slowing of traditional industrial proposals.
Morristown (Town)	Leading office sales (~$100 M in 2023); Office-to-industrial turnover occurring modestly via repositioning of older buildings.
Other Municipalities (incl. Mountain Lakes, Mount Arlington, Chatham, Boonton Township, Pequannock, etc.)	Minimal to no reported large-scale commercial or industrial activity. Most towns retain low-density single-family zoning or small infill use.
Randolph Township	No notable industrial-specific projects reported; growth primarily residential/commercial mixed-use compliance with affordability mandates.
Roxbury Township	Under review: proposed massive warehouse (2.5 M sq ft) near former Hercules plant; minor other industrial interest.

2.5.3.3 FUTURE DEVELOPMENT

Morris County is poised for continued residential growth over the next five years, with a strong pipeline of multifamily housing concentrated in municipalities such as Parsippany, Morristown, Randolph, and East Hanover. This growth is largely driven by affordable housing requirements and the adaptive reuse of former corporate campuses, fostering mixed-use developments that integrate residential and retail spaces. At the same time, towns like Morris Plains, Parsippany, Montville, and Roxbury are expected to see ongoing warehouse and light industrial redevelopment, particularly along major transportation corridors. These commercial expansions reflect shifting market demands and capitalize on the county's strategic location near key highways and rail lines.

Supporting this growth, Morris County has committed significant investments in infrastructure improvements, including road resurfacing, bridge and culvert replacements, and intersection upgrades, which will enhance connectivity and resilience across multiple municipalities. Additionally, transit and trail enhancements, such as the Pompton Valley Rail Trail and long-range transportation planning by the New Jersey Transportation Planning Authority (NJTPA), are expected to promote transit-oriented development and expand commuter access.

2.5.3.4 DEVELOPMENT IMPACTS ON HAZARD RISK

Overall, Morris County and its communities have seen slow by steady growth since 2020, and this growth is anticipated to occur into the future. Any growth increases exposure to the hazards identified in this plan. Growth is not evenly distributed across Morris County, with some communities absorbing far more residential and commercial intensity than others, as noted in Table 9 and Table 10.

2.6 CRITICAL FACILITIES

Critical facilities and infrastructure provide services and functions essential to a community, especially during and after a disaster. Critical facilities include essential facilities, transportation systems, lifeline utility systems, high potential loss facilities and hazardous material facilities. Transportation systems include roadways, bridges, airways, and waterways. Utility systems include potable water, wastewater, oil, natural gas, electric power facilities, and emergency communication systems.

The inventory of critical facilities identified for the HMP is considered sensitive information. It is protected by the Protected Critical Infrastructure Information (PCII) program and under New Jersey Executive Order 21. Therefore, individual facility names and addresses are not provided in this HMP update. A summary of the facility types used for the risk assessment are presented further in this section.

2.6.1 ESSENTIAL FACILITIES

This section provides information regarding Morris County's emergency facilities, hospital and medical facilities, schools, shelters, senior care and living facilities and government facilities. As stated above, these assets provide indispensable services that need to remain in operation before, during and after natural hazard events. Figure 9 shows these facilities.

2.6.2 EMERGENCY FACILITIES

For the purposes of this HMP, emergency facilities include police, fire, emergency medical services (EMS) and emergency operations centers (EOC). The County has a highly coordinated and interconnected network of emergency facilities and services at the county and municipal level. The Morris County Office of Emergency Management (MCOEM) serves as the primary coordinating agency between local, state and federal agencies. In response to an emergency event, MCOEM will work with County and municipal health agencies and healthcare providers, emergency facilities and the County Sheriff's Office to provide aid to residents of the County.

Each municipality is responsible for maintaining its own police department, fire department and emergency operation center. There are 37 enforcement facilities, 99 fire stations, 36 emergency medical services facilities and 39 emergency operation centers.

2.6.3 CORRECTIONAL FACILITIES

The Morris County Correctional Facility is located in Morris Township.

2.6.4 HOSPITAL AND MEDICAL FACILITIES

There are 17 hospitals located within the County.

2.6.5 SCHOOLS

There are 261 schools ranging from pre-kindergarten to higher education learning establishments in the County. During an emergency event, schools can be used as a shelter for residents.

2.6.6 SHELTERS

According to the County's official website, there are 66 warming and cooling centers shelters identified within the County; many schools, community centers and municipal buildings could serve as a shelter during an emergency.

2.6.7 SENIOR CARE AND LIVING FACILITIES

It is important to identify and account for senior facilities, as they are highly vulnerable to the potential impacts of disasters. Understanding the location and numbers of these types of facilities can help manage effective response plan post disaster. There are 47 senior facilities located in the County.

2.6.8 GOVERNMENT BUILDINGS

In addition to the facilities discussed, county and municipal buildings, department of public works facilities and public health departments are essential to the continuity of operations pre-, during and post-disasters. These facilities are included in the risk assessment.

2.7 TRANSPORTATION SYSTEMS

The County is bisected by a network of approximately 2,000 miles of federal interstate freeways, and state, county and municipal roads. Major interstate highways in Morris County included Interstate 80, 280, and 287, and State Routes 10 and 46. In addition to the roadways, the County is served by rail, bus and air, which are described below. Figure 3 13 illustrates the regional transportation lifelines serving the County. The transportation inventory included as part of this HMP includes airports, major bus stations, and major rail facilities.

2.7.1 RAIL SERVICE

Morris County benefits from the services of three prominent freight railroad companies: the Morristown & Erie Railway, the New York, Susquehanna, and Western Railway, and the Norfolk Southern Railway. Moreover, the county possesses ownership of three vital railroads, all diligently managed and maintained through a contractual partnership with the Morristown & Erie Railway. These pivotal lines include the Chester Branch, High Bridge Branch Railroad, and the Dover & Rockaway Railroad. Together, these railroads play a crucial role in the transportation and logistics infrastructure of Morris County.

Figure 10. Essential Facilities in Morris County

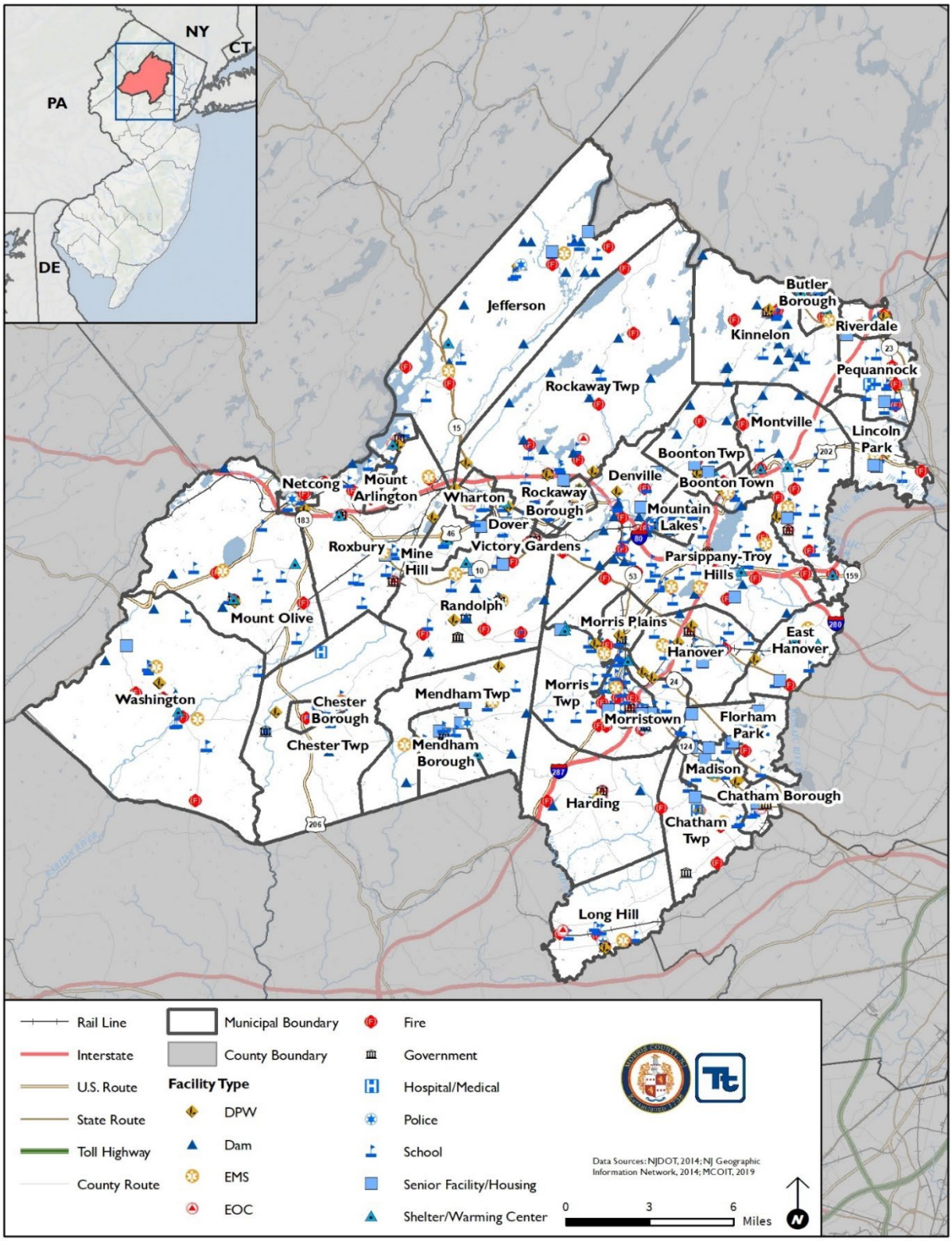
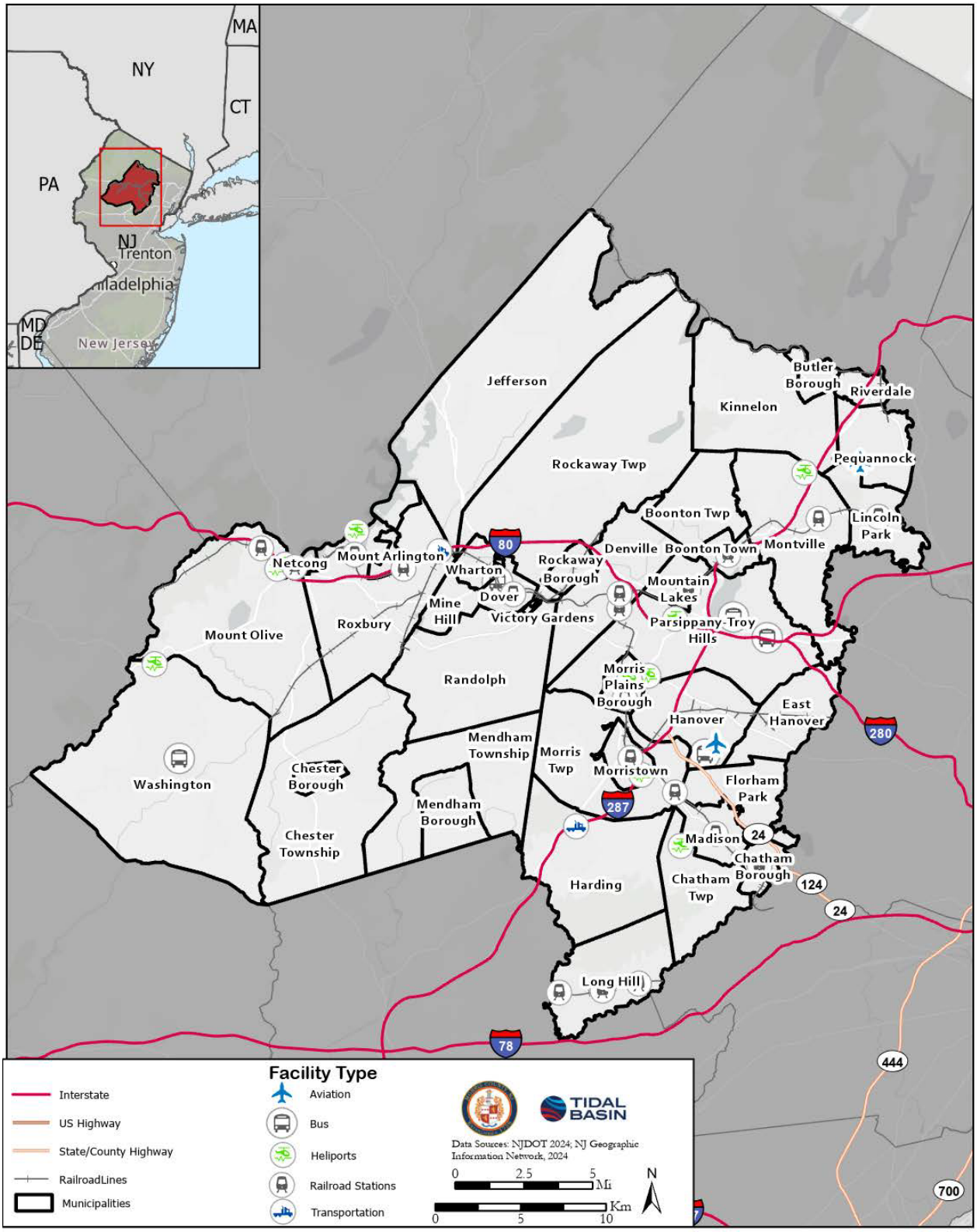


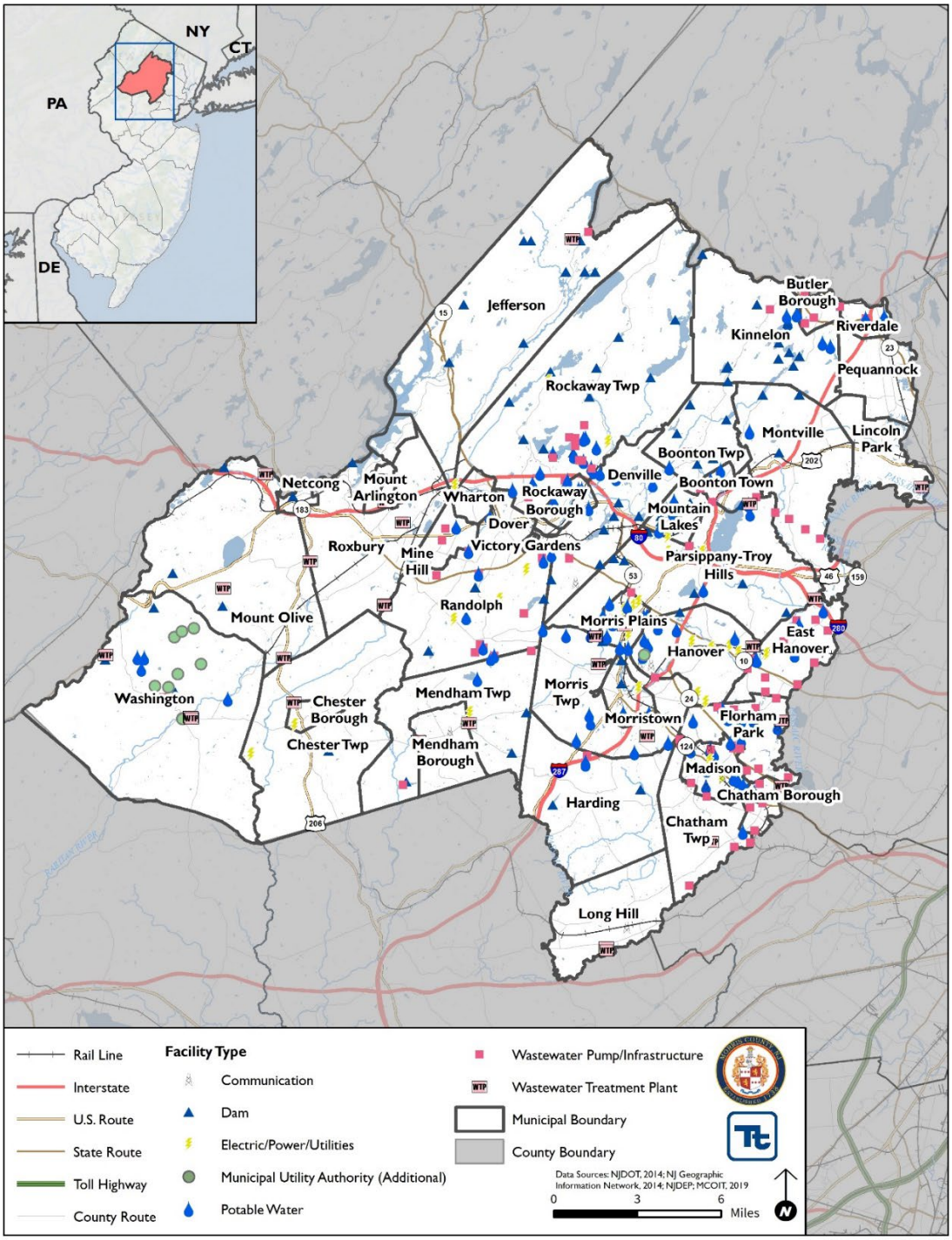
Figure 11. Transportation Facilities in Morris County



2.8 LIFELINE UTILITY SYSTEMS

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

Figure 12. Utility Lifelines in Morris County



2.8.1 COMMUNICATION

Morris County has a network of both public and private communication facilities and towers. Telecommunication services are provided by multiple organizations, including Verizon, Sprint International, and TRANSCOM. There were nine essential communication facilities identified in the County.

2.8.2 POTABLE WATER

Public community water supply systems in Morris County serve approximately 55% of the total County area and approximately 85% of the County's population. The water supply infrastructure generally serves areas that are also served by sewers. Individual onsite wells typically serve the more rural and less densely populated areas in the County. There are 121 potable water pumps, tanks, and facilities identified in the County for the purposes of this analysis. The following table provides the water supply utilities in the County and the municipalities each serve.

Table 11. Potable Water Supply Systems in Morris County

Municipality	Major Water Systems
Boonton Town	Boonton WD
Boonton Twp.	Denville WD, Boonton Twp. WD, Mt. Lakes WD
Butler Boro.	Butler WD
Chatham Boro.	Southeast Morris County MUA, Chatham Boro. WD
Chatham Twp.	NJ American Water Co. (Passaic Basin), Southeast Morris County MUA
Chester Boro.	NJ American Water Co. (Raritan and Passaic Basin), Washington Twp. MUA-Hager
Chester Twp.	NJ American Water Co. (Passaic Basin), AWM Four Seasons at Chester
Denville Twp.	Denville WD, Mt. Lakes WD, Rockaway Boro. WD
Dover Town	Dover Water Commission
East Hanover Twp.	East Hanover WD
Florham Park Boro.	NJ American Water Co. (Passaic Basin), Florham Park WD
Hanover Twp.	Southeast Morris County MUA
Harding Twp.	Southeast Morris County MUA, NJ American Water Co. (Passaic Basin), Lake Shore Water Co.
Jefferson Twp.	Sparta Twp. Water Utility, Jefferson Twp. Water Utility (Lake Hopatcong, Milton & Vassar Road), Sun Valley Park
Kinnelon Boro.	Kinnelon WD, Butler WD, Fayson Lakes Water Co.
Lincoln Park Boro.	Lincoln Park WD, Lincoln Park Jacksonville System, Pequannock WD, Pequannock Twp. WD-Cedar Crest
Madison Boro.	Madison WD
Mendham Boro.	NJ American Water Co. (Passaic Basin)
Mendham Twp.	Southeast Morris County MUA, NJ American Water Co. (Passaic Basin)
Mine Hill Twp.	Mine Hill WD, Dover Water Commission, Wharton WD
Montville Twp.	Montville MUA, Jersey City MUA, Green Briar Res Health, Signature Care Home@Montville
Morris Twp.	Southeast Morris County MUA, Sisters of Charity South Elizabeth
Morris Plains Boro.	Southeast Morris County MUA
Morristown Town	Southeast Morris County MUA
Mt. Lakes Boro.	Mt. Lakes WD, Denville WD, Parsippany-Troy Hills WD
Mt. Arlington Boro.	Mt. Arlington WD (Kadel & Main System), Roxbury WD (Shore), Suez Water (Arlington Hills)

Municipality	Major Water Systems
Mount Olive Twp.	Mt. Olive WD (Goldmine, Sand, Pinecrest, Lynwood, Tinc Farm, Carlton Hills, Village and Main Systems (Flanders), AWM Country Oaks, Mt. Olive Villages WD, NJ American Water Co. (West Jersey, Passaic Basin and ITC) NJ Vasa Home Water, Hackettstown MUA, Morris Chase/Morris Hunt Water System, Netcong WD, Mount Olive Twp.-Flanders, NJ American Water-Mount Olive/West Jersey
Netcong Boro.	Netcong WD
Parsippany Troy Hills Twp.	Parsippany Troy Hills WD, Denville WD, Mt. Lakes WD,
Long Hill Twp.	NJ American Water Co. (Passaic Basin)
Pequannock Twp.	Pequannock WD (Main and Cedar Crest)
Randolph Twp.	Randolph WD, Denville WD, Morris County MUA, Dover Water Commission
Riverdale Boro.	Riverdale WD
Rockaway Boro.	Rockaway Boro WD, Denville Twp. WD
Rockaway Twp.	Rockaway Twp. WD, Denville WD, Wharton WD, Picatinny Arsenal, Hoffman Homes Community LLC, Rockaway Boro WD, Dover WD
Roxbury Twp.	Roxbury WD (Evergreen, Sky View, Shore), Netcong WD, NJ American Water-Roxbury
Victory Gardens Boro.	Dover Water Commission
Washington Twp.	Washington MUA (Hager and Schooley's Mountain), Hackettstown MUA, Sherwood Village, Aqua, Cliffside Park Assoc. Inc.
Wharton Boro.	Dover Water Commission, Wharton WD

Source: NJDEP Data Miner; Mobile Home Parks Excluded

2.8.3 WASTEWATER FACILITIES

2.8.3.1 CURRENT SEWER SERVICE AREAS AND FACILITIES

Centralized wastewater treatment systems in Morris County play a pivotal role in servicing a substantial portion of the region. They cover approximately 41% of the county's total area and serve around 70% of its population. Similarly, public community water supply systems have a wide reach, covering roughly 55% of the county's area and meeting the water needs of approximately 85% of its population. Notably, these water supply systems are primarily concentrated in areas also served by sewer systems.

In contrast, individual onsite wells are the primary water source for the more rural and less densely developed areas of the county. Overall, there are 25 major facilities dedicated to serving Morris County's wastewater needs. These major facilities fall into several categories, including non-industrial facilities providing treatment for entire municipalities, regionalized treatment plants serving multiple municipalities across counties, and residential or multi-use facilities catering to specific areas within municipalities, where potential future wastewater generation is anticipated. These facilities collectively ensure the effective management and distribution of water resources across Morris County.

Table 12. Current Sewer Service Utilities and Municipalities Served

Wastewater Utility	Municipalities Served in Morris County
Ajax Terrace Water Pollution Control Plant	Roxbury Twp.
Butterworth Sewage Treatment Plant	Morris Plains Boro., Parsippany-Troy Hills Twp., Randolph Twp.
Chatham Twp. WPCP #1 (Chatham Main)	Chatham Twp.
Chester Boro. Wastewater Treatment Plant	Chester Boro.
Clover Hill Sewage Treatment Plant	Mount Olive Twp.

Wastewater Utility	Municipalities Served in Morris County
Florham Park Sewerage Utility	Florham Park Boro., East Hanover Twp., Morris Twp.
Greystone Park Psychiatric Hospital	Parsippany-Troy Hills Twp.
Hackettstown Municipal Utilities Authority Sewage Treatment Plant	Mount Olive Twp., Washington Twp.
Hanover Municipal Utilities Authority Sewage Treatment Plant	East Hanover Twp. Hanover Twp., Morris Plains Boro., Morris Twp., Parsippany-Troy Hills Twp.
Hercules Company WPCP	Roxbury Twp.
Long Hill Twp. Sewage Treatment Plant	Long Hill Twp.
Mendham Boro. Sewage Treatment Plant	Mendham Boro.
Molitor Water Pollution Control Facility (Madison-Chatham Joint Meeting)	Chatham Boro., Chatham Twp., Madison Boro.
Moosepac Pond Sewage Treatment Plant/ Water's Edge	Jefferson Twp.
Morristown Sewer Utility Sewage Treatment Plant	Hanover Twp., Morris Twp. Morristown
Mount Olive Villages Sewer Company Sewage Treatment Plant	Mount Olive Twp.
Musconetcong Sewerage Authority Sewage Treatment Plant (MSA)	Mount Arlington Boro., Mount Olive Twp., Netcong Boro., Roxbury Twp., Jefferson Twp.
Parsippany-Troy Hills Sewage Treatment Plant	Denville Twp., East Hanover Twp., Montville twp., Mountain Lakes Boro., Parsippany-Troy Hills Twp.
Rockaway Valley Regional Sewerage Authority Sewage Treatment Plan (RVRSA)	Boonton Town, Boonton Twp., Denville Twp., Dover Town, Mine Hill Twp. Montville Twp., Parsippany-Troy Hills Twp., Randolph Twp., Rockaway Boro., Rockaway Twp. Victory Gardens Boro., Wharton Boro.
Two Bridges Wastewater Treatment Plant	Butler Boro., Kinnelon Boro., Lincoln Park Boro., Pequannock Twp., Riverdale Boro.
United Water (Suez) Mid-Atlantic (Arlington Hills) Sewage Treatment Plant	Mount Arlington Boro., Roxbury Twp.
Schooley's Mountain Wastewater Treatment Plant	Washington Twp.
White Rock Lake Sewage Treatment Plant	Jefferson Twp.
Woodland Sewage Treatment Plant	Florham Park Boro., Madison Boro., Harding Twp., Morris Twp., Morristown Town

Source: NJDEP Office of Water Resource Management Coordination

2.8.4 PACKAGE PLANTS

Despite the existence of regional facilities, many areas of the County remain outside sewer service areas. As a result, many commercial and housing developments are served by small on-site discharge to groundwater (DGWs) and discharge to surface water (DSWs) systems that provide treatment for individual or small sites. Typically identified as "package plants," these small, dedicated treatment systems are designed to serve specific users that typically generate over 2,000 gallons per day (gpd), with some older package treatment systems treating less than 2,000 gpd; they are not part of a regional system capable of addressing multiple users. These facilities provide a level of sewage treatment, which may be less rigorous than the treatment provided by the regional systems, but more effective than that provided by individual septic systems. According to analysis conducted by the Morris County Office of Planning and Preservation in October 2019, there are approximately 110 of these sites located throughout the County.

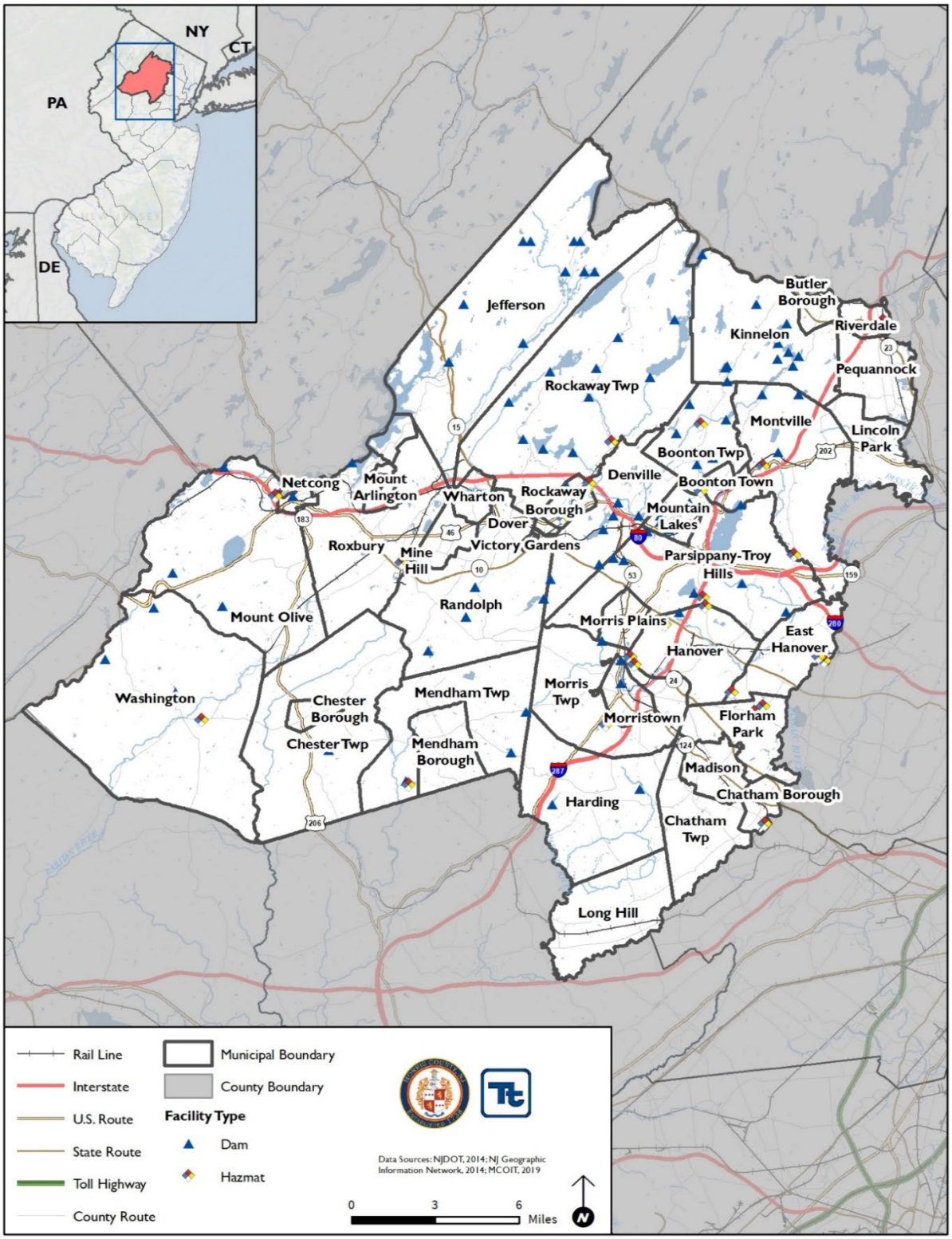
2.9 ENERGY RESOURCES

Jersey Central Power & Light (JCP&L) is the primary energy service provider for Morris County. Other service providers include Public Service Electricity & Gas (PSE&G), New Jersey Natural Gas, Transco Gas Transmission, Madison Electric Department, Elizabethtown Gas, Duke Energy, Columbia Gas Transmission, Butler Electric Company and Algonquin Pipeline Company. There are seven electric generation facilities, eight electric substations, seven natural gas facilities, three nuclear facilities, and three oil facilities identified in the County for the purposes of the risk assessment.

2.10 HIGH POTENTIAL LOSS FACILITIES

High-potential loss facilities include dams/levees, chemical storage facilities and military installations. Figure 12 displays the general locations of these facilities in the County.

Figure 13. High Potential Loss Facilities



2.11 DAMS AND LEVEES

According to the National Inventory of Dams there are 120 dams located in Morris County, 42 of which are classified with a high-hazard potential. Please see the Flooding section of the HIRA for more information on dams and levees in Morris County.

2.12 HAZARDOUS MATERIALS FACILITIES

There are 115 hazardous waste sites within Morris County for the purposes of this assessment. Please see the Hazardous Materials section of the HIRA for more information on fixed sites, known contaminated sites, and how substances are transported in Morris County.

2.13 MILITARY

Picatinny Arsenal is the Joint Center of Excellence for Guns and Ammunition, providing products and services to all branches of the U.S. military. Nestled in the northern New Jersey Highlands, there are more than 6,000 personnel which includes Soldiers, Sailors, Airmen, Marines, U.S. Federal employees and contractor personnel who lead in the research, development, acquisition and lifecycle management of advanced conventional weapon systems and ammunition.

2.14 COMMUNITY CAPABILITIES

Section 1 of each community-specific annex contains information on that jurisdiction's specific capabilities. The following capabilities are presented:

- Planning, Legal and Regulatory Capabilities
- Administrative and Technical Capabilities
- Fiscal Capabilities
- Education and Outreach Capabilities
- Community Classifications
- National Flood Insurance Program Compliance

As part of the capability review process, communities to were asked whether specific capabilities could be integrated with the hazard mitigation plan and program based on authority and ability. Where this integration was called for, specific mitigation actions were written and noted in the assessment. Communities were also encouraged to utilize specific hazard mitigation-related capability gaps to develop mitigation actions – where they did, closing those gaps is reflected in each community's updated hazard mitigation strategy.

SECTION 3: HAZARD ANALYSIS AND RISK ASSESSMENT

3.1 RISK ASSESSMENT

A risk assessment is the process of measuring the potential loss of life, personal injury, and economic and property damage resulting from identified hazards. It allows planning personnel to address and reduce hazard impacts and emergency management personnel to establish early response priorities by identifying potential hazards and vulnerable assets. Results of the risk assessment are used to inform mitigation planning processes, including determining and prioritizing mitigation actions that reduce a community's risk to a specified hazard. Past, present, and future conditions must be evaluated to assess risk most accurately for each jurisdiction. The Morris County risk assessment includes the following:

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

3.2 HAZARD SUMMARY

3.2.1 IDENTIFICATION OF HAZARDS

Morris County considered a full range of natural hazards that could impact the planning area, and then identified and ranked those hazards that presented the greatest concern. The process incorporated input from the County and participating jurisdictions; review of the State of New Jersey Hazard Mitigation Plan (NJ HMP) and previous hazard identification efforts; research of local, state, and federal information on the frequency, magnitude, and costs associated with the various hazards that have previously, or could feasibly, impact the region; and qualitative or anecdotal information regarding natural hazards and the perceived vulnerability of the study area's assets to them.

Except for hazardous substance release (fixed and in-transit), Morris County continued to focus on natural hazards in this update.

A total of eight natural hazards and one human-caused hazard of concern were identified as significant hazards affecting the entire planning area, to be addressed at the county level in this plan:

- Drought
- Earthquake
- Extreme Temperatures
- Flood
- Geological Hazards
- Hazardous Materials
- Severe Weather
- Severe Winter Weather
- Wildfire

3.2.2 CHANGES IN HAZARDS FOR THE 2025 HMP UPDATE

The planning team reviewed the hazards in the 2020 Morris County Hazard Mitigation Plan (HMP) to ensure that all hazards were still relevant to the county and to the hazard mitigation process. Three hazards were identified for removal from the updated strategy:

- Disease Outbreak
- Infestation
- Algae Bloom

These hazards were removed after discussion with the participating jurisdictions. It was decided that these three hazards were better and more effectively captured by other agencies and efforts. After examining the hazards list, it was also observed that the Dam Failure chapter predominantly contained impacts and data related to flood hazards. To enhance usability and streamline the plan, pertinent dam failure information has been incorporated as a subset within the Flood hazard chapter.

3.3 ASSESSMENT METHODOLOGY

Once the list of hazards for the 2025 plan update were finalized, an assessment of each hazard was conducted. Each hazard was assessed using the following criteria:

Hazard Profile

- Location – geographic area most affected by the hazard
- Extent – severity of each hazard
- Previous Occurrences and Losses
- Probability of Future Hazard Events
- Impacts of Climate Change

Following the hazard profiles, each hazard was assessed for the following vulnerabilities:

- Impact to Life, Health, and Safety
- Impact to the General Building Stock
- Impact to Critical Facilities and Lifelines
- Impact to the Economy
- Future Changes that May Impact Vulnerability
- Change of Vulnerability Since the 2020 HMP

Hazards were ranked on three metrics to determine an overall significance – Probability of Occurrence, Severity of Impact, and Extent, based on the following metrics:

Probability of Occurrence. Probability was assessed and ranked based on a hazard's likelihood over the next ten years.

Indicator	Probability of Future Incidents	Numerical Hazard Score
Highly Likely	An event probable in the next year	4
Likely	An event probable in the next 2–3 years	3
Possible	An event possible in the next 4–5 years	2
Unlikely	An event is unlikely in the next 10 years	1

Severity of Impact. Severity was assessed and ranked based on a hazard's likely impacts to people, facilities, and property.

Severity Indicator	Deaths/Injuries	Shutdown of Facilities	Percentage of Property Destroyed	Numerical Hazard Score
Catastrophic	High number of deaths and/or injuries	Complete shutdown for 30 days or more	More than 50% damaged or destroyed	4
Critical	Multiple deaths and/or injuries	Complete shutdown for a week to 30 days	25% to 50% of property damaged or destroyed	3
Limited	Minor injuries only	Complete shutdown of facilities for one day to one week	10% to 25% of property damaged or destroyed	2
Minor	Few, if any, injuries	Shutdown of facilities only temporary	Less than 10% of property damaged or destroyed	1

Extent. Extent was assessed and ranked based on a hazard's geographic impact on the planning area.

Extent Indicator	Spatial Extent	Numerical Hazard Score
Extensive	Expected to affect more than 50% of people and/or property	4
Moderate	Expected to affect 25–50% of people and/or property	3
Limited	Expected to affect 10–25% of people and/or property	2
Minimal	Expected to affect less than 10% of people and/or property	1

Public Perception. Public perception was measured through the results of the public survey.

Public Perception Indicator	Public Survey Result	Numerical Hazard Score
High	Most survey respondents marked high level of concern	3
Moderate	Most survey respondents marked moderate level of concern	2
Low	Most survey respondents marked low level of concern	1

3.3.1 GEOGRAPHIC INFORMATION SYSTEMS (GIS) METHODOLOGY

Leveraging Geographic Information Systems (GIS) in hazard mitigation planning allows readers and decision-makers to visualize hazard risks within the study area. Risk mapping and analysis through GIS can benefit decision-making throughout the emergency management lifecycle.

Advances in the geospatial field have resulted in numerous open-source datasets being made available to general users. The initial decision not to update the GIS system for the current plan early in the planning process was made in conjunction with county officials, considering the age of the previous update and the minimal changes to base data that did not justify a comprehensive mapping overhaul. Consequently, select information from the previous plan remains visible in the risk assessment. The decision not to update this information reflects the stability of the underlying data and strategic approach to maintain consistency in the risk assessment process. As the process continued, GIS needs were revisited and mapping and analysis were updated in areas where new data had been developed.

3.4 HAZARD RANKINGS

Following the specific scoring for probability, severity and extent, hazards were given a total ranking based on each individual score.

1–5 Low
6–10 Moderate
11–15 High

The following table notes the scoring for each hazard assessed in this plan, on a countywide level.

Hazard	Probability	Severity of Impact	Extent	Public Perception	Total
Drought	Possible - 2	Minor - 1	Limited - 1	Moderate - 2	Moderate -6
Earthquake	Unlikely – 1	Critical – 3	Moderate – 3	Low - 1	Moderate - 8
Extreme Temps	Highly Likely - 4	Limited - 2	Minimal - 1	High - 3	Moderate - 10
Flood	Highly Likely - 4	Critical – 3	Moderate - 3	High – 3	High - 13
Geological Hazards	Possible – 2	Limited - 2	Limited – 2	Moderate – 2	Moderate - 8
Hazardous Materials	Highly Likely – 4	Critical – 3	Limited – 2	High – 3	High - 12
Severe Weather	Highly Likely - 4	Limited – 2	Moderate -3	High – 3	High - 12
Severe Winter Weather	Highly Likely - 4	Limited – 2	Moderate - 3	High – 3	High - 12
Wildfire	Possible - 2	Limited - 2	Limited - 2	Medium - 2	Moderate - 8

Specific communities may have different levels of probability, expected severity, extent and public perception relative to the countywide rankings; community-specific rankings are reflected in the community annexes.

3.5 DROUGHT

3.5.1 2025 HMP UPDATE CHANGES

- All subsections have been updated using the best available data.
- Previous occurrences were updated with events that occurred between 2019 and 2024.

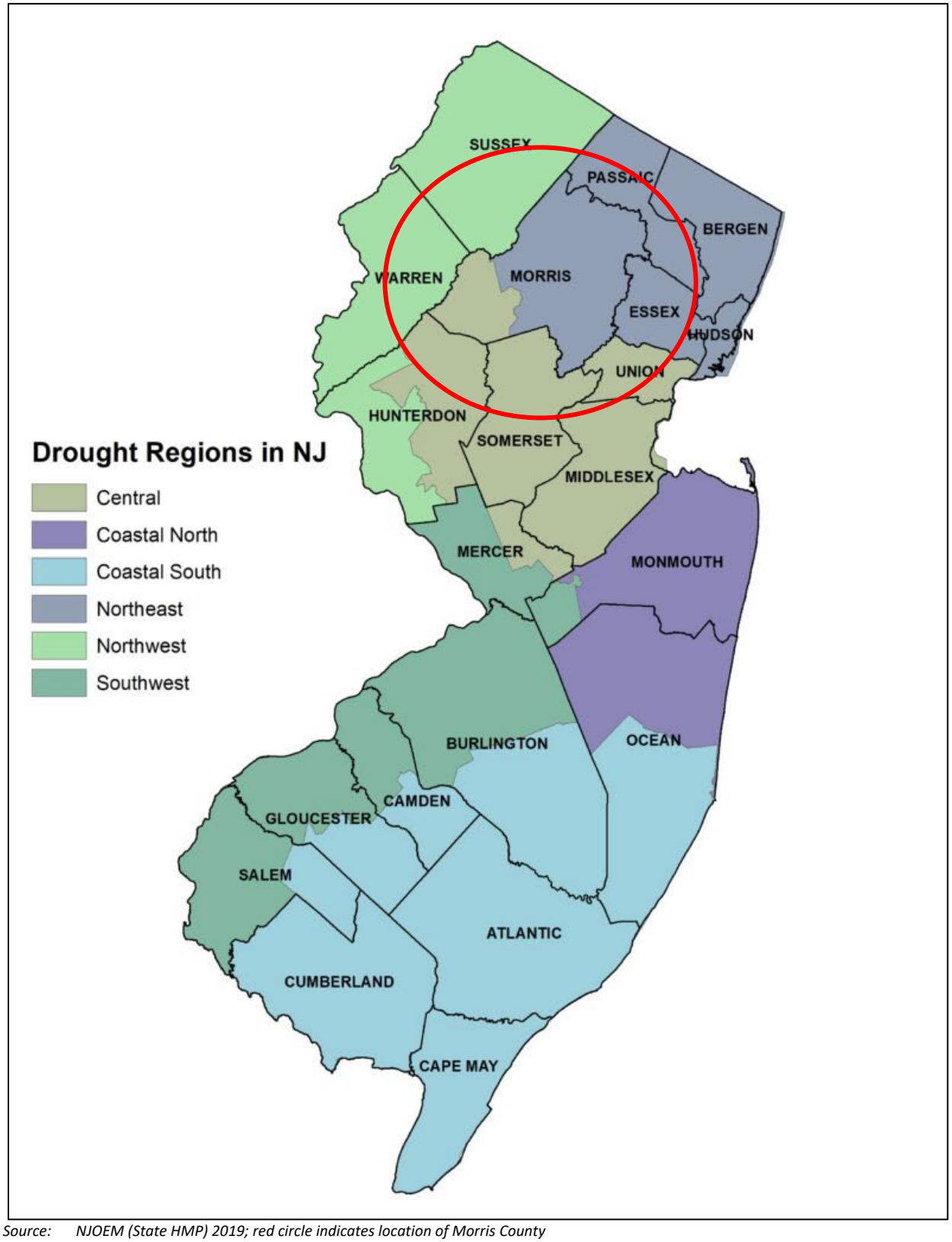
3.5.2 PROFILE

Drought is a period characterized by long durations of below-normal precipitation. Drought conditions occur in virtually all climatic zones, yet characteristics of drought vary significantly from one region to another, relative to normal precipitation within respective regions. Drought can affect agriculture, water supply, aquatic ecology, wildlife, and plant life. Drought is a temporary irregularity in typical weather patterns and differs from aridity, which reflects low rainfall within a specific region and is a permanent feature of the climate of that area.

3.5.3 LOCATION

Drought is a regional hazard that can impact the entire planning area at once. To better respond to drought conditions, New Jersey is separated into drought regions, allowing the state to respond to changing conditions without imposing restrictions on areas not experiencing water supply shortages. New Jersey is divided into six drought regions that are based on regional similarities in water supply sources and rainfall patterns; Figure 14 shows these drought regions. Morris County is mainly located in the Northeast Drought Region, with the western portion of the county located in the Central Drought Region.

Figure 14. Drought Regions of New Jersey



Source: NJOEM (State HMP) 2019; red circle indicates location of Morris County

Morris County's water supply sources are from confined groundwater, unconfined groundwater, and surface water sources.

3.5.4 EXTENT

The severity of a drought depends on the degree of moisture deficiency, duration, and 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. The State of New Jersey uses a multi-index system that takes advantage of some of these indices to determine the severity of a drought or extended period of dry conditions.

The Palmer Drought Severity Index (PDSI) is commonly used by drought monitoring agencies for drought reporting. The PDSI is primarily based on soil conditions. Soil with decreased moisture content is the first indicator of an overall moisture deficit. Table 13 lists the PDSI classifications.

Table 13. Palmer Drought Severity Index (PDSI) Classifications

Category	Description	Possible Impacts	Palmer Drought Index
D0	Abnormally Dry	Going into drought: short-term dryness slowing planting and growth of crops or pastures; fire risk above average. Coming out of drought: some lingering water deficits; pastures or crops not fully recovered.	-1.0 to -1.99
D1	Moderate drought	Some damage to crops and pastures; fire risk high; streams, reservoirs, or wells low; some water shortages developing or imminent; voluntary water-use restrictions requested.	-2.0 to -2.99
D2	Severe drought	Crop or pasture losses likely; fire risk very high; water shortages common; water restrictions imposed.	-3.0 to -3.99
D3	Extreme drought	Major crop or pasture losses; extreme fire danger; widespread water shortages or restrictions.	-4.0 to -4.99
D4	Exceptional drought	Exceptional and widespread crop/pasture losses; exceptional fire risk; shortages of water in reservoirs, streams, and wells, creating water emergencies.	-5.0 or less

Source: NOAA

The Division of Water Supply and Geoscience within the NJDEP regularly monitors various water supply conditions across the state based on the different Water Supply Regions. The water supply conditions aid the department in declaring the regions as being within one of the four stages of water supply drought - Normal, Drought Watch, Drought Warning, and Drought Emergency.

- A *Drought Watch* is an administrative designation made by the department when drought or other factors begin to adversely affect water supply conditions. A Watch indicates that conditions are dry but not yet significantly so. During a drought Watch, the department closely monitors drought indicators (including precipitation, stream flows, reservoir and groundwater levels, and water demands) and consults with affected water suppliers.
- A *Drought Warning* represents a nonemergency phase of managing available water supplies during the developing stages of drought and falls between the Watch and Emergency levels of drought response. A Drought Watch aims to avert a more serious water shortage that would necessitate the declaration of a water emergency, imposition of mandatory water use restrictions, bans on water use, or other potentially drastic measures.
- A *Drought Emergency* can only be declared by the governor. While drought warning actions focus on increasing or shifting the supply of water, efforts initiated under an Emergency focus on reducing water

demands. During an Emergency, a phased approach to restricting water consumption is typically initiated. Phase I water use restrictions typically target nonessential, outdoor water use.

3.5.5 PREVIOUS OCCURRENCES

Precipitation variability coupled with concentrated population centers can produce wide fluctuations in water availability and demands. The state and county have experienced several episodes of drought that have resulted in water shortages of varying degrees (e.g., mid-1960's, early to mid-1980's and 2001-2002). New Jersey experienced drought conditions in 2016 and 2017. A Drought Warning was declared for 14 counties in October 2016 that ended for all but two counties on April 12, 2017. The Drought Warning was lifted in full on August 11, 2017.

The State of New Jersey has experienced two FEMA-declared drought-related disasters or emergencies classified as a water shortage, as shown in Table 14. Generally, these disasters cover a wide region of the state and impact many counties. Morris County was included in both declarations.

Table 14. FEMA Declarations Related to Drought

Declaration	Event Date	Declaration Date	Event Description
DR-205	August 18, 1965	August 8, 1967	Drought: Water Shortage
EM-3083	October 19, 1980	May 21, 1983	Drought: Water Shortage

Source: FEMA

Agriculture-related drought disasters are quite common. The USDA Secretary of Agriculture is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in counties that are contiguous to a designated county. Table 15 shows agricultural declarations that included Morris County.

Table 15. Agricultural Drought Declarations Including Morris County

Year	Declaration Number	Causes
2015	S3930	Excessive heat and drought
2016	S4071	Freeze, excessive heat and drought
2022	S5342	Drought and excessive heat
2022	S5345	Drought and excessive heat
2022	S5346	Drought and excessive heat
2024	34027	Drought and excessive heat

Source: USDA

The National Centers for Environmental Information (NCEI) Storm Events Database records 41 instances of drought between January 1, 1997, and September 30, 2024. No injuries, deaths, property damages, or crop damages were reported by the NCEI. Recorded impacts include reduced reservoir and river levels, stress on vegetation, and reduction in crop yields. Protective measures implemented during these drought incidents included forest fire warnings, as well as voluntary and mandatory water restrictions. The University of Nebraska Lincoln's Drought Impact Reporter was also consulted for the same timeframe; recorded impacts for Morris County included impacts to tourism and recreation, water supply and quality, and restrictions.

Drought is a normal climate pattern that has occurred in varying degrees of length, severity, and size throughout history. The US Drought Monitor provides data on a week-by-week basis for drought conditions in counties. Table 12 shows drought data in Morris County for 1,303 weeks between January 2000 and December 2024, along with the percentage of time that the county spent in each drought condition. Most of the time spent in drought conditions was spent in D0 or D1 drought.

Table 16. Time Spent in Drought Conditions 2000 - 2023

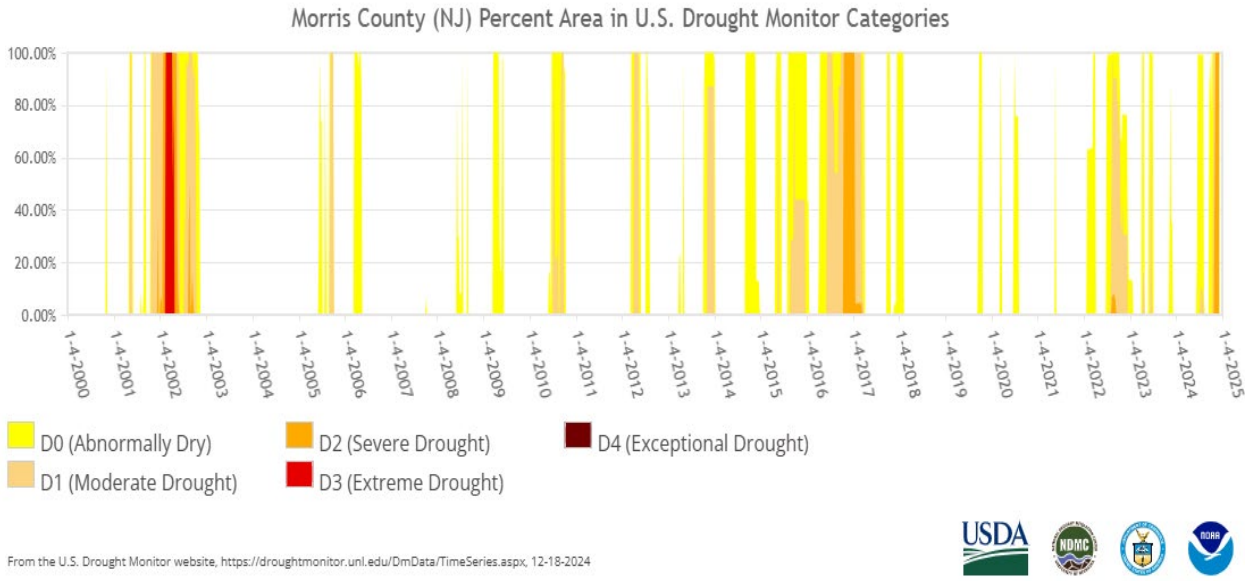
Drought Category	Number of Weeks Spent in Each Category*	Percentage of Time Spent in Each Category
None	1050	80.66%
D0	364	27.42%
D1	178	13.27%
D2	61	4.40%
D3	10	0.80%
D4	0	0.00%

*Different areas of the county can be in different drought categories in the same week

Source: US Drought Monitor

Figure 15 shows weekly drought conditions in Morris County graphically between the year 2000 and December 2024.

Figure 15. Drought History in Morris County 2000-2023



Source: US Drought Monitor

3.5.6 PROBABILITY

Based on the historical occurrences for drought, Morris County can anticipate a range of drought from abnormally dry to severe, or D0 to D2, based on the Palmer Drought Category. It is estimated that Morris County will continue to experience direct and indirect impacts of drought and its impacts on occasion, with the secondary effects causing potential disruption or damage to agricultural activities and creating shortages in water supply within communities. Morris County experienced some level of drought condition for approximately 20% of the period from 2000 to 2024. Extrapolating this trend, there is a 20% likelihood that Morris County will be in some level of drought condition in any given year, with an even lower probability of experiencing major drought conditions.

3.5.7 CLIMATE CHANGE IMPACTS

The future drought potential that New Jersey is modeled to experience indicates the State will experience more frequent but not necessarily more severe droughts. While all droughts impose some level of stress on water supplies, some will have long-term effects. If the projected more frequent droughts are spaced out over time, then New Jersey's water supply systems should be capable of recovering between droughts. However, more frequent droughts raise the potential for sequential droughts that do not allow for recovery of reservoir levels or aquifer storage, resulting in a scenario where moderate droughts could have aggregate results that severely test water supply capabilities.

As temperatures rise, people and animals will need more water to maintain their health and to thrive. Many economic activities, such as hydropower, raising livestock, and growing foods, will also require water. The amount of water available for these activities may be reduced as temperatures rise and if competition for water resources increases.

3.5.8 VULNERABILITY ASSESSMENT

3.5.8.1 IMPACT TO LIFE, HEALTH, AND SAFETY

The entire population of Morris County is exposed to drought events. Drought conditions can cause a shortage of potable water for human consumption, both in quantity and quality. A decrease in available water may also impact power generation and availability to residents.

Public health impacts may include an increase in heat-related illnesses, waterborne illnesses, recreational risks, limited food availability, and reduced living conditions. Vulnerable populations could be particularly susceptible to the drought hazard and cascading impacts due to age, health conditions, and limited ability to mobilize to shelter, cooling, and medical resources. Other possible impacts to health due to 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.

3.5.8.2 IMPACT ON GENERAL BUILDING STOCK

No structures are anticipated to be directly affected by a drought event. However, droughts contribute to conditions conducive to wildfires and reduce fire-fighting capabilities. Risk to life and property is greatest in those areas where forested areas adjoin urbanized areas (high density residential, commercial and industrial) also known as the wildfire urban interface (WUI). Therefore, all assets in and adjacent to, the WUI zone, including population, structures, critical facilities, lifelines, and businesses are considered vulnerable to wildfire. Refer to Section 1.14 for the Wildfire risk assessment.

3.5.8.3 IMPACT ON CRITICAL FACILITIES

While drought events generally do not impact buildings, droughts have the potential to impact agriculture-related facilities and critical facilities that rely on potable water supplies. Additionally, critical facilities in and adjacent to wildfire hazard areas are also considered vulnerable.

3.5.8.4 IMPACT ON THE ECONOMY

Drought can produce a range of impacts that span many economic sectors and can reach beyond areas 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. When a state of water emergency is declared by the governor, the NJDEP may impose mandatory water restrictions and require specific actions to be taken by water suppliers. According to the New Jersey Water Supply Plan, a water emergency seeks to cause as little disruption as possible to commercial activity and employment.

A prolonged drought can have a serious economic impact on a community. Increased demand for water and electricity can 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.

Direct impacts of drought include reduced crop yield, increased fire hazard, reduced water levels, and damage to wildlife and fish habitat. The many impacts of drought can be listed as economic, environmental, or social. Direct and indirect losses include the following:

- Damage to crop quality and crop losses.
- Insect infestation leading to crop and tree losses.
- Plant diseases leading to loss of agricultural crops and trees.
- Reduction in outdoor activities.
- Increased risk of brush fires and wildfires due to dried crops, grasses, and dying trees.

The 2017 Census of Agriculture provides the most recent data for agriculture in Morris County. 418 farms are present in Morris County, encompassing 14,514 acres of total farmland. Most of the farms are under 49.9 acres in size; the median operation size of a farm is 12 acres. Table 17 lists the acreage of agricultural land exposed to the drought hazard.

Table 17. Agricultural Land in Morris County

Number of Farms	Land in Farms (acres)	Total Cropland (acres)	Harvested Cropland (acres)
471	14,552	6,831	5,084

Source: USDA 2022 Census of Agriculture

3.5.9 FUTURE CHANGES THAT MAY IMPACT VULNERABILITY

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

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

3.5.9.1 PROJECTED DEVELOPMENT

The New Jersey Water Supply Plan indicates seasonal outdoor water use is rising and is attributable to continued suburbanization and increases in residential and commercial lawn and landscape maintenance. Changes in water demands by commercial/industrial users will depend on future development of this water type use and how effectively efficiency techniques are implemented.

3.5.9.2 PROJECTED CHANGES IN POPULATION

Potable water use is the second largest water use sector and largest consumptive use in New Jersey. As such, population projections, per capital water use, and percent nonresidential water use by water system are important factors to consider when assessing future water needs. According to the 2018 Morris County Strategic Plan, Morris County's population is projected to continue to increase. An increasing population will add new demands to existing water infrastructure. NJDEP assessed future water needs for public water systems factoring in future projected population growth for each municipality, culminating in the NJDEP New Jersey Water Supply Plan 2017-2022. The analysis suggests an additional 68 million gallons per day (mgd) (over 2015 rates) will be needed by 2025 to meet the anticipated growth in potable water demand, 103 mgd by 2030, 134 mgd by 2035, and 164 mgd by 2040.

3.5.9.3 CLIMATE CHANGE

The State of New Jersey is anticipated to undergo a rise in average annual temperatures in the future. The State is projected to encounter more frequent droughts which may affect the availability of water supplies and placing an increased stress on the population and available potable water sources. Agricultural water needs may increase if the climate grows warmer but may decrease if more efficient irrigation techniques are adopted broadly or if precipitation increases. A decrease in water supply, or increase in water supply demand, may increase the County's vulnerability to structural fire and wildfire events. Critical water-related service sectors may need to adjust management practices and actively manage resources to accommodate for future changes.

3.5.10 VULNERABILITY CHANGE SINCE THE 2020 HMP

Overall, the entire County remains vulnerable to droughts. Potable water withdrawal and demand continues to increase as population increases. In terms of the agricultural industry, from 2012 to 2017, there was a 28% increase in number of farms (366 farms to 471 farms), and a 0.65% increase in land in farms (14,458 acres to 14,552 acres) in Morris County. This may suggest an increase in water withdrawals, typically with peaks in the summer months, for traditional agricultural uses like irrigation of crops, plants, and animals as well as other horticultural uses.

3.6 EARTHQUAKE

3.6.1 2025 HMP UPDATE CHANGES

- All subsections have been updated using best available data.
- Previous occurrences were updated with events that occurred between 2019 and 2023.
- The New Jersey Geological and Water Survey (NJGWS) updated liquefaction data has been integrated into the vulnerability assessment.

3.6.2 PROFILE

An earthquake is the sudden movement of the earth's surface caused by the release of stress accumulated within or along the edge of the earth's tectonic plates, a volcanic eruption, or by a manmade explosion. Most earthquakes occur at the boundaries where the earth's tectonic plates meet; less than 10% of earthquakes occur within plate interiors. New Jersey is in an area where the rarer plate interior-related earthquakes occur. As plates continue to move and plate boundaries change geologically over time, weakened boundary regions become part of the interiors of the plates. These zones of weakness within the continents can cause earthquakes in response to stresses that originate at the edges of the plate or in the deeper crust.

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

According to the United States Geological Survey (USGS) Earthquake Hazards Program, an earthquake hazard is any disruption associated with an earthquake that may affect residents' normal activities. This includes surface faulting, ground shaking, landslides, liquefaction, tectonic deformation, tsunamis, and seiches, and other impacts as defined below:

- Surface faulting: Displacement that reaches the earth's surface during a 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 a 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 the wet sand near the water at the beach. Earthquake shaking can cause this effect.
- Tectonic deformation: A change in the original shape of a material caused by stress and strain.
- Tsunami: A sea wave of local or distant origin that results from large-scale seafloor displacements associated with large earthquakes, major sub-marine slides, or exploding volcanic islands.
- Seiche: The sloshing of a closed body of water, such as a lake or bay, from earthquake shaking.

Earthquakes can cause large and sometimes disastrous landslides and mudslides. Any steep slope is vulnerable to slope failure, often as a result of loss of cohesion in clay-rich soils. Unless properly secured, hazardous materials can be released, causing significant damage to the environment and people. Earthen dams and levees are highly susceptible to seismic events and the impacts of their eventual failures can be considered secondary risks for earthquakes.

Earthquakes can also cause dam failures. The most common mode of earthquake-induced dam failure is slumping or settlement of earth-fill dams where the fill has not been property compacted. If the slumping occurs when the dam is full, then overtopping of the dam, with rapid erosion leading to dam failure is possible. Dam failure is also possible if strong ground motions heavily damage concrete dams. Earthquake-induced landslides into reservoirs have also caused dam failures.

Another secondary effect of earthquakes that is often observed in low-lying areas near water bodies is ground liquefaction. Liquefaction is the conversion of water-saturated soil into a fluid-like mass. This can occur when loosely packed, waterlogged sediments lose their strength in response to strong shaking. Liquefaction effects may occur along the shorelines of the ocean, rivers, and lakes and they can also happen in low-lying areas away from water bodies in locations where the ground water is near the earth's surface.

3.6.3 LOCATION

Earthquakes are most likely to occur in the northern parts of New Jersey (including Morris County) where significant faults are concentrated; however, low-magnitude events can and do occur in many other areas of the state. The National Earthquake Hazard Reduction Program (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, 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.

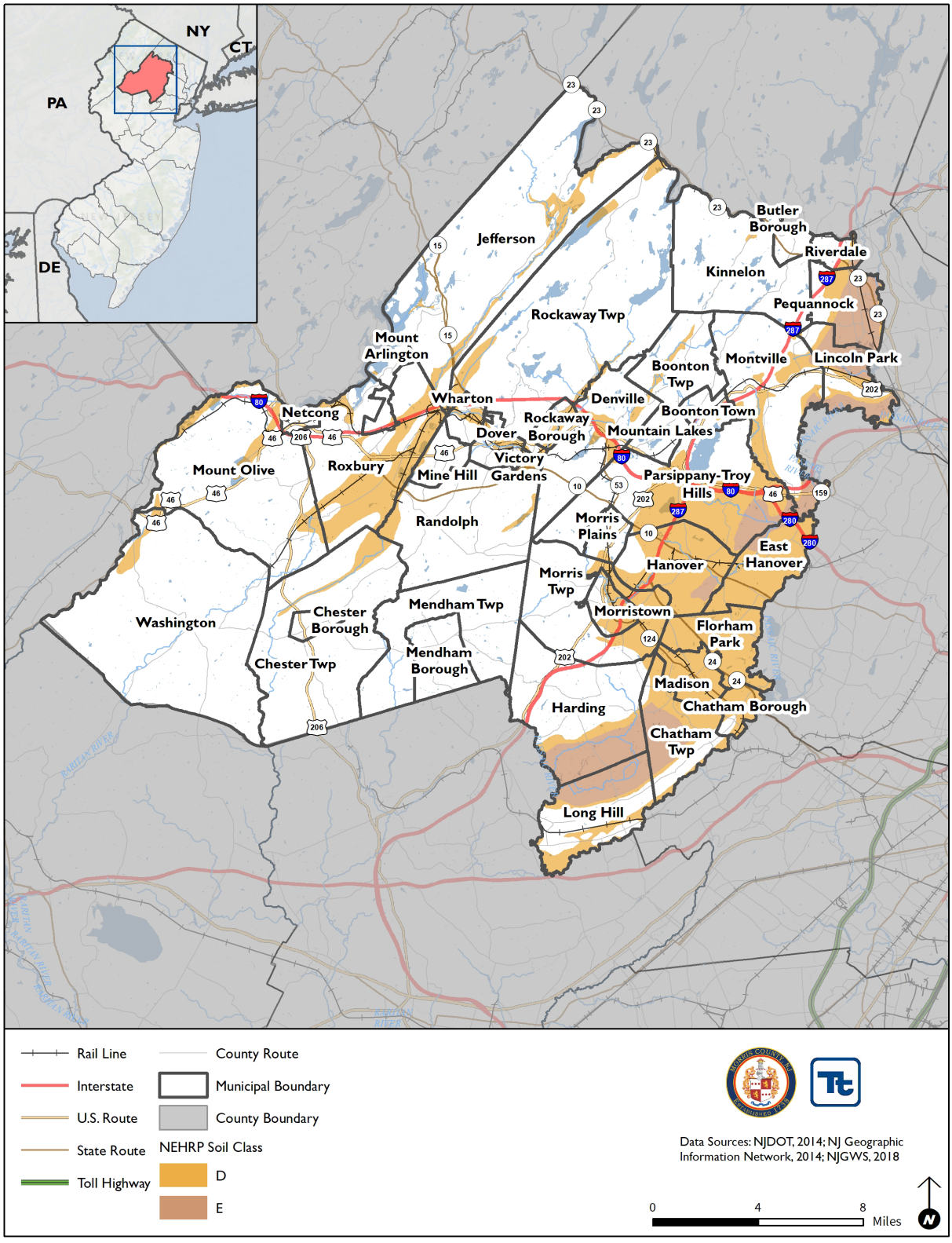
Table 18. National Earthquake Hazard Reduction Program (NEHRP) Soil Classifications

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

Source: FEMA

Figure 16 illustrates the NEHRP soils located in the northeast quadrant of the state. The available NEHRP soils information is incorporated into the HAZUS-MH earthquake model for the risk assessment (discussed in further detail later in this section). According to this figure, Morris County is predominately underlain by class C soils, with bands of class A in the norther portion of the county, bands of class D in the central portion of the county, and large areas of class D and E in the eastern areas.

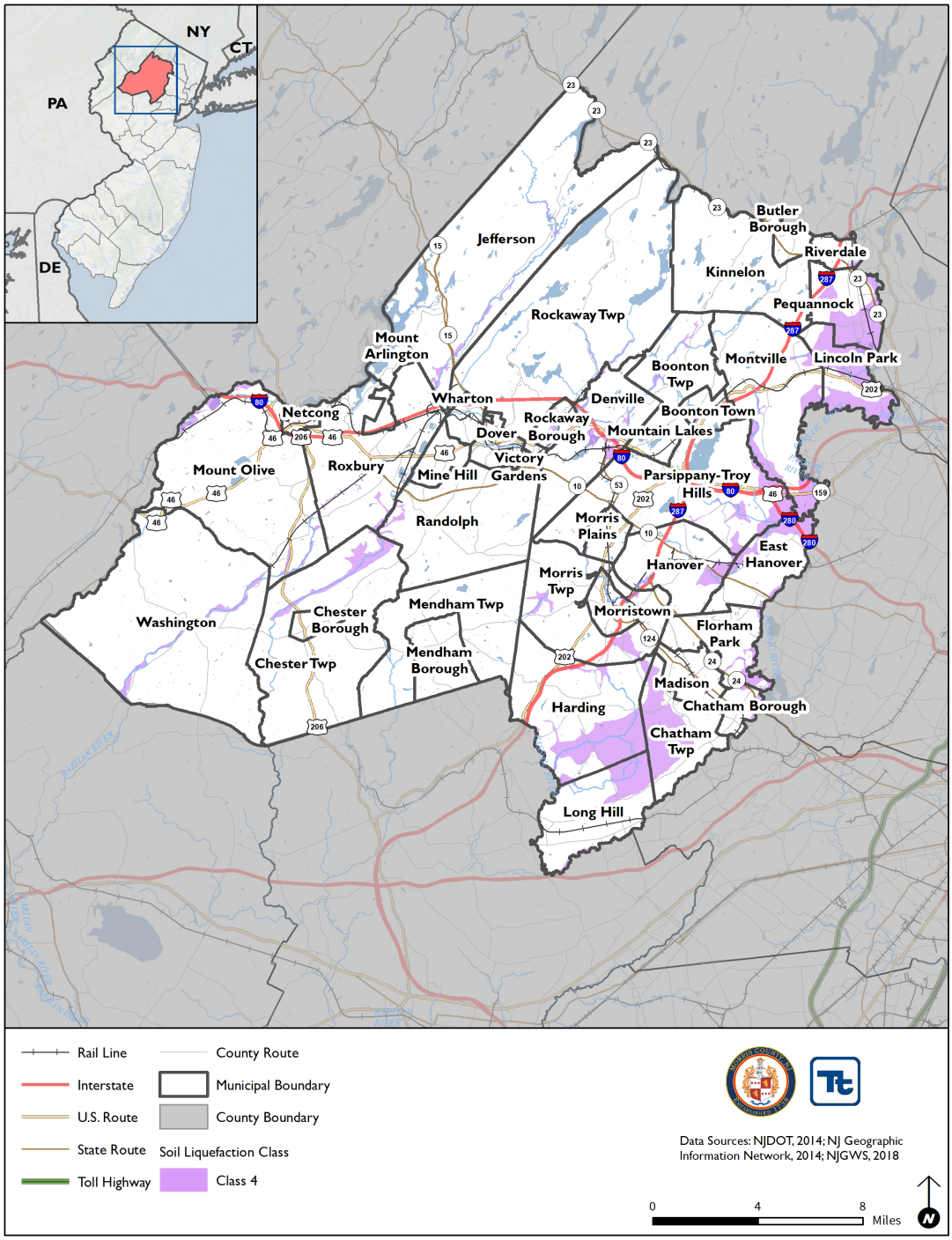
Figure 16. NEHRP Soils in Morris County



Source: 2020 Morris County Hazard Mitigation Plan

Liquefaction has been responsible for tremendous amounts of damage in historical earthquakes around the world. Shaking behavior and liquefaction susceptibility of soils are determined by their grain size, thickness, compaction, and degree of saturation. These properties, in turn, are determined by the geologic origin of the soils and their topographic position. In terms of liquefaction susceptibility, the majority of the susceptibility is found in the eastern portion of Morris County with small areas throughout other areas of the county.

Figure 17. Liquefaction Susceptibility in Morris County

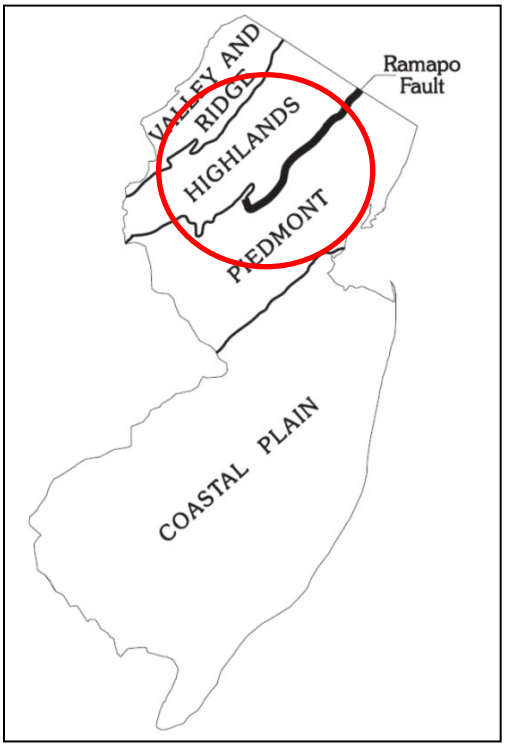


Source: 2020 Morris County Hazard Mitigation Plan

Faults are observed and mapped at the surface. There is no known surface ground displacement along faults in the eastern U.S. from historic earthquakes. Earthquake epicenters in eastern North America and the New Jersey area, in general, occur on known faults. The faults in these parts are from tectonic activity more than 200 million years ago.

There are many faults in New Jersey; however, the Ramapo Fault, which separates the Piedmont and Highlands Physiographic Provinces, is best known and runs through Morris County. Numerous minor earthquakes have been recorded in the Ramapo Fault zone, a 10- to 20-mile-wide area lying adjacent to, and west, of the actual fault. Figure 18 illustrates the relationship of the Ramapo fault line with the physiologic provinces of New Jersey.

Figure 18. Physiographic Provinces of New Jersey and the Ramapo Fault Line



Source: New Jersey Department of Environmental Protection

Note: The red circle indicates the approximate location of Morris County. The County is part of Piedmont Province and the Highlands Province.

3.6.4 EXTENT

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

- Great Mw > 8
- Major Mw = 7.0 – 7.9
- Strong Mw = 6.0 – 6.9
- Moderate Mw = 5.0 – 5.9

- Light Mw = 4.0 – 4.9
- Minor Mw = 3.0 – 3.9
- Micro Mw = 3.0 – 3.9

The most used intensity scale is the Modified Mercalli (MM) Intensity scale. The lower numbers of the intensity scale generally describe how the earthquake is felt by people, while the higher numbers of the scale are based on observed structural damage. Ratings of the scale detailed further in Table 15.

Table 19. Modified Mercalli Intensity Scale

Mercalli Intensity	Description
I	Felt by very few people; barely noticeable.
II	Felt by few people, especially on upper floors.
III	Noticeable indoors, especially on upper floors, but may not be recognized as an earthquake.
IV	Felt by many indoors, few outdoors. May feel like passing truck.
V	Felt by almost everyone, some people awakened. Small objects move; trees and poles may shake.
VI	Felt by everyone; people have trouble standing. Heavy furniture can move; plaster can fall off walls. Chimneys may be slightly damaged.
VII	People have difficulty standing. Drivers feel their cars shaking. Some furniture breaks. Loose bricks fall from buildings. Damage is slight to moderate in well-built buildings; considerable in poorly built buildings.
VIII	Well-built buildings suffer slight damage. Poorly built structures suffer severe damage. Some walls collapse.
IX	Considerable damage to specially built structures; buildings shift off their foundations. The ground cracks. Landslides may occur.
X	Most buildings and their foundations are destroyed. Some bridges are destroyed. Dams are seriously damaged. Large landslides occur. Water is thrown on the banks of canals, rivers, and lakes. The ground cracks in large areas.
XI	Most buildings collapse. Some bridges are destroyed. Large cracks appear in the ground. Underground pipelines are destroyed.
XII	Almost everything is destroyed. Objects are thrown into the air. The ground moves in waves or ripples. Large amounts of rock may move.

Source: USGS 2016

The MM Intensity Scale is generally represented visually using shake maps, which show the expected ground shaking at any given location produced by an earthquake with a specified magnitude and epicenter. An earthquake has only one magnitude and one epicenter, but it produces a range of ground shaking at sites throughout the region, depending on the distance from the earthquake, the rock and soil conditions at sites, and variations in the propagation of seismic waves from the earthquake due to complexities in the structure of the earth's crust. A USGS shake map shows the variation of ground shaking in a region immediately following significant earthquakes. Table 19 displays the MM Intensity Scale and its relationship to the areas peak ground acceleration (PGA).

Table 20. Modified Mercalli Intensity and PGA Equivalents

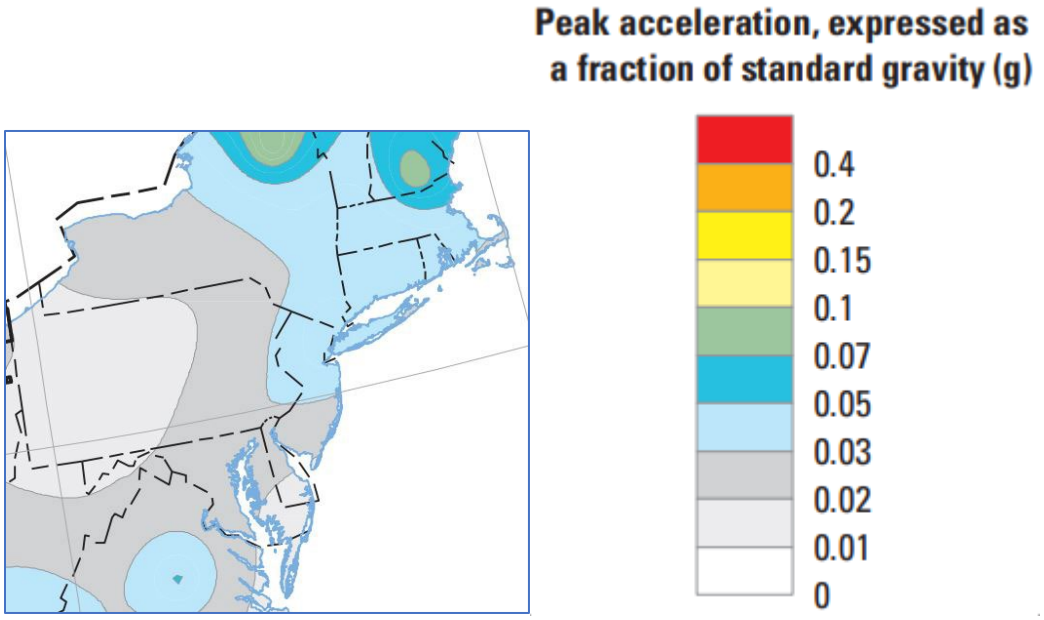
Modified Mercalli Intensity	Acceleration (%g) (PGA)	Perceived Shaking	Potential Damage
I	< .17	Not Felt	None
II	.17 – 1.4	Weak	None
III	.17 – 1.4	Weak	None
IV	1.4 – 3.9	Light	None
V	3.9 – 9.2	Moderate	Very Light
VI	9.2 – 18	Strong	Light
VII	18 – 34	Very Strong	Moderate
VIII	34 – 65	Severe	Moderate to Heavy

Source: Freeman et al. 2004

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

According to the USGS Earthquake Hazards Program, PGA maps (also known as earthquake hazard maps) are used as planning tools when designing buildings, bridges, highways, and utilities so that they can withstand shaking associated with earthquake events. These maps are also used as planning tools for the development of building codes that establish construction requirements appropriate to preserve public safety.

Figure 19. Peak Ground Acceleration



Source: USGS

Table 21. Damage Levels Experienced in Earthquakes

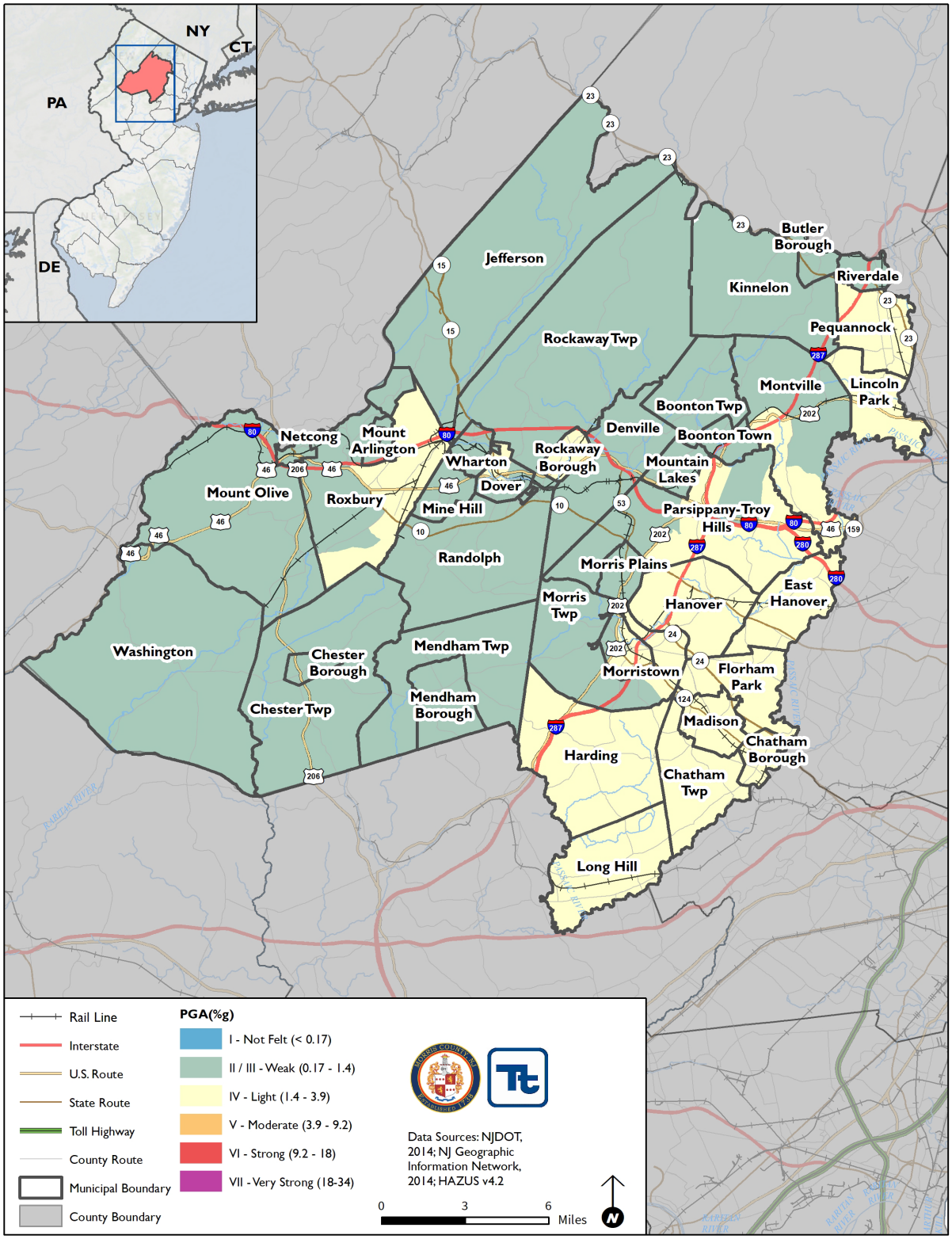
Ground Motion Percentage	Explanation of Damages
1-2%g	Motions are widely felt by people; hanging plants and lamps swing strongly, but damage levels, if any, are usually very low.
Below 10%g	Usually causes only slight damage, except in unusually vulnerable facilities.
10 - 20%g	May cause minor-to-moderate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

Source: NJOEM
Note: %g Peak Ground Acceleration

National maps of earthquake shaking hazards provide information for creating and updating seismic design requirements for building codes, insurance rate structures, earthquake loss studies, retrofit priorities, and land use planning. After thorough review of the studies, professional organizations of engineers update the seismic-risk maps and seismic design requirements contained in building codes. The USGS updated the National Seismic Hazard Maps in 2014. New seismic, geologic, and geodetic information on earthquake rates and associated ground shaking were incorporated into these revised maps.

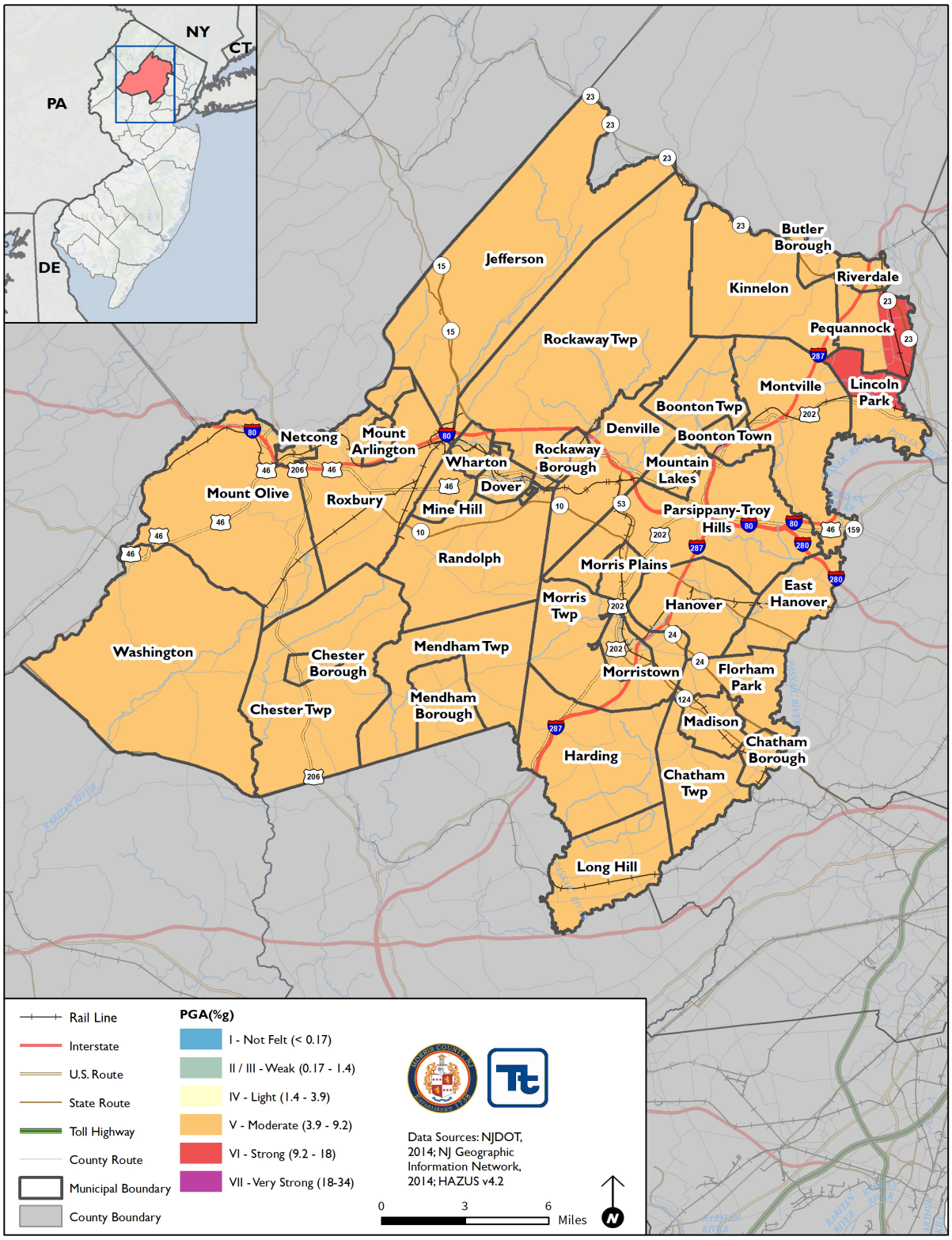
Figure 20, Figure 21 and Figure 22 illustrate geographic distributions of the modified Mercalli scale based on PGAs (%g) across Morris County for 100 , 500-, and 2,500-year MRP events by U.S. Census tract. A 100-year mean return period (MRP) event is an earthquake with 1-percent chance that mapped ground motion levels (PGA) will be exceeded in any given year. A 500-year MRP is an earthquake with 0.2 percent chance that mapped PGAs will be exceeded in any given year. A 2,500-year MRP is an earthquake with 0.04 percent chance that mapped PGAs will be exceeded in any given year.

Figure 20. PGA 100-Year Mean Return Period for Morris County



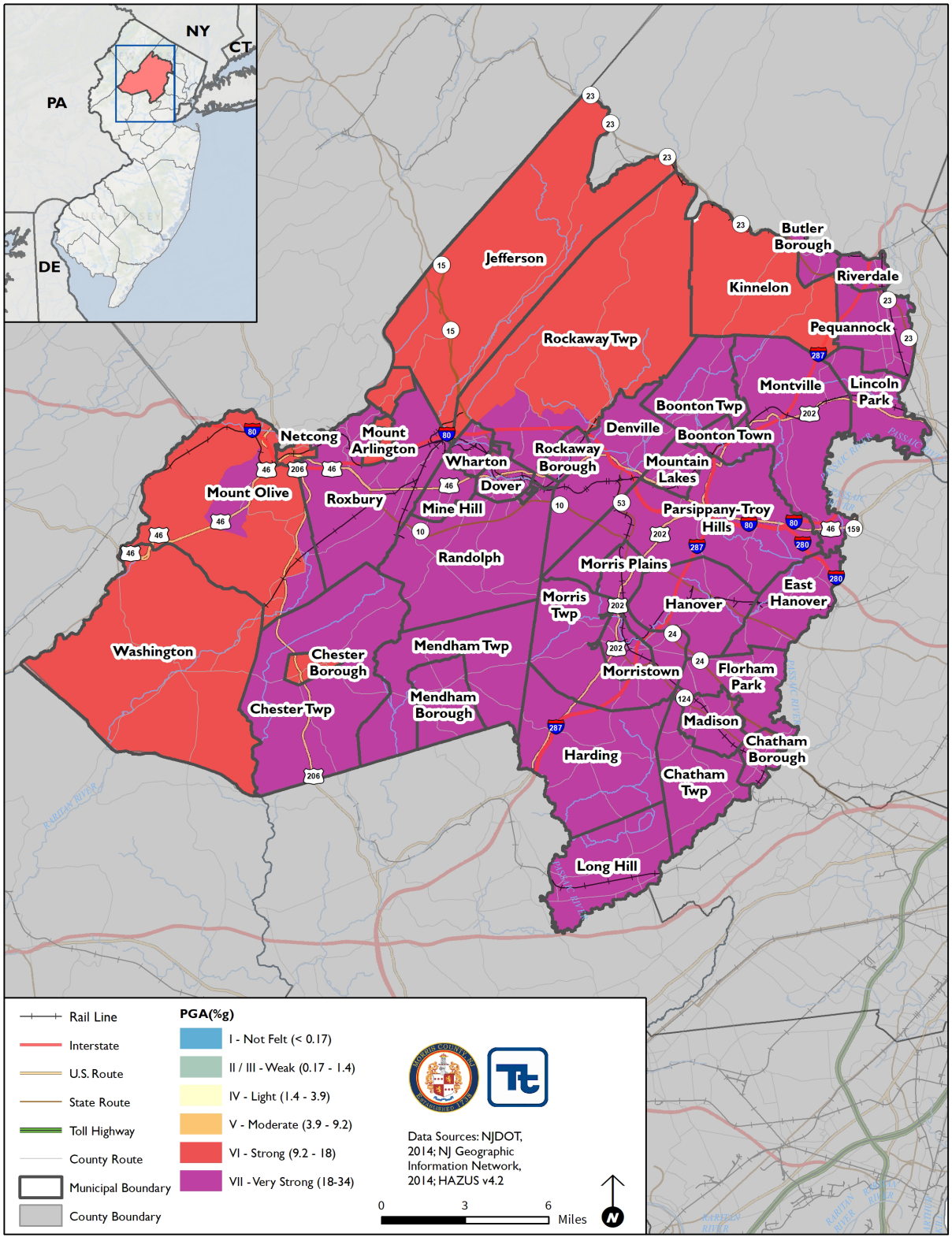
Source: 2020 Morris County Hazard Mitigation Plan

Figure 21. PGA 500-Year Return Period for Morris County



Source: 2020 Morris County Hazard Mitigation Plan

Figure 22. Peak Ground Acceleration 2,500-Year Mean Return Period for Morris County



Source: 2020 Morris County Hazard Mitigation Plan

3.6.5 PREVIOUS OCCURRENCES

New Jersey has an extensive history of earthquakes. Small earthquakes occur several times a year and generally do not cause significant damage. The largest earthquake to impact New Jersey occurred in 1783. That earthquake, a magnitude 5.3 quake, occurred west of New York City and was felt from New Hampshire to Pennsylvania.

Figure 23 illustrates earthquake epicenters in Morris County; Figure 23 illustrates earthquake events with epicenters located in New Jersey. Of the 178 events in the State, 17 earthquake epicenters were in Morris County.

Figure 23. Earthquakes with Epicenters in Morris County

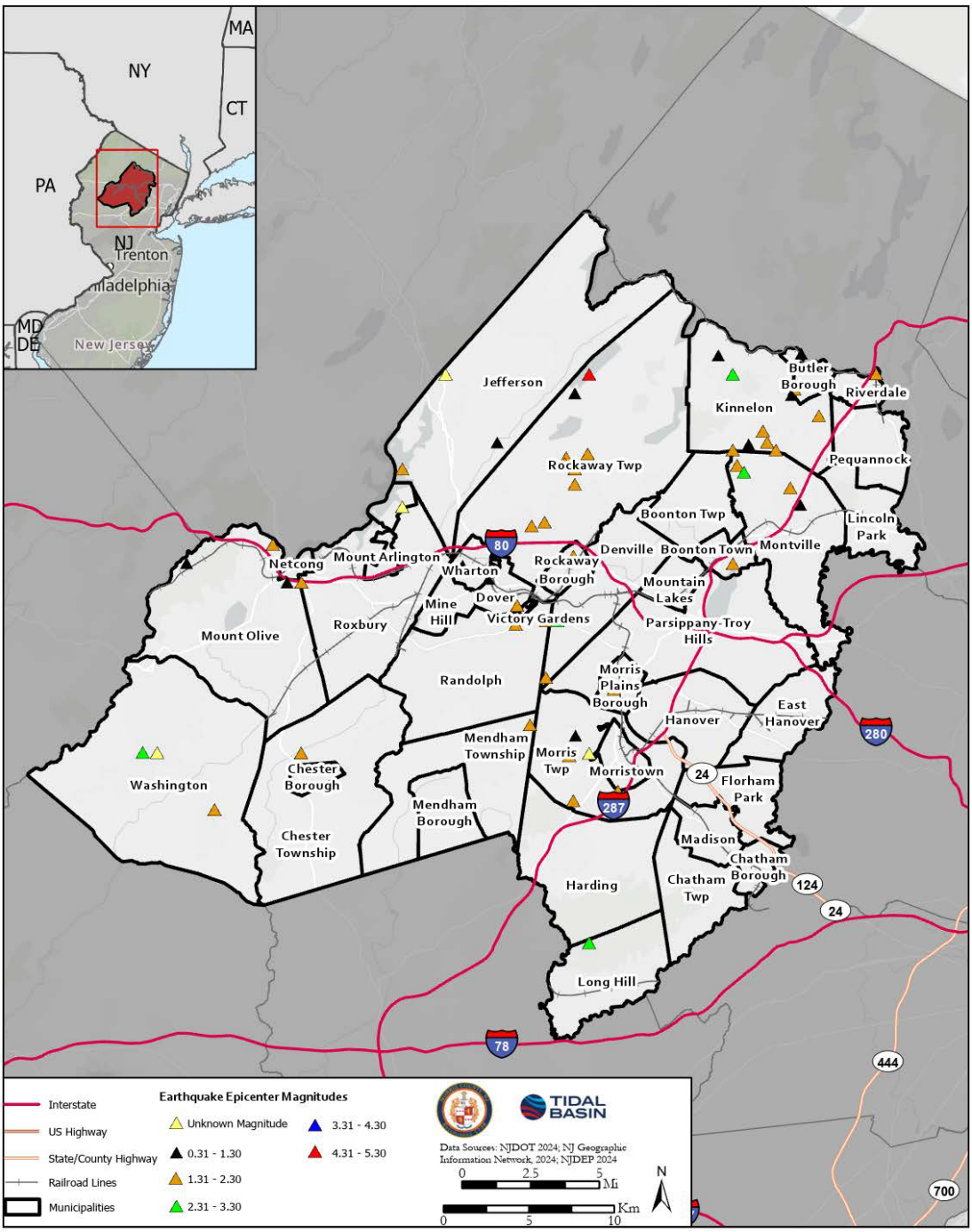
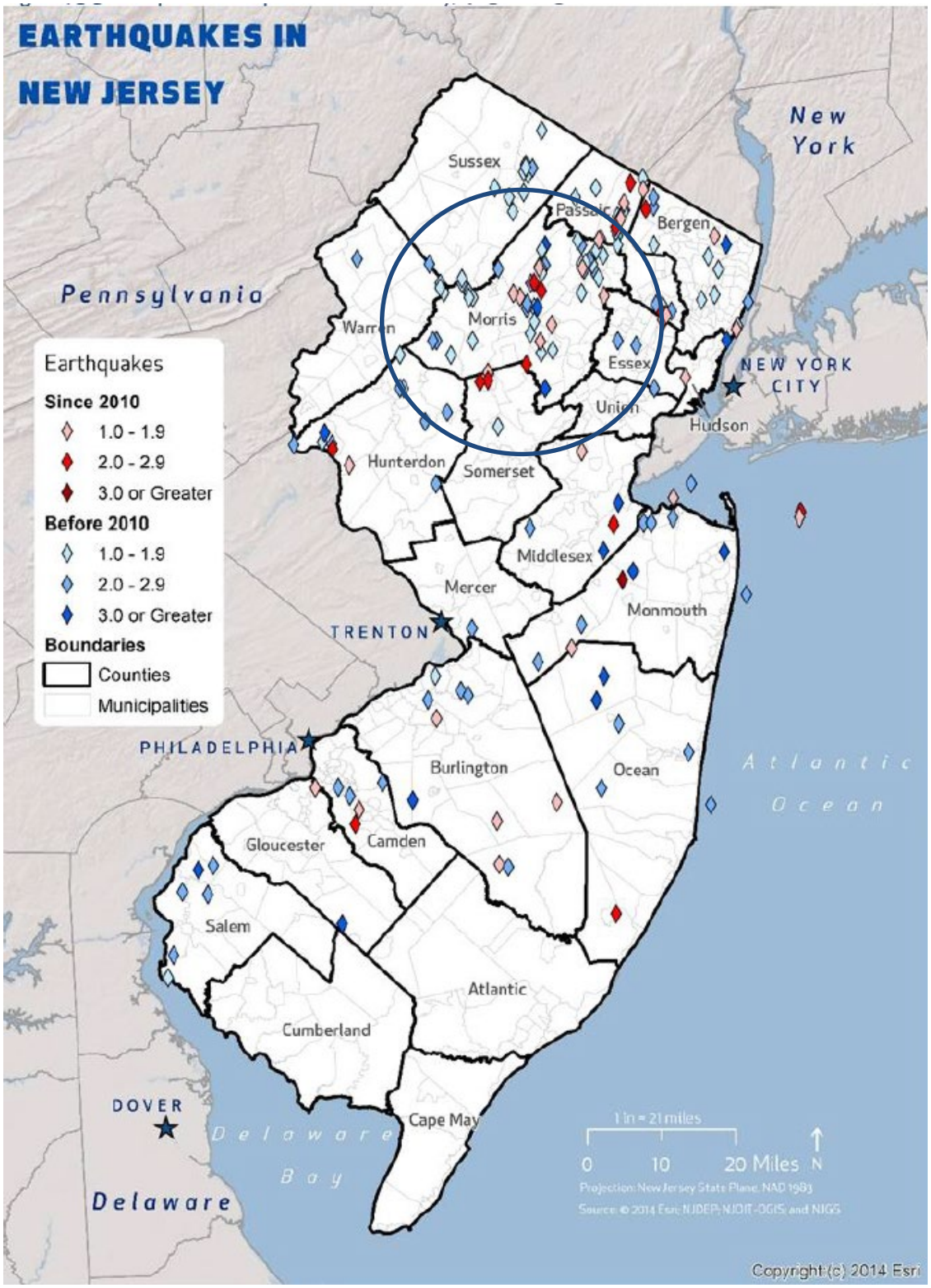


Figure 24. Earthquakes with Epicenters in New Jersey, 1783 - 2023



Source: *New Jersey Hazard Mitigation Plan 2024; NJDEP*

Note: *The blue circle indicates the location of Morris County. The figure shows that several earthquakes have been epicentered in Morris County.*

Earthquake events that have impacted Morris County between 2019 and 2024 are listed in Table 22. Neither Morris County nor the State of New Jersey has not been included in any FEMA disaster (DR) or emergency (EM) declarations for earthquake events.

Table 22. Earthquakes Impacting Morris County, 2014 - 2024

Date of Event	Magnitude	Location	Losses/Impacts
August 14, 2015	2.6 Earthquake	Bernardsville, NJ	A magnitude 2.6 earthquake took place in Bernardsville, NJ at the border of Morris and Somerset County. The quake was faintly felt in Morris County.
August 22, 2015	1.2 Earthquake	Fairfield	A magnitude 1.2 earthquake took place in Fairfield at the border of Essex and Morris County.
January 2, 2016	2.1 Earthquake	Ringwood, NJ	A magnitude 2.1 earthquake took place in Ringwood, NJ. The quake was faintly felt in Morris County.
February 19, 2016	1.1 Earthquake	Butler	A magnitude 1.1 Earthquake took place just north of Butler at the border of Morris and Passaic County.
February 21, 2016	0.5 Earthquake	Kinnelon	A magnitude 0.5 earthquake took place just north of Kinnelon at the border of Morris and Passaic County.
July 4, 2016	1.1 Earthquake	Kinnelon	A magnitude 1.1 earthquake took place in Kinnelon.
March 29, 2017	1.2 Quarry Blast	Riverdale	A quarry blast registered a 1.2 magnitude earthquake at Riverdale.
March 25, 2017	1.3 Earthquake	Morris Plains	A magnitude 1.3 earthquake took place in Morris Plains.
September 25, 2017	1.7 Earthquake	Morristown	A magnitude 1.7 earthquake took place in Morristown.
September 30, 2017	1.0 Earthquake	Morristown	A magnitude 1.0 earthquake took place in Morristown.
November 30, 2017	4.1 Earthquake	Dover, DE	Morris County residents felt ground shake from nearby 4.1 magnitude earthquake in Dover, Delaware. The quake was felt from central Virginia to Massachusetts.
April 12, 2019	1.8 Earthquake	Clifton, NJ	A magnitude 1.8 earthquake took place in Clifton, NJ. The quake was faintly felt in Morris County.
August 4, 2019	0.8 Earthquake	Pompton Lakes	A magnitude 0.8 earthquake took place in Pompton Lakes.
August 30, 2022	1.7 Earthquake	Telemark, NJ	A magnitude 1.7 earthquake took place one mile from Lake Telemark, NJ.
August 30, 2022	2.3 Earthquake	Dover, NJ	A magnitude 2.3 earthquake hit near Dover, New Jersey. According to documented reports, 66 people felt the earthquake. No tsunami was triggered due to the quake.
April 5, 2024	4.8 Earthquake	Tewksbury, NJ	A magnitude 4.8 earthquake occurred on April 5 around 10:23 AM, centered in Tewksbury. While it was felt across the New York metropolitan area, the Washington DC metropolitan area and other parts of the northeastern US between Virginia and Maine, no major damage was reported. Several aftershocks were felt.
July 31, 2024	2.2 Earthquake	Califon, NJ	A magnitude 2.2 earthquake occurred at 1:44 AM. No reports of damages or injuries in the area.

Source: NJGWS, USGS

3.6.6 PROBABILITY

Earthquakes cannot be predicted and may occur any time of the day or year. The probability of damaging earthquakes affecting New Jersey and Morris County is low. However, there is a definite threat of major earthquakes that could cause widespread damage and casualties in New Jersey. Major earthquakes are infrequent in the State and may occur only once every few hundred years or longer, but the consequences of major earthquakes would be very high.

3.6.7 CLIMATE CHANGE IMPACTS

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. National Aeronautics and Space Administration (NASA) and USGS scientists found that retreating glaciers in southern Alaska might be opening the way for future earthquakes.

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

3.6.8 VULNERABILITY ASSESSMENT

3.6.8.1 IMPACT TO LIFE, HEALTH AND SAFETY

The entire county may experience an earthquake. However, the degree of impact is dependent on many factors including the age and type of construction people live in, the soil types their homes are located on, 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.

The U.S. Census Morris County population estimate for 2022 was 511,151. Overall, risk to public safety and loss of life from an earthquake in the county is expected to be 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.

As noted earlier, NEHRP soil classes D and E and liquefaction class 4 soils can amplify ground shaking to damaging levels even during a moderate earthquake, and thus increase risk to the population. Populations within municipalities located on NEHRP class D and E soils and high liquefaction susceptible soils were estimated and are listed in Table 23. Overall, approximately 170,939 people (34.3% of the county's population) reside on NEHRP class D and E soils. In addition, 22,461 people (4.5% of the county's population) reside in areas of high susceptibility to liquefaction. The Borough of Florham Park and the Borough of Madison have the greatest percent of their population living on NEHRP class D and E soils (100% and 99.9%, respectively). The Township of Pequannock has the greatest percent of its population living on liquefaction class 4 soils (53.6%).

Table 23. Approximate Population Living on NEHRP Class D and E and Liquefaction-Susceptible Soils

Municipality	American Community Survey (2017-2021) Population	Estimated Population Exposed			
		NEHRP D&E Soils	% of Total	Liquefaction Class 4	% of Total
Town of Boonton	8,815	85	1.0%	0	0.0%
Township of Boonton	4,380	231	5.3%	13	0.3%
Borough of Butler	8,047	0	0.0%	0	0.0%
Chatham Borough	9,212	7,682	85.3%	49	0.5%
Chatham Township	10,983	5,628	53.6%	572	5.4%
Chester Borough	1,514	0	0.0%	0	0.0%

Municipality	American Community Survey (2017-2021) Population	Estimated Population Exposed			
		NEHRP D&E Soils	% of Total	Liquefaction Class 4	% of Total
Chester Township	7,713	175	2.2%	3	0.0%
Denville Township	17,107	3,234	19.2%	1,357	8.1%
Town of Dover	18,460	5,195	28.4%	0	0.0%
Township of East Hanover	11,105	11,055	98.3%	822	7.3%
Borough of Florham Park	12,585	11,792	100.0%	76	0.6%
Township of Hanover	14,677	10,984	76.1%	43	0.3%
Township of Harding	3,871	295	7.6%	315	8.1%
Township of Jefferson	20,538	2,622	12.2%	11	0.1%
Borough of Kinnelon	9,966	189	1.8%	0	0.0%
Borough of Lincoln Park	10,915	6,010	57.4%	4,911	46.9%
Township of Long Hill	8,629	911	10.4%	184	2.1%
Borough of Madison	16,937	16,066	99.9%	0	0.0%
Borough of Mendham	4,981	0	0.0%	0	0.0%
Township of Mendham	6,016	0	0.0%	0	0.0%
Township of Mine Hill	3,651	492	13.6%	0	0.0%
Township of Montville	22,450	5,942	27.3%	1,896	8.7%
Township of Morris	6,153	9,838	43.7%	783	3.5%
Borough of Morris Plains	33,974	630	11.2%	0	0.0%
Town of Morristown	20,180	11,365	60.3%	160	0.9%
Borough of Mount Arlington	5,909	127	2.3%	0	0.0%
Township of Mount Olive	28,886	5,052	17.4%	171	0.6%
Borough of Mountain Lakes	4,472	0	0.0%	0	0.0%
Netcong Borough	3,375	0	0.0%	0	0.0%
Township of Parsippany-Troy Hills	56,162	20,629	38.6%	2,503	4.7%
Township of Pequannock	15,571	14,633	94.4%	8,308	53.6%
Township of Randolph	26,504	728	2.8%	0	0.0%
Borough of Riverdale	4,107	2,110	49.8%	134	3.2%
Borough of Rockaway	6,598	1,685	26.0%	12	0.2%
Township of Rockaway	25,341	587	2.4%	15	0.1%
Township of Roxbury	22,950	12,948	55.2%	29	0.1%
Borough of Victory Gardens	1,582	160	9.7%	0	0.0%
Township of Washington	18,197	1,183	6.3%	93	0.5%
Borough of Wharton	7,241	675	10.2%	0	0.0%
Morris County (Total)	**509,285**	**170,939**	**34.3%**	**22,461**	**4.5%**

Sources: American Community Survey 5-year Estimate, 2017-2021; NJGWS, 2016

Populations considered most vulnerable are those located in/near the built environment, particularly those near unreinforced masonry structures. Of these most vulnerable populations, socially vulnerable populations, including

the elderly (persons over age 65) and individuals living below the poverty threshold, are most susceptible. Factors leading to this higher susceptibility include decreased mobility and financial ability to react or respond during a hazard, and the location and construction quality of their housing. Within the NEHRP class D and E soils, there are 29,464 people over the age of 65 and 8,484 people below the poverty level. Within liquefaction class 4 soils, there are 4,350 people over the age of 65 and 946 people below the poverty level.

Residents may be displaced or require temporary to long-term sheltering due to an earthquake event. The number of people requiring shelter is generally less than the number displaced because some displaced persons use hotels or stay with family or friends following a disaster event. Table 20 summarizes the households HAZUS-MH estimates will be displaced and population that may require short-term sheltering as a result of the 100-, 500- and 2,500-year MRP earthquake events.

Table 24. Summary of Estimated Sheltering Needs for Morris County

Scenario	Displaced Households	Persons Seeking Short-Term Shelter
100-Year Earthquake	0	0
500-Year Earthquake	69	37
2,500-Year Earthquake	905	483

Source: HAZUS-MH v4.2

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, time of day also exposes different sectors of the community to the hazard. For example, HAZUS-MH considers residential occupancy at its maximum at 2:00 AM, whereas educational, commercial, and industrial sectors are at their maximum at 2:00 PM, and peak commute time is at 5:00 PM. Whether directly impacted or indirectly impacted, the entire population will be affected to some degree. Business interruption could prevent people from working, road closures could isolate populations, and loss of utilities could impact populations that suffered no direct damage from an event.

Table 25 summarizes the County-wide injuries and casualties estimated for the 100-, 500-, and 2,500-year MRP earthquake events.

Table 25. Estimated Number of Injuries and Casualties from 100-, 500- and 2,500-Year MRP Earthquakes

Level of Severity	Time of Day		
	2:00 AM	2:00 PM	5:00 PM
100-year MRP			
Injuries	0	0	0
Hospitalization	0	0	0
Casualties	0	0	0
500-year MRP			
Injuries	20	31	23
Hospitalization	3	4	3
Casualties	0	1	0
2,500-year MRP			
Injuries	2004	312	227
Hospitalization	37	61	45
Casualties	7	12	9

Source: HAZUS-MH v4.2

3.6.8.2 IMPACT ON GENERAL BUILDING STOCK

The entire County's general building stock is considered at risk and exposed to this hazard. As stated earlier, soft soils (NEHRP soil classes D and E) can amplify ground shaking to damaging levels even during a moderate earthquake (State of New Jersey 2019). Therefore, buildings located on NEHRP classes D and E soils and high liquefaction susceptible soils are at increased risk of damage from an earthquake. Table 26 summarizes the number and replacement cost value of buildings in Morris County located on NEHRP soils classes D and E and liquefaction class 4 soils.

Table 26. Number and Replacement Cost Value of Buildings Located on Seismic and Liquefaction Susceptible Soils

Municipality	Total Number of Buildings	Total RCV (Structure and Contents)	Buildings NEHRP Class "D" and "E" Soils			Buildings Liquefaction Class 4		
			Number	RCV	% of Total RCV	Number	RCV	% of Total RCV
Town of Boonton	3,262	$1,832,625,537	33	1.0%	$33,927,506	1.9%	0	0.0%
Township of Boonton	1,898	$1,388,780,135	111	5.8%	$166,548,877	12.0%	10	0.5%
Borough of Butler	2,701	$1,489,686,071	0	0.0%	$0	0.0%	0	0.0%
Chatham Borough	3,286	$1,673,960,469	2,820	85.8%	$1,458,301,271	87.1%	29	0.9%
Chatham Township	4,080	$2,300,237,613	2,448	60.0%	$1,368,843,490	59.5%	258	6.3%
Chester Borough	853	$694,668,411	0	0.0%	$0	0.0%	0	0.0%
Chester Township	3,680	$2,782,631,274	70	1.9%	$28,867,739	1.0%	4	0.1%
Denville Township	7,198	$4,397,845,504	1,382	19.2%	$894,700,008	20.3%	507	7.0%
Town of Dover	4,514	$2,640,787,978	1,384	30.7%	$951,675,214	36.0%	0	0.0%
Township of East Hanover	4,848	$4,740,072,304	4,779	98.6%	$4,703,188,849	99.2%	347	7.2%
Borough of Florham Park	3,805	$3,768,421,982	3,805	100.0%	$3,768,421,982	100.0%	26	0.7%
Township of Hanover	7,090	$5,609,469,027	5,662	79.9%	$5,073,465,211	90.4%	108	1.5%
Township of Harding	2,230	$1,808,255,972	207	9.3%	$130,159,850	7.2%	192	8.6%
Township of Jefferson	9,625	$4,421,074,958	1,101	11.4%	$484,647,435	11.0%	6	0.1%
Borough of Kinnelon	4,093	$2,858,766,250	76	1.9%	$47,482,164	1.7%	0	0.0%
Borough of Lincoln Park	4,166	$2,125,371,898	2,055	49.3%	$1,341,526,568	63.1%	1623	39.0%
Township of Long Hill	3,643	$2,253,461,094	480	13.2%	$342,138,859	15.2%	97	2.7%
Borough of Madison	6,301	$3,066,320,935	6,301	100.0%	$3,066,320,935	100.0%	0	0.0%
Borough of Mendham	2,139	$1,479,178,043	0	0.0%	$0	0.0%	0	0.0%
Township of Mendham	2,667	$2,099,041,883	0	0.0%	$0	0.0%	0	0.0%
Township of Mine Hill	1,590	$766,971,485	204	12.8%	$60,911,396	7.9%	0	0.0%
Township of Montville	8,179	$6,714,034,036	2,250	27.5%	$2,434,175,958	36.3%	749	9.2%

Municipality	Total Number of Buildings	Total RCV (Structure and Contents)	Buildings NEHRP Class "D" and "E" Soils			Buildings Liquefaction Class 4		
			Number	RCV	% of Total RCV	Number	RCV	% of Total RCV
Township of Morris	9,713	$6,091,077,654	4,299	44.3%	$2,785,036,128	45.7%	317	3.3%
Borough of Morris Plains	2,378	$1,738,775,034	298	12.5%	$227,122,566	13.1%	0	0.0%
Town of Morristown	4,413	$2,945,511,672	2,314	52.4%	$1,714,784,391	58.2%	52	1.2%
Borough of Mount Arlington	2,333	$1,065,424,961	63	2.7%	$35,122,417	3.3%	0	0.0%
Township of Mount Olive	9,115	$7,181,400,421	1,402	15.4%	$854,794,139	11.9%	54	0.6%
Borough of Mountain Lakes	1,642	$1,183,405,498	0	0.0%	$0	0.0%	0	0.0%
Netcong Borough	1,100	$695,081,980	2	0.2%	$4,579,971	0.7%	0	0.0%
Township of Parsippany-Troy Hills	17,064	$11,747,551,200	6,953	40.7%	$5,608,078,333	47.7%	833	4.9%
Township of Pequannock	5,642	$3,911,039,941	5,348	94.8%	$3,590,341,293	91.8%	3008	53.3%
Township of Randolph	8,600	$6,709,486,516	294	3.4%	$375,887,519	5.6%	1	0.0%
Borough of Riverdale	1,183	$1,165,082,666	563	47.6%	$469,298,571	40.3%	39	3.3%
Borough of Rockaway	2,617	$1,612,749,951	851	32.5%	$636,285,299	39.5%	18	0.7%
Township of Rockaway	11,485	$7,225,058,745	471	4.1%	$802,365,022	11.1%	23	0.2%
Township of Roxbury	9,544	$5,918,169,131	5,670	59.4%	$3,685,412,618	62.3%	23	0.2%
Borough of Victory Gardens	339	$163,035,099	41	12.1%	$47,807,502	29.3%	0	0.0%
Township of Washington	8,062	$5,265,032,309	491	6.1%	$397,709,902	7.6%	50	0.6%
Borough of Wharton	2,051	$1,539,335,501	250	12.2%	$729,851,119	47.4%	0	0.0%
Morris County (Total)	**189,129**	**$127,068,881,137**	**64,478**	**34.1%**	**48,319,780,104**	**38.0%**	**8,374**	**4.4%**

Sources: Morris County 2019; Microsoft, 2018, Open Street Map, 2019; NJOIT, 2018; NJGWS, 2016

RCV Replacment Cost Value

There is a strong correlation between PGA and damage a building might suffer. The HAZUS-MH probabilistic earthquake model was applied to analyze effects from the earthquake hazard on general building stock in Morris County.

A building's construction determines how well it can withstand the force of an earthquake. FEMA has written guides to help homebuilders design homes based on their vulnerability to an earthquake event. Extra caution must be taken for structures with masonry chimneys, old chimneys, and open-front configurations such as one or two-family homes where the fronts are attached garages that have inadequate bracing length. The State of New Jersey HMP indicates that unreinforced masonry buildings are most at risk during an earthquake because the walls are prone to collapse outward, whereas steel and wood buildings absorb more of the earthquake's energy. Additional attributes that affect a building's capability to withstand an earthquake's force include its age, number of stories, and quality of construction. During the second planning meeting, attendees noted that there are no separate

building regulations that specifically account for the earthquake hazard in construction outside of the state building code.

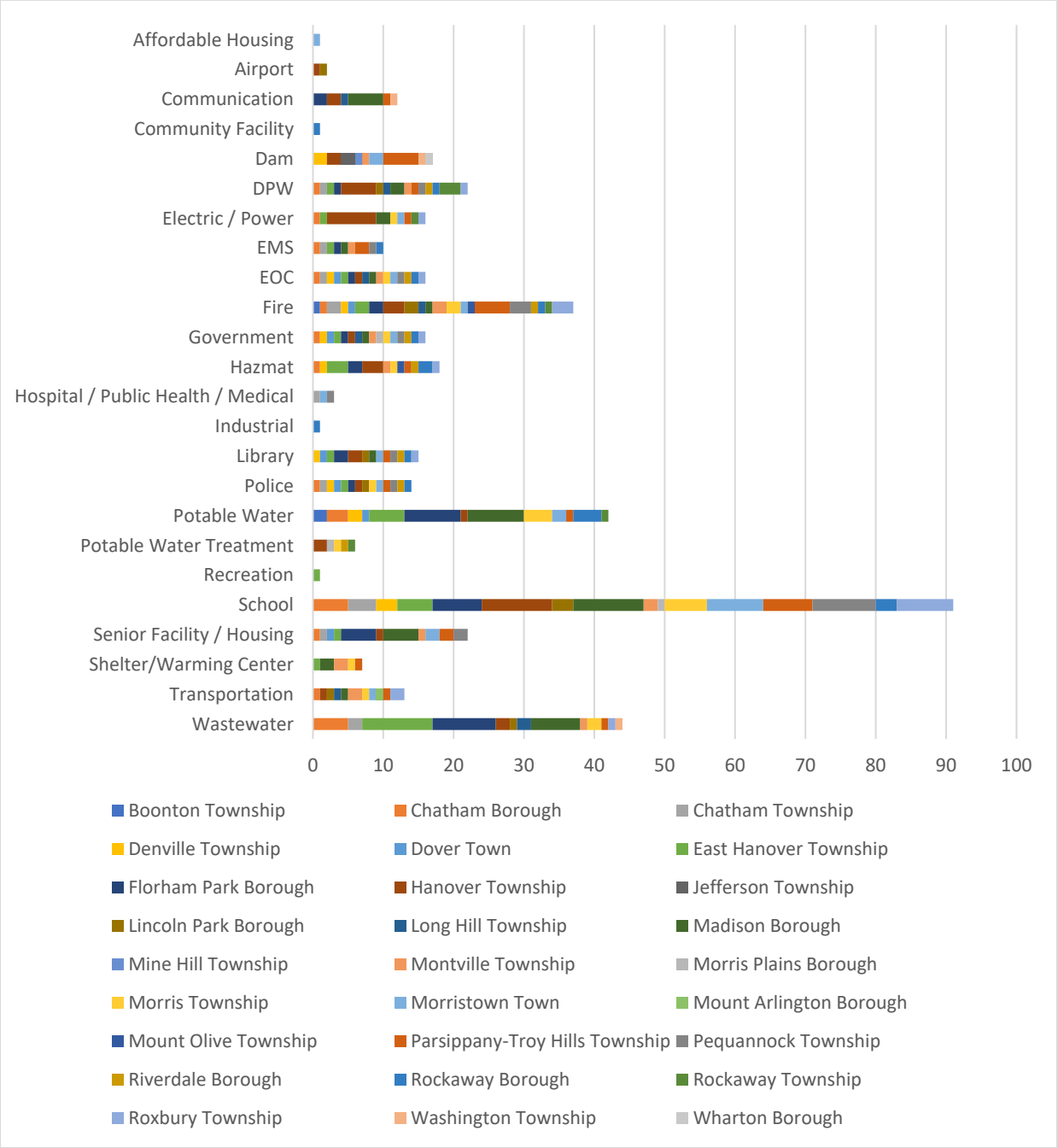
HAZUS-MH considers building construction and age of building as part of the analysis. Because a custom general building stock inventory was developed for Morris County, the building ages and types, where available, were incorporated into the HAZUS-MH model.

3.6.8.3 IMPACT ON CRITICAL FACILITIES

All critical facilities in Morris County are considered exposed to the earthquake hazard. Two sets of exposure analyses were conducted for critical facilities located in Morris County. The first analysis reviewed the number of County critical facilities and determined which facilities are constructed on NEHRP classes D or E soils and liquefaction class 4 soils. The analysis shows that 13 County critical facilities are located on NEHRP soils class D or E, and 5 are located on liquefaction class 4 soils.

Furthermore, 1,137 additional critical facilities are exposed countywide. The Borough of Madison has the greatest number of critical facilities located on NEHRP classes D or E soils (47 facilities), followed by the Township of Hanover with 45 facilities. Of the 47 facilities in the Borough of Madison, 27 were identified as community lifelines, and of the 45 facilities in the Township of Hanover 14 were identified as community lifeline. The Township of Pequannock has the greatest number of critical facilities located on liquefaction class 4 soils (11 facilities). Two of these facilities in the Town of Pequannock are considered community lifelines. Figure 25 shows the number of critical facilities by municipality that are exposed to NEHRP D and E soils and liquefaction class 4 soils, respectively.

Figure 25. Critical Facilities Exposed to NEHRP Soil Type D/E in Morris County Municipalities



3.6.8.4 IMPACT ON THE ECONOMY

Earthquakes also impact the economy, including loss of business function, damage to inventory (buildings, transportation, and utility systems), relocation costs, wage loss, and rental loss due to repair and replacement of buildings. Roads and railroad tracks would also presumably suffer earthquake damages, resulting in disruptions in regional transportation and distribution of materials. Earthquake events can significantly affect road bridges, many of which provide the only access to certain neighborhoods. Because softer soils generally follow floodplain boundaries, bridges that cross watercourses should be considered vulnerable. Another key factor in degree of

vulnerability is age of facilities and infrastructure, which correlates with standards in place at times of construction of these.

Debris is another risk after an earthquake, potentially resulting in thousands of tons of material that will need to be disposed of.

3.6.9 FUTURE CHANGES THAT MAY IMPACT VULNERABILITY

3.6.9.1 PROJECTED DEVELOPMENT

New development located in areas with softer NEHRP soil classes and high liquefaction susceptibility may be more vulnerable to the earthquake hazard. Information regarding new development, both recent and expected development, within Morris County was received during the planning process. Any development location that could be located using an address or Parcel ID were geocoded and overlaid with the NEHRP Class D and E soils spatial layer to determine vulnerability. In total, there are 24 new development sites located on NEHRP Class D and E soils. 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.

3.6.9.2 PROJECTED CHANGES IN POPULATION

The County has and is projected to continue experiencing population growth. As noted above, vulnerability greatly depends upon the location residents reside. The HAZUS-MH earthquake model indicates the Borough of Lincoln Park and the Township of Pequannock are most vulnerable to greater ground shaking and building impacts as a result of more frequent events such as the 100-year MRP event. Populations moving to Morris County and living in older buildings may be vulnerable to this hazard. As noted earlier, if moving into new construction, current building codes require seismic provisions that should render new construction less vulnerable to seismic impacts.

3.6.9.3 CLIMATE CHANGE

Because the impacts of climate change on the earthquakes are not well understood, a change in the County's vulnerability is difficult to determine. However, climate change has the potential to magnify secondary impacts of earthquakes, including landslides and mudslides.

3.6.10 VULNERABILITY CHANGE SINCE THE 2020 HMP

There is no significant change in vulnerability since the 2020 HMP.

3.7 EXTREME TEMPERATURES

3.7.1 2025 HMP CHANGES

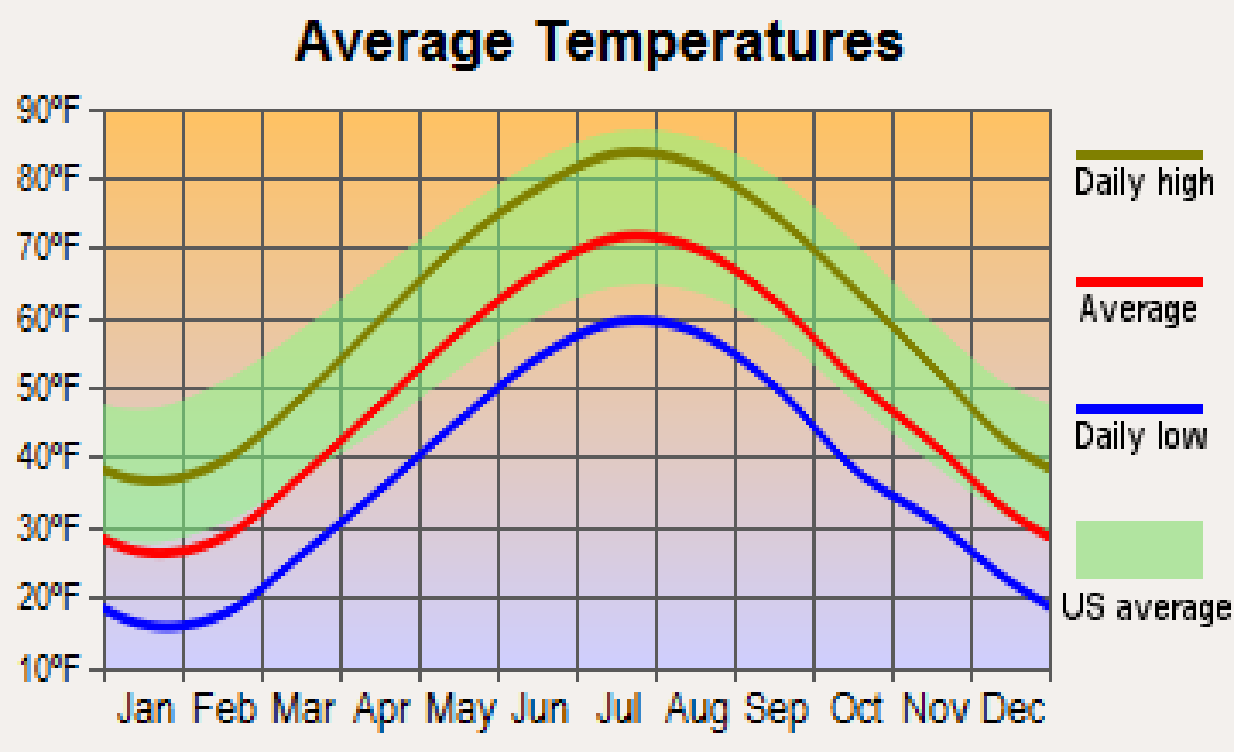
- All subsections have been updated using best available data.
- Previous occurrences are updated with events that occurred between 2019 and 2023.
- The NJTPA Climate Resilience Planning Study has been integrated.

3.7.2 PROFILE

Extreme temperature includes both heat and cold events that can have significant direct impacts to human health and commercial/agricultural businesses and primary and secondary effects on infrastructure (e.g., burst pipes and

power failure). Distinguishing characteristics of “extreme cold” or “extreme heat” vary by location, based on the conditions to which the population is accustomed. Figure 26 shows the average low and high temperatures each month at the Boonton station in the center of Morris County.

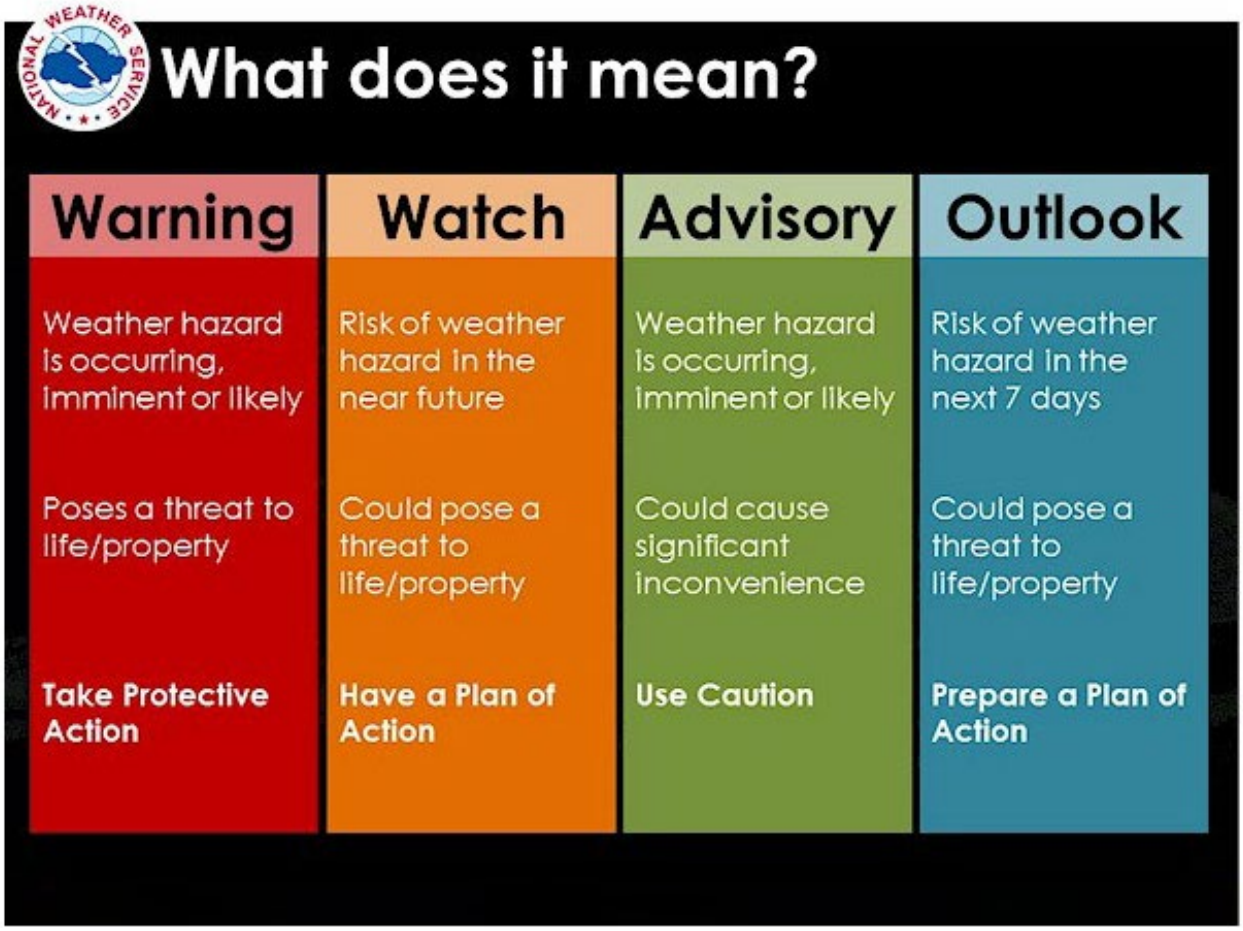
Figure 26. Average Temperatures at Boonton



Source: citi-data.com, based on data reported by over 4,000 weather stations

Meteorologists can accurately forecast extreme temperature event development and the severity of the associated conditions with several days lead time. These forecasts provide an opportunity for public health and other officials to notify vulnerable populations. The National Weather Service (NWS) and National Oceanic and Atmospheric Association (NOAA) issues Outlooks, Watches, and Warnings to communicate local hazardous weather risks. It is important to understand the difference between each type of alert, and the appropriate actions to take. Of note, warnings issues for severe thunderstorms, tornadoes, and flash flooding typically have shorter lead times than other natural hazards.

Figure 27. NWS Definitions



Source: National Weather Service (NWS)

3.7.2.1 EXTREME COLD

Extreme cold events occur 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 generally characterized in temperate zones by the ambient air temperature dropping to approximately 0ºF or below. Winter temperatures may fall to extreme cold readings with no wind occurring. At present, extremely cold temperatures are only highlighted by using the NWS-designated Wind Chill Advisory or Warning products. When actual temperatures reach Wind Chill Warning criteria with little to no wind, extreme cold warnings may be issued.

Extremely cold temperatures often accompany a winter storm, which can cause power failures and icy roads. Although staying indoors as much as possible can help reduce the risk of car crashes and falls on the ice, individuals may also face indoor hazards. Many homes will be too cold—either due to a power failure or because the heating system is not adequate for the weather. The use of space heaters and fireplaces to keep warm increases the risk of household fires and carbon monoxide poisoning.

3.7.2.2 EXTREME HEAT

Extreme heat is defined as summertime temperatures that are much hotter and/or humid than average. A heat wave is a period of abnormally hot weather generally lasting more than two days.

According to the NWS, extreme heat is the leading weather-related killer in the U.S. This is especially true in urban areas where population density, the urban heat island, and building construction exacerbate the effects of extreme heat, compared to rural and suburban areas. For heat events, the NWS issues excessive heat outlooks when the potential exists for an excessive heat event in the next 3-7 days. Watches are issued when conditions are favorable for an excessive heat event in the next 24 to 72 hours. Excessive heat warning/advisories are issued when an excessive heat event is expected in the next 36 hours.

As defined by the U.S. Census, urban areas are classified as all territory, population, and housing units located within urbanized areas and urban clusters. The term urbanized area denotes an urban area of 50,000 or more people. Urban areas under 50,000 people are called urban clusters.

As these urban areas develop and change, so does the landscape. Buildings, roads, and other infrastructure replace open land and vegetation. Surfaces that were once permeable and moist are now impermeable and dry. These changes cause urban areas to become warmer than the surrounding areas. This forms an 'island' of higher temperatures.

The term "heat islands" are urbanized areas that experience higher temperatures than outlying areas. The annual mean air temperature of a city with more than one million people can be between 1.8 ºF and 5.4ºF warmer than its surrounding areas. In the evening, the difference in air temperatures can be as high as 22ºF. Heat islands occur on the surface and in the atmosphere. On a hot, sunny day, the sun can heat dry, exposed urban surfaces to temperatures 50ºF to 90ºF hotter than the air. Heat islands can affect communities by increasing peak energy demand during the summer, air conditioning costs, air pollution and greenhouse gas emissions, heat-related illness and death, and water quality degradation.

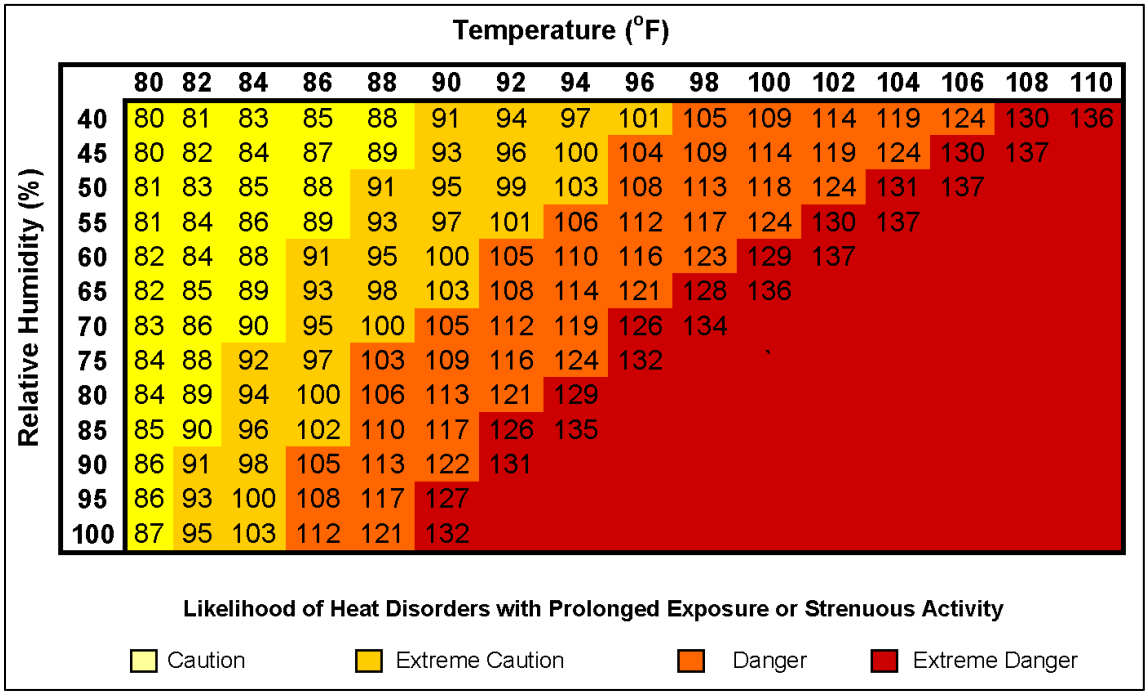
3.7.3 LOCATION

Extreme temperatures impact a large footprint at once, almost always encompassing the entirety of Morris County with minor variations in temperature in different areas.

3.7.4 EXTENT

NOAA's heat alert procedures are based mainly on Heat Index values. The Heat Index is given in degrees Fahrenheit. The Heat Index is a measure of how hot it really feels when relative humidity is factored in with the actual air temperature. To find the Heat Index temperature, the temperature and relative humidity need to be known. Once both values are known, the Heat Index will be the corresponding number with both values. The Heat Index indicates the temperature the body feels. It is important to know that the Heat Index values are devised for shady, light wind conditions. Exposure to full sunshine can increase heat index values by up to 15°F. Strong winds, particularly with very hot dry air, can also be extremely hazardous. The NWS will activate alert procedures when the Heat Index is expected to exceed 105°-110°F.

Figure 28. National Weather Service Heat Index Chart



Source: NWS

Figure 29. Adverse Effects of Prolonged Exposure to Heat on Individuals

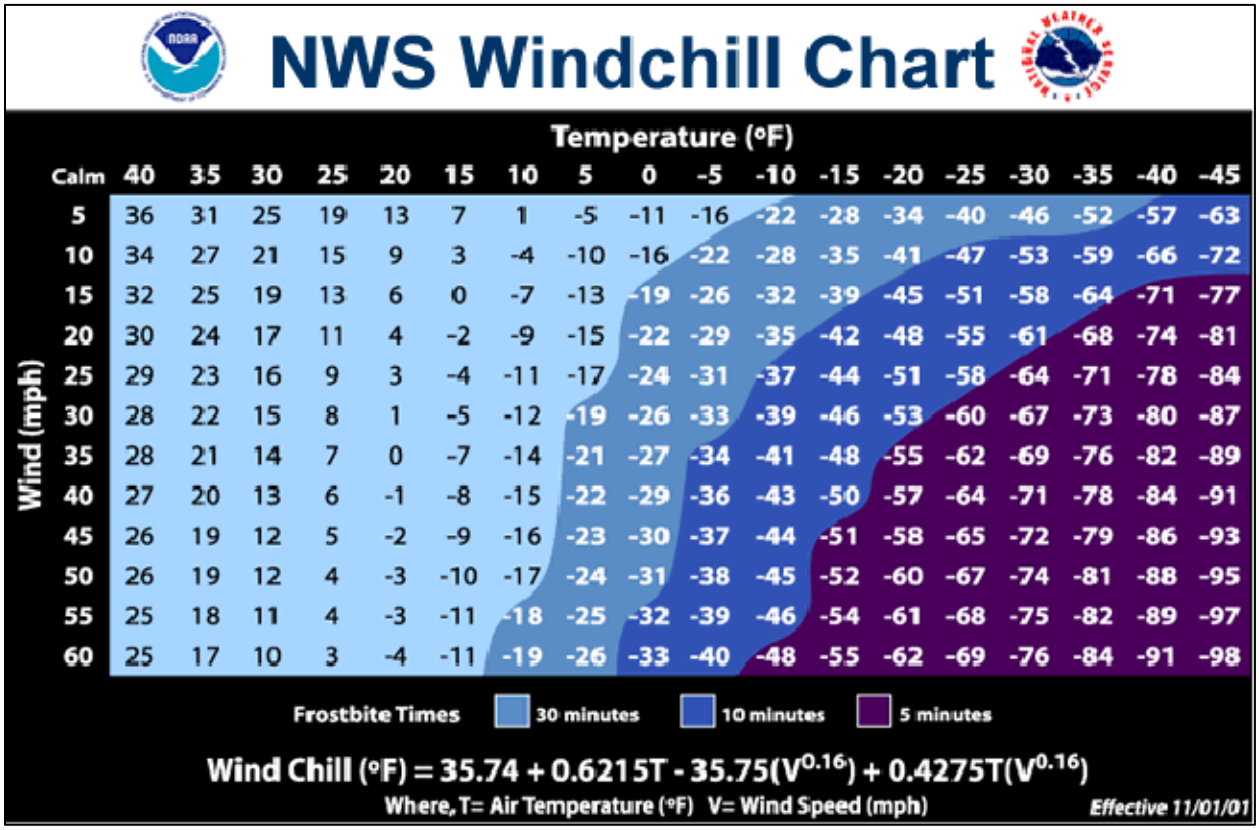
Category	Heat Index	Health Hazards
Extreme Danger	130 °F – Higher	Heat Stroke / Sunstroke is likely with continued exposure.
Danger	105 °F – 129 °F	Sunstroke, muscle cramps, and/or heat exhaustion possible with prolonged exposure and/or physical activity.
Extreme Caution	90 °F – 105 °F	Sunstroke, muscle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

The extent (severity or magnitude) of extreme cold temperatures is generally measured through the Wind Chill Temperature (WCT) Index. Wind Chill Temperature is the temperature that people and animals feel when outside, and it is based on the rate of heat loss from exposed skin by the effects of wind and cold. As the wind increases, the body is cooled at a faster rate, causing the skin's temperature to drop.

The WCT Index includes a frostbite indicator, showing points where temperature, wind speed, and exposure time will produce frostbite to humans. Figure 30 shows three shaded areas of frostbite danger. Each shaded area shows how long a person can be exposed before frostbite develops.

Figure 30. NWS Wind Chill Index



Source: NWS

Morris County and its communities are vulnerable to the fullest extent of both the heat index and wind chills.

3.7.5 PREVIOUS OCCURRENCES

New Jersey has been experiencing an increase in extreme temperatures across the state. The number of very hot days has been above average since the early 2000's. According to NOAA, declines in the number of extreme cold days have occurred since the early 1990's.

Between 1954 and 2024, Morris County was not included in any major disaster (DR) or emergency (EM) declarations due to extreme temperatures. However, during the same time period, the Federal Emergency Management Agency (FEMA) included Morris County in six winter storm-related DR or EM declarations classified as one or a combination of the following disaster types that may have had associated extreme cold temperatures: severe winter storm, snowstorm, snow, ice storm, winter storm, and blizzard.

Table 27. Winter Weather Related Disaster (DR) and Emergency (EM) Declarations 1954 - 2023

Declaration	Event Date	Declaration Date	Event Description
DR-528	February 8, 1977	February 8, 1977	Severe Ice Storm
EM-3106	March 13-17, 1993	March 17, 1993	Snow: Severe Blizzard
DR-1088	January 7-12, 1996	January 13, 1996	Snow: Blizzard of 96 (Severe Snowstorm)
EM-3181	February 16-17, 2003	March 20, 2003	Snow: Snow

Declaration	Event Date	Declaration Date	Event Description
EM-1954	December 26-27-2010	February 4, 2011	Snow: Severe Winter Storm and Snowstorm
DR-4597	January 31-February 2, 2021	April 28, 2021	Severe Winter Sorm and Snowstorm

Source: FEMA 2024

The NOAA National Centers for Environmental Information (NCEI) Storm Events Database records and defines extreme temperature events as follows:

- Cold/Wind Chill is reported in the NOAA-NCEI database when a period of low temperatures or wind chill temperatures reach or exceed locally or regionally defined advisory conditions (typical value is -18 °F or colder).
- Excessive Heat is reported in the NOAA-NCEI database whenever heat index values meet or exceed locally or regionally established excessive heat warning thresholds.
- Extreme Cold / Wind Chill is reported in the NOAA-NCEI database when a period of extremely low temperatures or wind chill temperatures reaches or exceeds locally or regionally defined warning criteria (typical value around -35 °F or colder).
- Heat is reported in the NOAA-NCEI database whenever heat index values meet or exceed locally or regionally established advisory thresholds.

Extreme temperature events that have impacted Morris County between 2014 and 2023 are identified in Table 28.

Table 28. Extreme Temperature Incidents in Morris County, 2014 - 2024

Date(s) of Event	Event Type	Description
January 7, 2015	Cold/wind Chill	The arrival of an arctic air mass brought one of the coldest mornings of the month of January to most of New Jersey. Morning low temperatures were mainly in the single numbers above zero. In addition, gusty northwest winds continued into the morning and lowest hourly wind chill factors reached around degrees below zero throughout the state. Temperatures dipped to 4 degrees above zero in Morristown.
February 13, 2015	Cold/wind Chill	Northwest winds that persisted into the morning of February 13 combined with an arctic air mass to produce wind chill factors of around 10 degrees below zero and low temperatures in the positive single numbers throughout most of New Jersey.
February 15-16, 2015	Cold/wind Chill	The combination of strong to high winds and an approaching arctic air mass produced windchill factors of 10 to 15 degrees below zero during the first half of the day on the 15th in New Jersey. One person in Ocean County died from hypothermia. Actual morning low temperatures were around 10 degrees above zero. In Lakewood (Ocean County), a 66-year-old woman died from hypothermia while walking home early on the 15th. Many municipalities declared code blues. Plumbers were swamped with frozen pipe calls. Some say it was the busiest they have been in over 20 years. Shelters were full. Even oil lines were freezing. Some homes ran out of heating oil. Temperatures dipped to one degree above zero in Morristown.
February 20, 2015	Cold/wind Chill	The arrival of another arctic air mass brought some of the lowest wind chills as well as the lowest temperatures of the winter season to New Jersey on the 20th and 21st. As far as wind chill factors went, the first half of the day on the 20th was colder with wind chill factors as low as around 20 degrees below zero during the morning. Actual low temperatures were around zero. On the morning of the 21st, little, if any, wind was present as the arctic high pressure system was nearby. Low temperatures in more rural inland areas were lower, many were below zero, some well below zero. But, because of the lack of wind, wind chill factors nearly matched the air temperatures and it felt relatively warmer on the morning of the 21st. A low temperature of five degrees below zero was recorded in Denville.

Date(s) of Event	Event Type	Description
February 24, 2015	Cold/wind Chill	The high pressure system responsible for third and last arctic blast of the month of February arrived in New Jersey on the morning of the 24th. Unlike the two previous arctic outbreaks earlier this month, this one was not accompanied by strong winds during the first half of the day. Air and wind chill temperatures were nearly the same. The calm conditions and snow cover combined to give many locations in northwest New Jersey the coldest morning of the winter season and comparably cold to the 20th and 21st weather in the rest of the state. Morning low temperatures averaged 25 to 35 degrees colder than normal.
July 19, 2015	Heat	Unseasonably hot and humid weather affected most of New Jersey on the 19th and 20th. High temperatures in most areas reached into the lower to mid-90s both days. The 19th was slightly hotter and more humid overall. The combination of heat and humidity brought afternoon heat index values as high as 100F to 105F on the 19th. These were some of the highest heat index values of the entire summer. A high temperature of 95 degrees was recorded in Madison.
February 14, 2016	Cold/wind Chill	Bitter cold temperatures and strong northwest winds associated with an Arctic outbreak combined to create dangerous wind chill temperatures across the entire northeast quadrant of the county beginning Saturday morning, February 13th into Sunday afternoon, February 14th. Many local governments set up Code Blue shelters for the vulnerable population. The lowest wind chill values were reported at the following locations during the early morning hours of February 14th: 26 degrees below zero in Stanhope, 22 degrees below zero in Basking Ridge, and 20 degrees below zero in Riverdale.
July 1, 2018	Excessive Heat	Temperatures in the middle to upper 90s and dew points in the upper 60s to lower 70s led to excessive heat across northern and western New Jersey. Heat indices reached 107 degrees at the Morristown Airport AWOS on July 3.
June 29, 2021	Excessive Heat	A multi-day excessive heat event occurred across much of the mid-Atlantic near the end of June 2021. High temperatures in the mid to locally upper 90s combined with dew points in the upper 60s to near 70 caused heat index values to reach 105 to 110 over much of the region. Heat index values reached 105F on both June 29 and 30, especially across the eastern half of the county, and locally reached 110F.
August 8, 2021	Excessive Heat	A multi-day excessive heat event occurred across much of the mid-Atlantic from August 11-13, 2021. Temperatures in the mid to upper 90s combined with dew point values near 70 caused widespread heat index values near to above 105F on both August 11 and 12, and locally into the 13th before a cold front brought relief. Heat index values reached 105F on August 11 and 12.
June 23, 2024	Excessive Heat	A strong ridge of high pressure both at the surface and aloft combined with a flow of moist air northward from the Gulf of Mexico resulted in excessive heat across parts of central and southern New Jersey. The heat index reached 105F at Morristown Municipal Airport.
July 5-16, 2024	Excessive Heat	A Bermuda high pressure resulted in high heat across parts of the state. The heat index reached 106F at Morristown Municipal Airport during this time.

Source: NOAA-NCDC 2024; NWS 2023

°F degrees Fahrenheit

N/A Not applicable

Note: With documentation for New Jersey and Morris County being so extensive, not all sources have been identified or researched; therefore, Table 4.3.5-2 may not include all events that have occurred or impacted the County.

3.7.6 PROBABILITY

It is anticipated that Morris County will continue to experience extreme temperatures annually that may coincide with or induce secondary hazards such as snow, hail, ice or windstorms, thunderstorms, drought, human health

impacts, and utility failures. Table 29 shows the annual number of events, recurrence interval, annual probability, and the annual percentage chance of occurrence for the hazards associated with extreme temperatures are reported in the NOAA-NCEI Storm Events Database.

Table 29. Probability of Occurrence of Extreme Temperatures

Hazard Type	Number of Occurrences Between 1954 and 2024	Rate of Occurrence or Annual Number of Events (average)	Recurrence Interval (in years)	Probability of event Occurring in Any Given Year	% Chance of Occurring in Any Given Year
Cold/Wind Chill	30	0.42	2.4	0.41	41.4
Excessive Heat	13	0.16	6.4	0.16	15.7
Extreme Cold/Wind Chill	2	0.03	35.0	0.03	2.9
Heat	54	0.78	1.3	0.77	77.1
Total	**99**	**1.39**	**0.73**	**1.37**	**100**

Source: NOAA-NCEI 2024

3.7.7 CLIMATE CHANGE IMPACTS

Over the past century, average annual temperatures have increased by 5°F in Morris County and 4°F in New Jersey overall; most of this warming has occurred since 1970. The State of New Jersey has observed an increased average temperature rate of 0.66°F/decade, the equivalent rate of 6.6°F century. Out of the 20 warmest years on record, 15 have occurred since 2000, with 2021 representing the third warmest. Statewide, temperatures for the winter of 2022/2023 averaged 38.5°. This is 4.5° above normal and ranks as the 2nd mildest of the past 128 winters. The average temperature of New Jersey in 2022 was 54.3° F.

3.7.8 VULNERABILITY ASSESSMENT

3.7.8.1 IMPACT TO LIFE, HEALTH AND SAFETY

The entire population of Morris County is exposed to extreme temperature events. These events can have potential health impacts, leading to injuries and fatalities. According to the Centers for Disease Control and Prevention (CDC), certain populations are particularly vulnerable to extreme cold and heat events, including:

- The elderly, due to their age, health conditions, and limited mobility to access shelters.
- Infants and children up to four years old.
- Individuals with chronic medical conditions like heart disease and high blood pressure.
- Low-income individuals who may lack access to proper heating and cooling.
- The general public, who may overexert during extreme heat events or experience hypothermia during extreme cold events.

Approximately 30.6% of the total population in Morris County falls under these vulnerable groups, including persons under 5, persons over 65, and persons in poverty, according to the 2021 ACS 5-Year Population Estimate. For example, 90,810 individuals in Morris County are over 65 years of age, with the highest concentration found in the Township of Harding and the Township of Pequannock (25.1% and 29.3% of total municipal population, respectively).

People with low incomes may face housing challenges, such as poor insulation and heating supply, making them more susceptible to cold temperatures. The Borough of Victory Gardens in Morris County has the highest concentration of population below the poverty level (18.8% of total municipal population).

According to the U.S. Fire Administration, the risk of structural fires increases during winter months, and although winter home fires only account for 8% of fires in the U.S., they contribute to approximately 30% of all fire deaths. Cooking and heat sources placed too close to combustible materials are leading factors in these incidents (U.S. Fire Administration 2018). Power outages are also common during extreme cold events, and individuals using generators without proper ventilation procedures are at risk of carbon monoxide poisoning. Improperly connected portable generators can also pose dangers to utility workers trying to restore power and may damage house wiring and/or generators.

3.7.8.2 IMPACT ON GENERAL BUILDING STOCK

All buildings are exposed to extreme temperature hazard. 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.

3.7.8.3 IMPACT ON CRITICAL FACILITIES

All critical facilities in the County are exposed to extreme temperature hazards. 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, due to increased usage from air conditioners and other energy-intensive appliances. Similarly, heavy snowfall and ice storms, associated with extreme cold temperature events, can cause power interruption. Backup power is recommended for critical facilities and infrastructure.

In 2019, the North Jersey Transportation Planning Authority (NJTPA) released a report for the Passaic River Basin that discusses climate change including extreme heat and impacts to transportation infrastructure. Impacts associated with extreme heat events on bridges, culverts, facilities, rail, roads and mass transit include stress, sagging, thermal expansion and system failure.

3.7.8.4 IMPACT ON THE ECONOMY

Extreme temperature events also have impacts on the economy, including loss of business function and damage to and loss of inventory. Business-owners can be faced with increased financial burdens due to unexpected damage to the building (e.g., pipes bursting), higher than normal utility bills, or business interruption due to power failure (i.e., loss of electricity, telecommunications). Disruptions in public transportation service will also impact the economy for both commuters and customers alike.

Extreme temperature events can impact agriculture yields. Based on information from the 2022 Census of Agriculture, 471 farms were present in Morris County, encompassing 14,552 acres of total farmland.

3.7.9 FUTURE CHANGES THAT MAY IMPACT VULNERABILITY

3.7.9.1 PROJECTED DEVELOPMENT

The ability of new development to withstand extreme temperature 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. These changes cause urban areas to become warmer than the surrounding areas forming heat islands.

3.7.9.2 PROJECTED CHANGES IN POPULATION

Municipalities that experience increases in population may require utility system upgrades to keep up with utility demands (e.g., water, electric) during extreme temperature events to prevent increased stresses on these systems. NJTPA includes high population growth forecasts as one criterion to prioritize transportation adaptation strategies.

3.7.9.3 CLIMATE CHANGE

Most studies project that the State of New Jersey will see an increase in average annual temperatures. As the climate warms, extreme cold events might decrease in frequency, while extreme heat events might increase in frequency; the shift in temperatures could also result in hotter extreme heat events. With increased temperatures, vulnerable populations could face increased vulnerability to extreme heat and its associated illnesses, such as heatstroke and cardiovascular and kidney disease. Additionally, as temperatures rise, more buildings, facilities, and infrastructure systems may exceed their ability to cope with the heat.

3.7.10 VULNERABILITY CHANGE SINCE THE 2020 HMP

Overall, the entire county remains vulnerable to extreme temperatures. As existing development and infrastructure continue to age, they can be at increased risk to failed utility and transportation systems if they are not properly maintained and do not adapt to the changing environment.

3.8 FLOOD

3.8.1 2025 HMP CHANGES

- All subsections have been updated using best available data.
- Previous events between 2020 and 2024 are added.
- The discussion of urban flooding has been expanded.
- The FEMA 2017 preliminary DFIRM was used to conduct the risk assessment.
- Dam failure has been integrated into the flood hazard chapter and is no longer a standalone hazard.

3.8.2 PROFILE

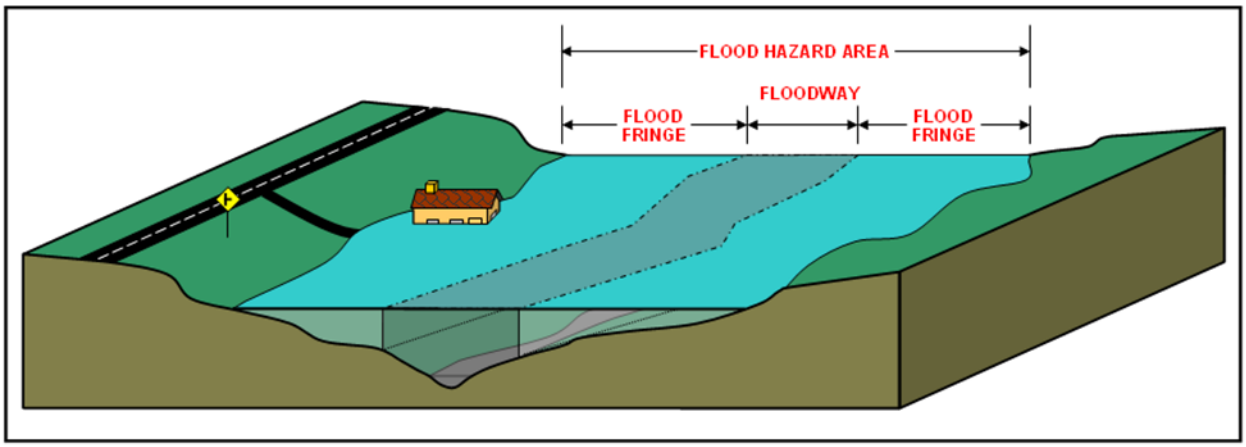
A flood is the inundation of normally dry land resulting from the rising and overflowing of a body of water. It can develop slowly over a period of days or quickly, with disastrous effects both local or regional. Floods are frequent and costly natural hazards in New Jersey in terms of human hardship and economic loss, particularly to communities that lie within flood-prone areas or floodplains of a major water source.

The flood-related hazards most likely to impact Morris County are riverine (inland) flooding, urban flooding, and flooding as a result of a dam failure.

3.8.2.1 RIVERINE FLOODING

FEMA defines a floodplain as any land susceptible to being inundated by floodwaters from any source, particularly waterways. In Morris County, floodplains line the rivers and streams of the county. The boundaries of the floodplains are altered as a result of changes in land use, the amount of impervious surface, placement of obstructing structures in floodways, changes in precipitation and runoff patterns, improvements in technology for measuring topographic features, and utilization of different hydrologic modeling techniques.

Figure 31. Illustrated Floodplain



Source: NJDEP

3.8.2.2 URBAN FLOODING

Heavy rainfall that overwhelms a developed area's stormwater infrastructure causing flooding is commonly referred to as urban flooding or flash flooding. Urban flooding can be worsened by aging and inadequate infrastructure and over-development of land. The growing number of extreme rainfall events that produce intense precipitation are resulting in increased urban flooding. While riverine and coastal flooding is mapped and studied by FEMA, urban flooding is not.

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.

3.8.2.3 DAM FAILURE

A dam or a levee is an artificial barrier that has the ability to impound water, wastewater, or any liquid-borne material for the purpose of storage or control of water. They can be built for many purposes, including power production, agriculture, water supply, recreation, and flood protection. Dam failure is any malfunction or abnormality outside of the design that adversely affects a dam's primary function of impounding water. Levees typically are earthen embankments constructed from a variety of materials ranging from cohesive to cohesionless soils. Dams and levees can fail for any number of reasons, resulting in flooding downstream. Failures are usually associated with intense rainfall and prolonged flood conditions; however, dam breaks may occur during dry periods as a result of progressive erosion of an embankment. The greatest threat from a dam break is to areas

immediately downstream. Dam failures may or may not leave enough time for evacuation of people and property, depending on their abruptness. Seepages in earth dams usually develop gradually, and if the embankment damage is detected early, downhill residents have at least a few hours or days to evacuate. Failures of concrete or masonry dams tend to occur suddenly, sending a wall of water and debris down the valley at more than 100 mph. Dam failures due to the overtopping of a dam normally give sufficient lead time for evacuation.

A levee failure or breach causes flooding in landward areas adjacent to the structure. The failure of a levee or other flood protection structure could be devastating, depending on the level of flooding for which the structure is designed and the amount of landward development present. Large volumes of water may be moving at high velocities, potentially causing severe damage to buildings, infrastructure, trees, and other large objects. Levee failures are generally worse when they occur abruptly with little warning and result in deep, fast-moving water through highly developed areas.

3.8.3 LOCATION

Flooding potential is influenced by climatology, meteorology and topography. Extensive development can impact flooding potential as it leaves fewer natural surfaces to absorb rainwater, forcing water directly into streams, rivers, and existing drainage systems and swelling them more than when more natural surface buffered the runoff rate.

3.8.3.1 RIVERINE FLOODING

Passaic River. The Passaic River is one of the major flood areas throughout Morris County. Municipalities flooded by the Passaic River include Chatham Borough, Chatham Township, East Hanover Township, Florham Park Borough, Hanover Township, Harding Township, Lincoln Park Borough, Long Hill Township and, Montville Township. The source of the Passaic River begins near the Borough of Mendham (Morris County) and winds through seven counties, 45 municipalities, and into Newark Bay. At its source, the river is approximately 600 ft above sea level and flows along for approximately 90 miles. The river's southeasterly flow goes south of Jockey Hollow at Morristown National Historical Park and becomes the boundary between Somerset and Morris counties.

Pompton River. The Pompton River is a tributary of the Passaic River; it is formed by the confluence of the Ramapo, Wanaque and Pequannock rivers. Located in the northeastern section of Morris County, the Pompton River flows south, passing between and significantly flooding Lincoln Park Borough and Pequannock Township, the two most flood-prone municipalities in Morris County.

Rockaway River. The Rockaway River originates in Jefferson Township and flows to the southwest and then to the east, emptying into the Boonton Reservoir. The river flows through the townships of Jefferson, Rockaway, Denville, Boonton, Randolph, Parsippany Troy Hills; the boroughs of Wharton and Rockaway; and the towns of Boonton and Dover. Municipalities that have flooded due to the Rockaway River include the Town of Boonton and the townships of Denville, Jefferson, Parsippany-Troy Hills, and Rockaway. In August 2011, the Rockaway River set a new flood record, carving out a section of Interstate 287 and causing two major slope failures in the Town of Boonton. Stream gage analysis in 20-year increments of USGS no. 01380500 in Boonton from 1938-2011 show an increase in average annual peak flow of 84%.

Whippany River. The Whippany River is a major tributary of the Rockaway River. It rises in Mendham Township and flows east-northeast until it joins the Rockaway River in Hatfield Swamp, just above the confluence of the Passaic River. The following municipalities are flooded by the Whippany River: East Hanover Township, Morris Township, Morristown, and Parsippany-Troy Hills Township.

Flooding of various origins may be experienced in any season of the year, particularly as New Jersey is located within the major storm tracks of North America. Flooding during winter months is less frequent, but spring

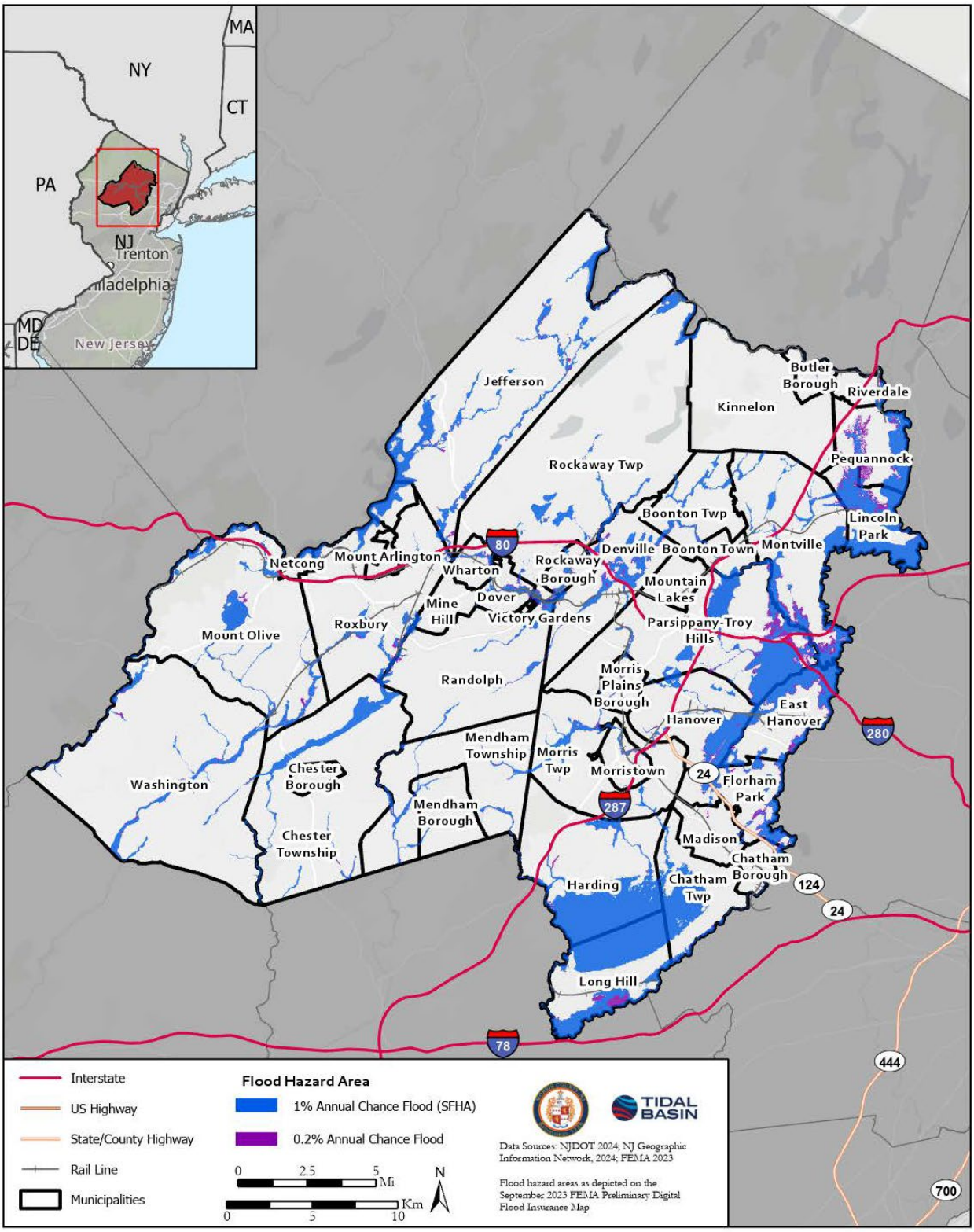
flooding compounded by ice and snow melt has occurred. The most extensive floods have occurred mostly in late summer and early fall and are usually associated with tropical disturbances moving north along the Atlantic coast.

FEMA released updated preliminary Digital Flood Insurance Rate Maps (DFIRMs) in 2017 for all Morris County municipalities; these remain current for the 2025 update, though they are in the process of being updated. The preliminary DFIRM shows the following flood hazard areas:

- 1% Annual Chance Flood Hazard: Areas subject to inundation by the 1% annual chance flood event. This is also referred to as the Special Flood Hazard Area (SFHA). Mandatory flood insurance requirements and floodplain management standards apply.
- 0.2% Annual Chance Flood Hazard: Area of minimal flood hazard, usually depicted on FIRMs as the shaded X Zone.

Locations of flood zones in Morris County as depicted on the DFIRMs are illustrated in Figure 32.

Figure 32. FEMA Flood Hazard Areas in Morris County



A majority of the 1% annual chance flood hazard zones are located in eastern Morris County, along the Pompton and Passaic rivers. In southwestern Morris County, the Black River has areas of the 1% annual chance flood hazard zones.

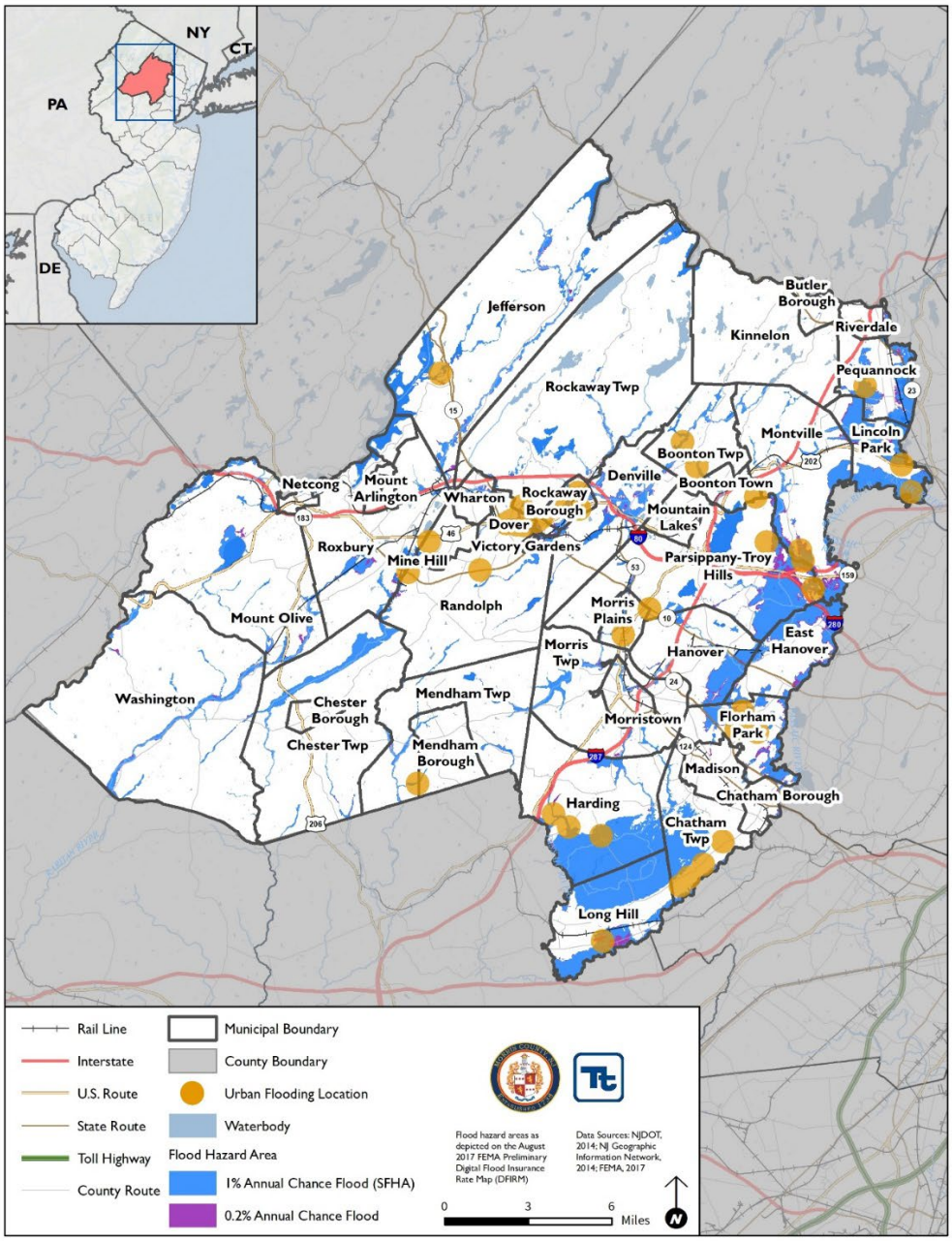
Mapping provided in this plan is based on the most current FEMA floodplain mapping and data. FEMA and NJDEP are currently in the process of updating Morris County's flood maps. Draft maps with updates have been developed, and the maps are currently under a review and comment process. Next steps include developing preliminary maps, completing the Consultation Coordination Officer Meeting and Public Open House, and then opening a formal appeal period, which FEMA and NJDEP expect to be completed in Summer 2025. Once the appeal period concludes, FEMA/NJDEP will move toward the letter of final determination and maps are expected to go effective in early 2027.

A few communities that went through the Scientific Review Panel to appeal the previous preliminary maps, including Pequannock. Updated modeling was issued for those communities and those maps should go effective in August 2025.

3.8.3.2 URBAN FLOODING

Municipalities have identified areas that flood outside the FEMA-mapped floodplain in an attempt to identify problem areas and assist with identifying mitigation solutions. Figure 33 illustrates those urban flood areas.

Figure 33. Urban Flood Areas

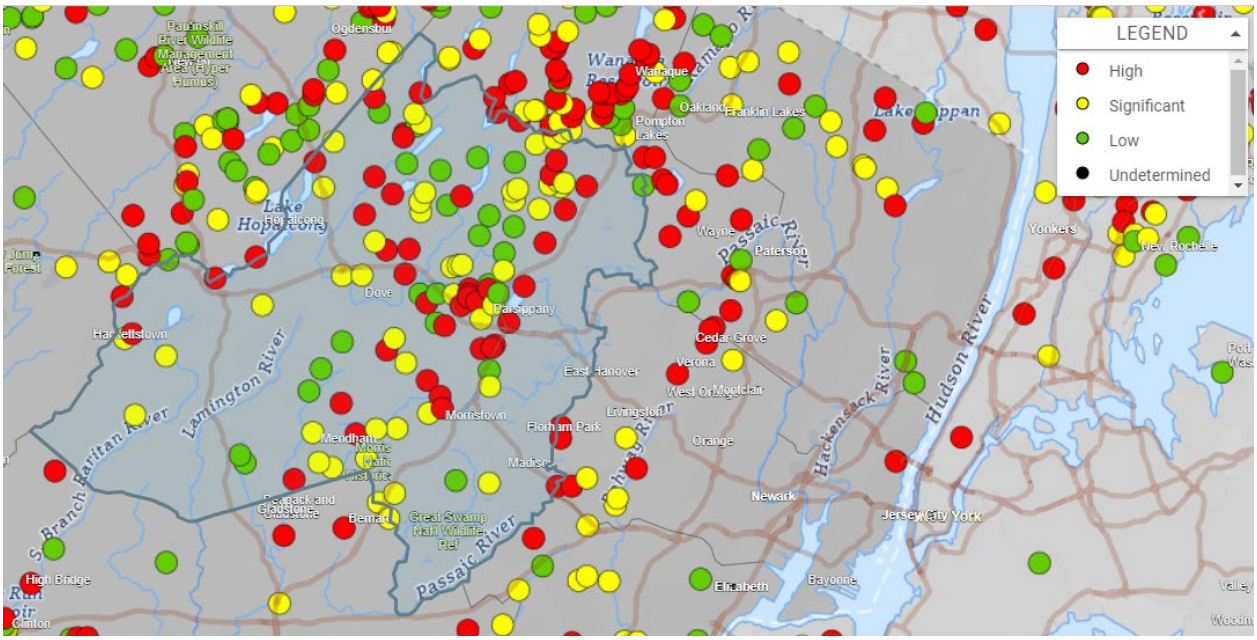


Source: 2020 Morris County Hazard Mitigation Plan

3.8.3.3 DAM FAILURE

There are 120 dams located in Morris County, including 42 high hazard dams, 45 significant hazard dams, and 23 low hazard dams. Figure 34 shows these dams.

Figure 34. Dams in Morris County



Source: National Inventory of Dams

3.8.4 EXTENT

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 each year. Flood studies use historical records to determine the probability of occurrence for the different discharge levels. FEMA maps floodplains using advanced modeling and data analysis to delineate the extent of potential flooding impact and assess the associated risk to specific areas. These comprehensive floodplain maps serve as crucial tools for communities and emergency management, aiding in informed decision-making and risk mitigation strategies.

The NJDEP is mandated to regulate flood hazard areas pursuant to N.J.S.A. 58:16A-50 et seq., the Flood Hazard Area Control Act. This Act authorizes the DEP to adopt land use regulations for development within the flood hazard areas, to control stream encroachments, and to integrate the flood control activities of the municipal, county, state, and federal governments. The State's Flood Hazard Area delineations are defined by the New Jersey Flood Hazard Area Design Flood, which is equal to a design flood discharge 25% greater in flow than the 1% annual chance flood. In addition, the floodway shall be based on encroachments that produce no more than a 0.2-foot water surface rise above the 1% annual chance flood.

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. Morris County has numerous active USGS stream gages; in addition, stream gages are located upstream in neighboring counties.

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

- Minor Flooding - minimal or no property damage, but possibly some public threat or inconvenience.

- Moderate Flooding - some inundation of structures and roads near streams. Some evacuations of people and/or transfer of property to higher elevations are necessary.
- Major Flooding - extensive inundation of structures and roads. Significant evacuations of people and/or transfer of property to higher elevations.

The severity of a flood depends not only on the amount of water that accumulates in a period of time but also on the land's ability to manage this water. The size of rivers and streams in an area and infiltration rates are significant factors. When it rains, soil acts as a sponge. When the land is saturated or frozen, infiltration rates decrease and any more water that accumulates must flow as runoff.

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

3.8.5 PREVIOUS OCCURRENCES

Many sources provided historical information regarding previous occurrences and losses associated with flooding throughout the State of New Jersey and Morris County; therefore, the loss and impact information for many events varies depending on the source.

Between 1954 and 2023, FEMA declared that the State of New Jersey experienced 45 flood-related disasters (DR) or emergencies (EM) classified as one or a combination of the following disaster types: hurricane, tropical storm, Nor'Easter, snowstorm, severe storms, flooding, inland and coastal flooding, coastal storm, high tides, heavy rain, and severe storms. Generally, these disasters cover a wide region of the state; therefore, they may have impacted many counties. Morris County was included in 27 of these flood-related declarations, as shown in Table 26.

Table 30. Flood-Related Disaster (DR) and Emergency (EM) Declarations, 1954 - 2024

Declaration	Event Date	Declaration Date	Event Description
DR-245	June 18, 1968	June 18, 1968	Flood: Heavy Rains & Flooding
DR-310	September 4, 1971	September 4, 1971	Flood: Heavy Rains & Flooding
DR-477	July 23, 1975	July 23, 1975	Flood: Heavy Rains, High Winds, Hail & Tornadoes
DR-701	March 28-April 8, 1984	April 12, 1984	Flood: Coastal Storms & Flooding
DR-973	December 10-17, 1992	December 18, 1992	Flood: Coastal Storm, High Tides, Heavy Rain, & Flooding
EM-3106	March 13-17, 1993	March 17, 1993	Snow: Severe Blizzard
DR-1088	January 7-12, 1996	January 13, 1996	Snow: Blizzard of 96 (Severe Snow Storm)
DR-1145	October 18-23, 1996	November 19, 1996	Severe Storms/Flooding
EM-3148	September 16-18, 1999	September 17, 1999	Hurricane: Hurricane Floyd Emergency Declarations
DR-1295	September 16-18, 1999	September 18, 1999	Hurricane: Hurricane Floyd Major Disaster Declarations
DR-1337	August 12-21, 2000	August 17, 2000	Severe Storms, Flooding and Mudslides
EM-3181	February 16-17, 2003	March 20, 2003	Snow: Snow
DR 1588	April 1-3, 2005	April 19, 2005	Severe Storm(s): Severe Storms and Flooding
DR-1694	April 14-20, 2007	April 26, 2007	Severe Storm(s): Severe Storms and Inland and Coastal Flooding
DR-1897	March 12-April 15, 2010	April 2, 2010	Severe Storm(s): Severe Storms and Flooding
EM-3332	August 26-September 5, 2011	August 27, 2011	Hurricane: Hurricane Irene
DR-4021	August 27-September 5, 2011	August 31, 2011	Hurricane: Hurricane Irene
DR-4048	October 29, 2011	November 30, 2011	Severe Storm(s): Severe Storm

Declaration	Event Date	Declaration Date	Event Description
DR-1954	December 26-27, 2010	February 4, 2011	Severe Winter Storm and Snowstorm
EM-3354	October 26-November 8, 2012	October 28, 2012	Hurricane: Hurricane Sandy
DR-4086	October 26-November 8, 2012	October 31, 2012	Hurricane: Hurricane Sandy
DR-4264	January 22-24, 2016	March 14, 2016	Severe Storm(s): Severe Winter Storm and Snowstorm
DR-4368	March 6-7, 2018	June 8, 2018	Severe Storm(s): Severe Winter Storm and Snowstorm
DR-4488	January 20, 2020- March 11, 2023	March 25, 2020	Covid-19 Pandemic
DR-4574	August 4. 2020	December 11, 2020	Tropical Storm: Tropical Storm Isaias
DR-4597	January 31, 2021- February 2, 2021	April 28, 2021	Severe Storms: Severe Winter Storm and Snowstorm
DR-4614	September 1, 2021 - September 3, 2021	September 5, 2021	Hurricane: Hurricane Ida

Source: FEMA

The Secretary of Agriculture from the U.S. Department of Agriculture (USDA) is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in counties that are contiguous to a designated county. Between 2019 and 2023, Morris County was included in three USDA declarations involving flooding.

The NOAA National Centers for Environmental Information Storm Events database records and defines flood events as follows:

- Flash Flood (urban flood) is reported in the NOAA-NCEI database for a life-threatening, rapid rise of water into a normally dry area beginning within minutes to multiple hours of the causative event (e.g., intense rainfall, dam failure, ice jam).
- Flood is reported in the NOAA-NCEI database for any high flow, overflow, or inundation by water which causes damage. In general, this would mean the inundation of a normally dry area caused by an increased water level in an established watercourse, or ponding of water, that poses a threat to life or property.

Between 1950 and 2023, the NCEI database reported 78 separate flood events; two fatalities were associated with these incidents, and over $256.5 million in property damage recorded. $200 million of those damages were associated with Hurricane Irene in 2011.

Flash flooding results from the same timeframe record 53 separate incidents, resulting in six injuries and over $53 million in property damages. $30 million of those damages and all six injuries are associated with Hurricane Floyd in 1999.

New Jersey has not experienced a catastrophic dam failure, but the number of small dam failures has increased. These failures are attributed to a lack of maintenance and inspection and the fact that many dams in the state are aging and nearing the end of their design life. Records of dam failure can be spotty, but there is historical data for dam failures in Morris County. According to the NJDEP, the Sarubbi Dam failed in Morris County in November 1927. Further, when Hurricane Floyd passed through Morris County in 1999, four dams were damaged, and one of these four dams was a total loss. Shortly after Hurricane Floyd, a storm event in August 2000 caused 12 dams to fail in Morris County. Nine out the 12 dams that failed were located in the Township of Jefferson. In total, $179 million of damages were caused by all the dams throughout four NJ counties that breached after the storm in 2000 that included loss from 2,700 homes and businesses and 2,600 people that were evacuated.

3.8.6 PROBABILITY

Morris County is expected to continue experiencing direct and indirect impacts of flooding in the future. Table 27 summarizes data regarding the probability of occurrences of flood events in Morris County based on the historic record. The information used to calculate the probability of occurrences is based solely on NOAA-NCEI storm events database results.

Table 31. Flood-Related Hazard Probability

Hazard Type	Number of Occurrences Between 1954 and 2024	Recurrence Interval	Probability of Incident Occurring in Any Given Year
Flash Flood	57	1.22 years	82%
Flood	80	0.97 years	100%

Source: NCEI

There is minimal history of occurrence of dam failure between 1950 and 2024. This suggests a low probability of future occurrence, though the construction of new dam and levee structures could increase dam and levee failure risk. Dam failure events are infrequent and usually coincide with events that cause them, such as earthquakes, landslides, and excessive rainfall and snowmelt. However, the risk of such an event increases for each dam as the dam's age increases or frequency of maintenance decreases. Additionally, future climate change may impact storm patterns, increasing the probability of more frequent, intense storms with varying duration. The probability of any type of dam failure is low given current dam safety regulatory and oversight environment.

3.8.7 CLIMATE CHANGE IMPACTS

According to the NJDEP, New Jersey is experiencing increased intensity, frequency and duration of storm events. Northern New Jersey's 1971-2000 precipitation average was over five inches (12-percent) greater than the average from 1895-1970. According to a report by the NJDEP Division of Science and Research, Projected Changes in Extreme Rainfall in New Jersey, projections for 2050-2099, under a moderate emissions scenario, suggest that the amount of precipitation associated with the 1% chance, 24-hour storm, will increase on average by 10% in much of southern New Jersey and by as much as 22% in northern counties. More frequent storms (such as the 2-year and 10-year) are expected to see increases in precipitation intensity, on average, of 5% to 15% across the state by the end of the century. Increased rainfall and heavy rainfalls increase the risk of flooding events.

Dams are designed partly based on assumptions about a river's flow behavior, expressed as hydrographs. Changes in weather patterns can significantly affect the hydrograph used for the design of a dam. If the hygrograph changes, the dam conceivably could lose some or all of its designed margin of safety, also known as freeboard. Loss of designed margin of safety increases the possibility that floodwaters would overtop the dam or create unintended loads, which could lead to a dam failure.

3.8.8 VULNERABILITY ASSESSMENT

To assess Morris County's risk to the flood hazard, a spatial analysis was conducted using the best available spatially-delineated flood hazard areas. The 1% and 0.2% annual chance flood events as depicted on the 2017 DFIRMs were examined to determine the assets located in the hazard areas and to estimate potential loss using the FEMA HAZUS-MH flood model. These results are summarized below.

3.8.8.1 IMPACT TO LIFE, HEALTH, AND SAFETY

The impact of flooding on life, health and safety is dependent upon several factors, including the severity of the event and whether adequate warning time is provided to residents. Hazard exposure represents the population

living in or near floodplain areas who could be impacted should a flood event occur. However, exposure is not limited to only those who reside in a defined hazard zone but all individuals 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.

Based on the spatial analysis, there are an estimated 12,578 people living in the Special Flood Hazard Area (SFHA, or 1% annual chance event floodplain) and an estimated 20,814 people living in the 0.2% annual chance flood event floodplain. These residents may be displaced due to their homes flooding, requiring them to seek temporary shelter with friends and family or in emergency shelters. The Borough of Lincoln Park has the greatest percentage of its population located in the floodplain; approximately 24.6% and 31.4% for the 1% annual chance event and 0.2% annual chance event, respectively. The Township of Pequannock has the greatest number of residents located in the floodplain. The potential population exposed should be used as a guide for planning purposes.

Table 32. Estimated Population Exposed to Flooding

Municipality	2022* Total Est. Population	1% Annual Chance Flood Event		0.2% Annual Chance Flood Event	
		Number	% of Total	Number	% of Total
Town of Boonton	8,815	0	0.0%	6	0.1%
Township of Boonton	4,380	44	1.0%	77	1.8%
Borough of Butler	8,119	58	0.7%	74	1.0%
Chatham Borough	9,226	14	0.2%	89	1.0%
Chatham Township	10,962	67	0.6%	67	0.6%
Chester Borough	1,681	0	0.0%	0	0.0%
Chester Township	7,719	3	0.0%	8	0.1%
Denville Township	17,127	1,013	6.0%	1,691	10.1%
Town of Dover	18,422	1,406	7.7%	2,160	11.8%
Township of East Hanover	11,120	495	4.4%	1,332	11.9%
Borough of Florham Park	13,325	92	0.8%	211	1.8%
Township of Hanover	14,646	71	0.5%	82	0.6%
Township of Harding	3,887	108	2.8%	112	2.9%
Township of Jefferson	20,517	158	0.7%	345	1.6%
Borough of Kinnelon	9,985	0	0.0%	0	0.0%
Borough of Lincoln Park	10,923	2,579	24.6%	3,287	31.4%
Township of Long Hill	8,621	477	5.4%	1,086	12.4%
Borough of Madison	16,261	2	0.0%	128	0.8%
Borough of Mendham	4,992	11	0.2%	14	0.3%
Township of Mendham	6,014	43	0.7%	58	1.0%
Township of Mine Hill	3,609	0	0.0%	0	0.0%
Township of Montville	22,440	457	2.1%	1,221	5.6%
Township of Morris	23,268	102	0.5%	133	0.6%
Borough of Morris Plains	6,145	14	0.3%	20	0.3%
Town of Morristown	20,339	6	0.0%	6	0.0%
Borough of Mount Arlington	5,908	6	0.1%	6	0.1%
Township of Mount Olive	28,977	372	1.3%	506	1.7%
Borough of Mountain Lakes	4,309	0	0.0%	0	0.0%
Netcong Borough	3,245	0	0.0%	0	0.0%
Township of Parsippany-Troy Hills	56,163	1,294	2.4%	3,324	6.2%
Township of Pequannock	15,569	2,831	18.3%	3,377	21.8%

Municipality	2022* Total Est. Population	1% Annual Chance Flood Event		0.2% Annual Chance Flood Event	
		Number	% of Total	Number	% of Total
Township of Randolph	26,497	61	0.2%	82	0.3%
Borough of Riverdale	4,238	362	8.5%	514	12.1%
Borough of Rockaway	6,592	94	1.5%	260	4.0%
Township of Rockaway	26,036	114	0.5%	198	0.8%
Township of Roxbury	23,140	54	0.2%	62	0.3%
Borough of Victory Gardens	1,655	0	0.0%	31	1.8%
Township of Washington	18,165	170	0.9%	243	1.3%
Borough of Wharton	7,245	0	0.0%	4	0.1%
Morris County (Total)	511,151	12,578	2.5%	20,814	4.2%

Research has shown that some populations, while they may not have more hazard exposure, may experience exacerbated impacts and prolonged recovery if/when impacted. This is due to many factors, including their physical and financial ability to react or respond during a hazard. Of the population exposed, the most vulnerable include the economically disadvantaged and the population over age 65. Economically disadvantaged populations are more vulnerable because they are likely to evaluate their risk and make decisions to evacuate based on net economic impacts on their families. The population over age 65 is also more vulnerable because they are more likely to seek or need medical attention that may not be available due to isolation during a flood event, and they may have more difficulty evacuating. Within the 1% annual chance event floodplain, there are approximately 2,101 people over the age of 65 and 688 people below the poverty level. These populations are all located within the SFHA. As for the 0.2% chance event, there are approximately 3,426 people over the age 65 and 1,090 people below the poverty level.

Cascading impacts may also include exposure to pathogens such as mold. After flood events, excess moisture and standing water contribute to the growth of mold in buildings. Mold may present a health risk to building occupants, especially those with already compromised immune systems such as infants, children, the elderly and pregnant women. The degree of impact will vary and is not strictly measurable. Molds can grow in as short a period as 24-48 hours in wet and damaged areas of buildings that have not been properly cleaned. Very small mold spores can easily be inhaled, creating the potential for allergic reactions, asthma episodes, and other respiratory problems. Buildings should be properly cleaned and dried out to safely prevent mold growth.

Molds and mildews are not the only public health risk associated with flooding. Floodwaters can be contaminated by pollutants such as sewage, human and animal feces, pesticides, fertilizers, oil, asbestos, and rusting building materials. Common public health risks associated with flood events also include:

- Unsafe food
- Contaminated drinking and washing water and poor sanitation
- Mosquitos and animals
- Carbon monoxide poisoning
- Secondary hazards associated with re-entering/cleaning flooded structures
- Mental stress and fatigue

Floodwaters from dam breaches can and will cause the same issues as a natural flood, however depending on the specifics of the breach a dam failure may also release water at a spectacular velocity.

3.8.8.2 IMPACT ON GENERAL BUILDING STOCK

Exposure to the flood hazard includes those buildings located in the flood hazard zone. 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 5,461 buildings located in the SFHA with a replacement cost value of approximately $4.78 billion of building and contents. This represents approximately 3.8% of the County's total general building stock inventory replacement cost value (approximately $127 billion).

There are 8,727 buildings located in the 0.2% annual chance flood boundary with approximately $7.87 billion of building/contents in replacement cost value (or 6.2% of the County's total replacement cost value). The Township of Pequannock has the greatest number of its buildings located in the floodplain; approximately 1,164 and 1,368 located in the 1% chance event and 0.2% chance event boundaries, respectively.

HAZUS-MH estimates $634 million in building and content damage as a result of the 1% annual chance flood event (or 0.5% of the total building stock replacement cost value). Of the $634 million in potential loss, $200 million is estimated to residential structures.

Table 33. Estimated General Building Stock Exposure to the 1% Annual Chance Flood Event - All Occupancies

Municipality	Total # Buildings	Total Replacement Cost Value (RCV)	Estimated Building Stock Exposed			
			Number of Buildings - 1% Annual Chance Flood	% of Total	RCV - 1% Annual Chance Flood	% of Total
Town of Boonton	3,262	$1,832,625,537	0	0.0%	$0	0.0%
Township of Boonton	1,898	$1,388,780,135	27	1.4%	$15,544,185	1.1%
Borough of Butler	2,701	$1,489,686,071	36	1.3%	$19,170,863	1.3%
Chatham Borough	3,286	$1,673,960,469	22	0.7%	$40,149,387	2.4%
Chatham Township	4,080	$2,300,237,613	28	0.7%	$8,632,360	0.4%
Chester Borough	853	$694,668,411	0	0.0%	$0	0.0%
Chester Township	3,680	$2,782,631,274	7	0.2%	$5,334,258	0.2%
Denville Township	7,198	$4,397,845,504	503	7.0%	$282,448,772	6.4%
Town of Dover	4,514	$2,640,787,978	482	10.7%	$380,283,612	14.4%
Township of East Hanover	4,848	$4,740,072,304	218	4.5%	$193,643,609	4.1%
Borough of Florham Park	3,805	$3,768,421,982	38	1.0%	$90,660,645	2.4%
Township of Hanover	7,090	$5,609,469,027	112	1.6%	$349,873,206	6.2%
Township of Harding	2,230	$1,808,255,972	90	4.0%	$47,732,628	2.6%
Township of Jefferson	9,625	$4,421,074,958	125	1.3%	$39,069,916	0.9%
Borough of Kinnelon	4,093	$2,858,766,250	0	0.0%	$0	0.0%
Borough of Lincoln Park	4,166	$2,125,371,898	882	21.2%	$688,552,685	32.4%

Municipality	Total # Buildings	Total Replacement Cost Value (RCV)	Estimated Building Stock Exposed			
			Number of Buildings - 1% Annual Chance Flood	% of Total	RCV - 1% Annual Chance Flood	% of Total
Township of Long Hill	3,643	$2,253,461,094	311	8.5%	$245,650,873	10.9%
Borough of Madison	6,301	$3,066,320,935	1	0.0%	$40,842	0.0%
Borough of Mendham	2,139	$1,479,178,043	7	0.3%	$4,216,933	0.3%
Township of Mendham	2,667	$2,099,041,883	26	1.0%	$9,874,031	0.5%
Township of Mine Hill	1,590	$766,971,485	1	0.1%	$905,738	0.1%
Township of Montville	8,179	$6,714,034,036	234	2.9%	$372,298,816	5.5%
Township of Morris	9,713	$6,091,077,654	52	0.5%	$24,250,122	0.4%
Borough of Morris Plains	2,378	$1,738,775,034	8	0.3%	$13,017,966	0.7%
Town of Morristown	4,413	$2,945,511,672	9	0.2%	$4,663,192	0.2%
Borough of Mount Arlington	2,333	$1,065,424,961	29	1.2%	$9,544,383	0.9%
Township of Mount Olive	9,115	$7,181,400,421	128	1.4%	$79,672,753	1.1%
Borough of Mountain Lakes	1,642	$1,183,405,498	0	0.0%	$0	0.0%
Netcong Borough	1,100	$695,081,980	1	0.1%	$182,743	0.0%
Township of Parsippany-Troy Hills	17,064	$11,747,551,200	499	2.9%	$162,369,226	1.4%
Township of Pequannock	5,642	$3,911,039,941	1,164	20.6%	$1,330,167,376	34.0%
Township of Randolph	8,600	$6,709,486,516	38	0.4%	$53,145,730	0.8%
Borough of Riverdale	1,183	$1,165,082,666	93	7.9%	$68,198,580	5.9%
Borough of Rockaway	2,617	$1,612,749,951	65	2.5%	$79,799,573	4.9%
Township of Rockaway	11,485	$7,225,058,745	79	0.7%	$78,355,686	1.1%
Township of Roxbury	9,544	$5,918,169,131	35	0.4%	$11,423,489	0.2%
Borough of Victory Gardens	339	$163,035,099	0	0.0%	$0	0.0%
Township of Washington	8,062	$5,265,032,309	107	1.3%	$54,505,470	1.0%
Borough of Wharton	2,051	$1,539,335,501	4	0.2%	$20,730,246	1.3%

Municipality	Total # Buildings	Total Replacement Cost Value (RCV)	Estimated Building Stock Exposed			
			Number of Buildings - 1% Annual Chance Flood	% of Total	RCV - 1% Annual Chance Flood	% of Total
Morris County (Total)	189,129	$127,068,881,137	5,461	2.9%	$4,784,109,892	3.8%

Table 34. Estimated General Building Stock Exposure to the 0.2% Annual Chance Flood Event - All Occupancies

Municipality	Total # Buildings	Total Replacement Cost Value (RCV)	Estimated Building Stock Exposed			
			Number of Buildings - 0.2% Annual Chance Flood	% of Total	RCV - 0.2% Annual Chance Flood	% of Total
Town of Boonton	3,262	$1,832,625,537	4	0.1%	$1,065,975	0.1%
Township of Boonton	1,898	$1,388,780,135	45	2.4%	$23,164,207	1.7%
Borough of Butler	2,701	$1,489,686,071	51	1.9%	$38,291,351	2.6%
Chatham Borough	3,286	$1,673,960,469	52	1.6%	$55,178,850	3.3%
Chatham Township	4,080	$2,300,237,613	29	0.7%	$8,704,383	0.4%
Chester Borough	853	$694,668,411	0	0.0%	$0	0.0%
Chester Township	3,680	$2,782,631,274	9	0.2%	$6,046,672	0.2%
Denville Township	7,198	$4,397,845,504	768	10.7%	$406,050,377	9.2%
Town of Dover	4,514	$2,640,787,978	683	15.1%	$486,552,090	18.4%
Township of East Hanover	4,848	$4,740,072,304	567	11.7%	$483,530,707	10.2%
Borough of Florham Park	3,805	$3,768,421,982	75	2.0%	$146,223,395	3.9%
Township of Hanover	7,090	$5,609,469,027	131	1.8%	$394,545,422	7.0%
Township of Harding	2,230	$1,808,255,972	102	4.6%	$60,821,975	3.4%
Township of Jefferson	9,625	$4,421,074,958	237	2.5%	$92,280,762	2.1%
Borough of Kinnelon	4,093	$2,858,766,250	0	0.0%	$0	0.0%
Borough of Lincoln Park	4,166	$2,125,371,898	1,128	27.1%	$865,769,279	40.7%
Township of Long Hill	3,643	$2,253,461,094	583	16.0%	$499,491,240	22.2%
Borough of Madison	6,301	$3,066,320,935	50	0.8%	$14,060,145	0.5%
Borough of Mendham	2,139	$1,479,178,043	9	0.4%	$5,001,978	0.3%
Township of Mendham	2,667	$2,099,041,883	34	1.3%	$15,169,183	0.7%
Township of Mine Hill	1,590	$766,971,485	1	0.1%	$905,738	0.1%
Township of Montville	8,179	$6,714,034,036	508	6.2%	$1,143,998,960	17.0%
Township of Morris	9,713	$6,091,077,654	71	0.7%	$34,605,149	0.6%
Borough of Morris Plains	2,378	$1,738,775,034	11	0.5%	$14,070,904	0.8%
Town of Morristown	4,413	$2,945,511,672	25	0.6%	$24,337,520	0.8%
Borough of Mount Arlington	2,333	$1,065,424,961	31	1.3%	$11,004,618	1.0%
Township of Mount Olive	9,115	$7,181,400,421	173	1.9%	$100,217,659	1.4%
Borough of Mountain Lakes	1,642	$1,183,405,498	0	0.0%	$0	0.0%
Netcong Borough	1,100	$695,081,980	1	0.1%	$182,743	0.0%
Township of Parsippany-Troy Hills	17,064	$11,747,551,200	1,080	6.3%	$593,481,076	5.1%
Township of Pequannock	5,642	$3,911,039,941	1,368	24.2%	$1,467,171,536	37.5%
Township of Randolph	8,600	$6,709,486,516	51	0.6%	$167,542,739	2.5%

Municipality	Total # Buildings	Total Replacement Cost Value (RCV)	Estimated Building Stock Exposed			
			Number of Buildings - 0.2% Annual Chance Flood	% of Total	RCV - 0.2% Annual Chance Flood	% of Total
Borough of Riverdale	1,183	$1,165,082,666	138	11.7%	$187,861,546	16.1%
Borough of Rockaway	2,617	$1,612,749,951	137	5.2%	$149,454,326	9.3%
Township of Rockaway	11,485	$7,225,058,745	118	1.0%	$152,354,654	2.1%
Township of Roxbury	9,544	$5,918,169,131	292	3.1%	$83,713,703	1.4%
Borough of Victory Gardens	339	$163,035,099	10	2.9%	$16,469,074	10.1%
Township of Washington	8,062	$5,265,032,309	145	1.8%	$84,069,690	1.6%
Borough of Wharton	2,051	$1,539,335,501	10	0.5%	$34,824,169	2.3%
Morris County (Total)	189,129	$127,068,881,137	8,727	4.6%	$7,868,213,791	6.2%

The National Flood Insurance Program (NFIP) is a federal insurance program that provides flood insurance to properties in communities participating in the program. Homes and businesses in high-risk flood areas with mortgages from government-backed lenders are required to have flood insurance. NFIP data was reviewed for the 2025 HMP update.

Table 35. NFIP Policies

Community Name and Number	Policies in Force	Total Coverage
Boonton, Town Of (340335)	6	$ 1,512,000
Boonton, Township Of (340336)	18	$ 6,600,000
Butler, Borough Of (340337)	29	$ 12,679,000
Chatham, Borough Of (340338)	39	$ 10,473,000
Chatham, Township Of (340504)	38	$ 11,147,000
Chester, Township Of (340555)	12	$ 3,192,000
Denville, Township Of (345292)	275	$ 76,354,000
Dover, Town Of (340340)	149	$ 41,764,000
East Hanover, Township Of (340341)	124	$ 36,272,000
Florham Park, Borough Of (340342)	83	$ 30,467,000
Hanover, Township Of (340343)	54	$ 23,197,000
Harding, Township Of (340344)	36	$ 12,259,000
Jefferson, Township Of (340522)	103	$ 29,083,000
Lincoln Park, Borough Of (345300)	396	$ 100,063,000
Long Hill, Township Of (340356)	138	$ 36,988,000
Madison, Borough Of (340347)	40	$ 11,152,000
Mendham, Borough Of (340540)	11	$ 3,850,000
Mendham, Township Of (340511)	21	$ 6,714,000
Mine Hill, Township Of (340556)	7	$ 2,310,000
Montville, Township Of (340349)	131	$ 45,733,000
Morris Plains, Borough Of (340351)	73	$ 19,372,000
Morris, Township Of (340350)	75	$ 25,172,000
Morristown, Town Of (340352)	31	$ 11,726,000

Community Name and Number	Policies in Force	Total Coverage
Mount Arlington, Borough Of (340541)	5	$ 1,526,000
Mount Olive, Township Of (340353)	53	$ 15,673,000
Parsippany-Troy Hills, Township Of (340355)	249	$ 73,048,000
Pequannock, Township Of (345311)	586	$ 145,428,000
Randolph, Township Of (340358)	68	$ 17,826,000
Riverdale, Borough Of (340359)	41	$ 12,658,000
Rockaway, Borough Of (345315)	26	$ 7,377,000
Rockaway, Township Of (340360)	46	$ 19,491,000
Roxbury, Township Of (340362)	56	$ 18,271,000
Washington, Township Of (340363)	49	$ 14,451,000
Wharton, Borough Of (340364)	4	$ 1,550,000

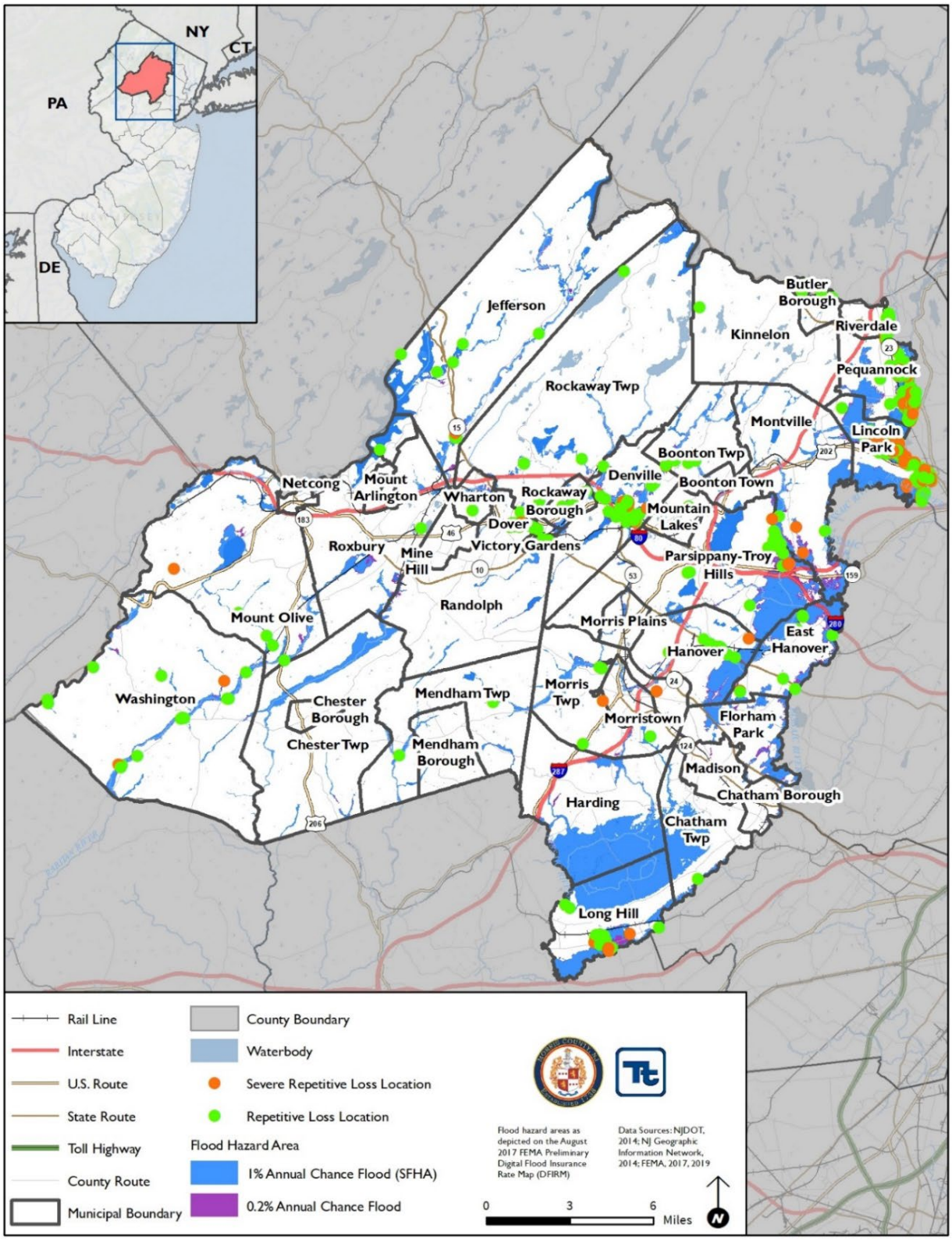
Source: FEMA

New Jersey ranks #2 nationally for repetitive flood losses. In Morris County, there are 4,450 flood-prone homes, 1,060 of which have a history of repetitive flooding loss. Hurricane Irene was the catalyst for the successful Flood Mitigation Program, a grant program that purchases flood-prone residential properties. After structures onsite are demolished, the land is permanently preserved. The Morris County Preservation Trust Fund funds the program.

3.8.8.3 REPETITIVE LOSS AND SEVERE REPETITIVE LOSS

NFIP data shows 886 repetitive loss and 293 severe repetitive loss properties located in Morris County. More information on repetitive loss properties specific to each jurisdiction is located in the jurisdictional annexes.

Figure 35. NFIP Repetitive Loss Properties in Morris County



Source: 2020 Morris County Hazard Mitigation Plan

3.8.8.4 IMPACT ON CRITICAL FACILITIES

Similar to the impacts on the general building stock, damage to critical facilities will vary for communities depending on the floodplain and proximity of critical facilities to flood sources.

3.8.8.5 IMPACT ON THE ECONOMY

Flood events can significantly impact the local and regional economy. This includes but is not limited to general building stock damages and associated tax loss, impacts to utilities and infrastructure, agricultural losses, business interruption, and effects on tourism. In areas that are directly flooded, renovations of commercial and industrial buildings may be necessary, disrupting associated services. Refer to the section earlier which discusses direct impacts to buildings in Morris County.

Flooding can cause extensive damage to public utilities and disruptions to delivery of services. Loss of power and communications may occur and drinking water and wastewater treatment facilities may be temporarily out of operation.

3.8.9 FUTURE CHANGES THAT MAY IMPACT VULNERABILITY

3.8.9.1 PROJECTED DEVELOPMENT

Any areas of growth could be potentially impacted by the flood hazard if located within the floodplain, there is insufficient stormwater drainage capacity present, and/or mitigation measures are not considered. It continues to be the intention of the County and all participating municipalities to discourage development in vulnerable areas or to encourage higher regulatory standards at the local level.

3.8.9.2 PROJECTED CHANGES IN POPULATION

The County has and is projected to continue experiencing population growth. In 2021, the NJ Transportation Planning Authority developed population forecasts for municipalities in New Jersey; this process included an estimate of 6.1% population growth in Morris County by 2050, with the county adding approximately 31,000 additional residents for a total projected population of 528,760 residents. Other projected trends include an aging population, decreased employment and shrinking household sizes. Projected changes in demographics and their location relative to hazard areas should be considered as Morris County identifies short and long-term mitigation measures.

3.8.9.3 CLIMATE CHANGE

Most studies project that the State of New Jersey will see an increase in average annual temperatures and precipitation. Annual precipitation amounts in the region are projected to increase, primarily in the form of heavy rainfalls, which have the potential to increase the risk to flash flooding, riverine flooding, and flood critical transportation corridors and infrastructure. Increases in precipitation may alter and expand the floodplain boundaries and runoff patterns, resulting in the exposure of populations, buildings, and critical facilities and infrastructure that were previously outside the floodplain. This increase in exposure would 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 future flooding events due to loss of service or access.

Existing dams may not be able to retain and manage increases in water flow from more frequent heavy rainfall events. Heavy rainfalls may result in more frequent overtopping of these dams and flooding of the County's assets

in adjacent inundation areas. However, the probable maximum flood used to design each dam may be able to accommodate changes in climate.

3.8.10 VULNERABILITY CHANGE SINCE THE 2020 HMP

Since DFIRMs and GIS data did not change, vulnerability remains consistent with the 2020 HMP.

3.9 GEOLOGICAL HAZARDS

3.9.1 2025 HMP CHANGES

- All subsections have been updated using best available data.
- Previous occurrences were updated with events that occurred between 2019 and 2023.

3.9.2 PROFILE

3.9.2.1 LANDSLIDES

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.

In New Jersey, there are four main types of landslides: slumps, debris flows, rockfalls, and rockslides. Slumps are coherent masses that move downslope by rotational slip on surfaces that underlie and penetrate the landslide deposit. A debris flow, also known as a mudslide, is a form of rapid mass movement in which loose soil, rock, organic matter, air, and water mobilize as slurry that flows downslope. Debris flows are often caused by intense surface water from heavy precipitation or rapid snow melt. This precipitation loosens surface matter, thus triggering the slide. Rockfalls are common on roadway cuts and steep cliffs. These landslides are abrupt movements of geological material such as rocks and boulders. Rockfalls happen when these materials become detached. Rockslides are the movement of newly detached segments of bedrock sliding on bedrock, joint, or fault surfaces.

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 or stockpiling of rock or ore, from waste piles or man-made structures may stress weak slopes to failure.

Landslides may be triggered by both natural and human-caused changes in the environment. 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.

3.9.2.2 SUBSIDENCE/SINKHOLES

Land subsidence can be defined as the sudden sinking or gradual downward settling of the earth's surface with little or no horizontal motion, owing to the subsurface movement of earth materials. Subsidence often occurs through the loss of subsurface support in karst terrain, which may result from a number of natural- and human-caused occurrences. Karst describes a distinctive topography that indicates dissolution of underlying carbonate rocks (limestone and dolomite) by surface water or groundwater over time. The dissolution process causes surface depressions and the development of sinkholes, sinking stream, enlarged bedrock fractures, caves, and underground streams.

Sinkholes are a common geologic feature in New Jersey, occurring naturally in areas with soluble rocks like limestone, carbonate rock, and salt beds. Over thousands of years, acidic rainwater dissolves the carbonate bedrock, creating larger openings through which water and soil materials travel. Eventually, the voids enlarge to the point where the roof can no longer support the land above, resulting in a sinkhole formation.

While some sinkholes are naturally occurring, others are anthropogenic in origin. Human activities that alter the water balance in an area, such as over-withdrawal of groundwater, diverting surface water to a single point, creating artificial surface water ponds, or drilling new water wells, can accelerate the process of soil void formation and lead to sinkhole development.

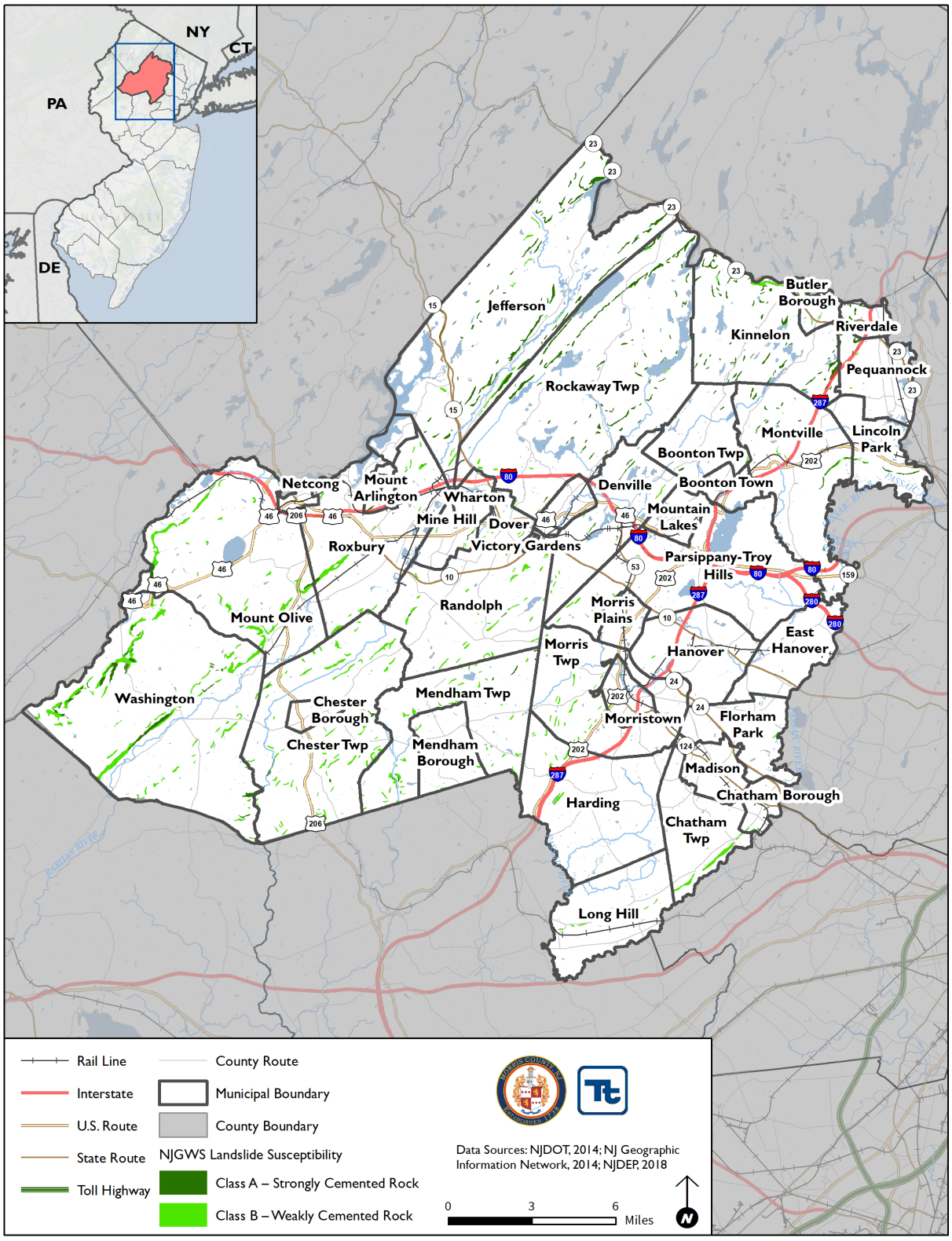
Both natural and man-made sinkholes can appear suddenly without warning. Specific signs include slumping or falling fence posts, trees, or foundations, the sudden formation of small ponds, wilting vegetation, discolored well water, and structural cracks in walls and floors. When sinkholes occur in developed areas, they can cause significant property damage, disruption of utilities, harm to roadways, injuries, and even loss of life.

3.9.3 LOCATION

3.9.3.1 LANDSLIDES

Landslides are common in New Jersey, primarily in the northern region of the State. Figure 36 shows landslide susceptibility in Morris County. An exposure analysis found that 11.6 square miles of Morris County is susceptible to landslides. There are just under 5 square miles located in the Class A landslide susceptible area and 6.9 square miles in the Class B landslide susceptible area.

Figure 36. Landslide Susceptibility in Morris County

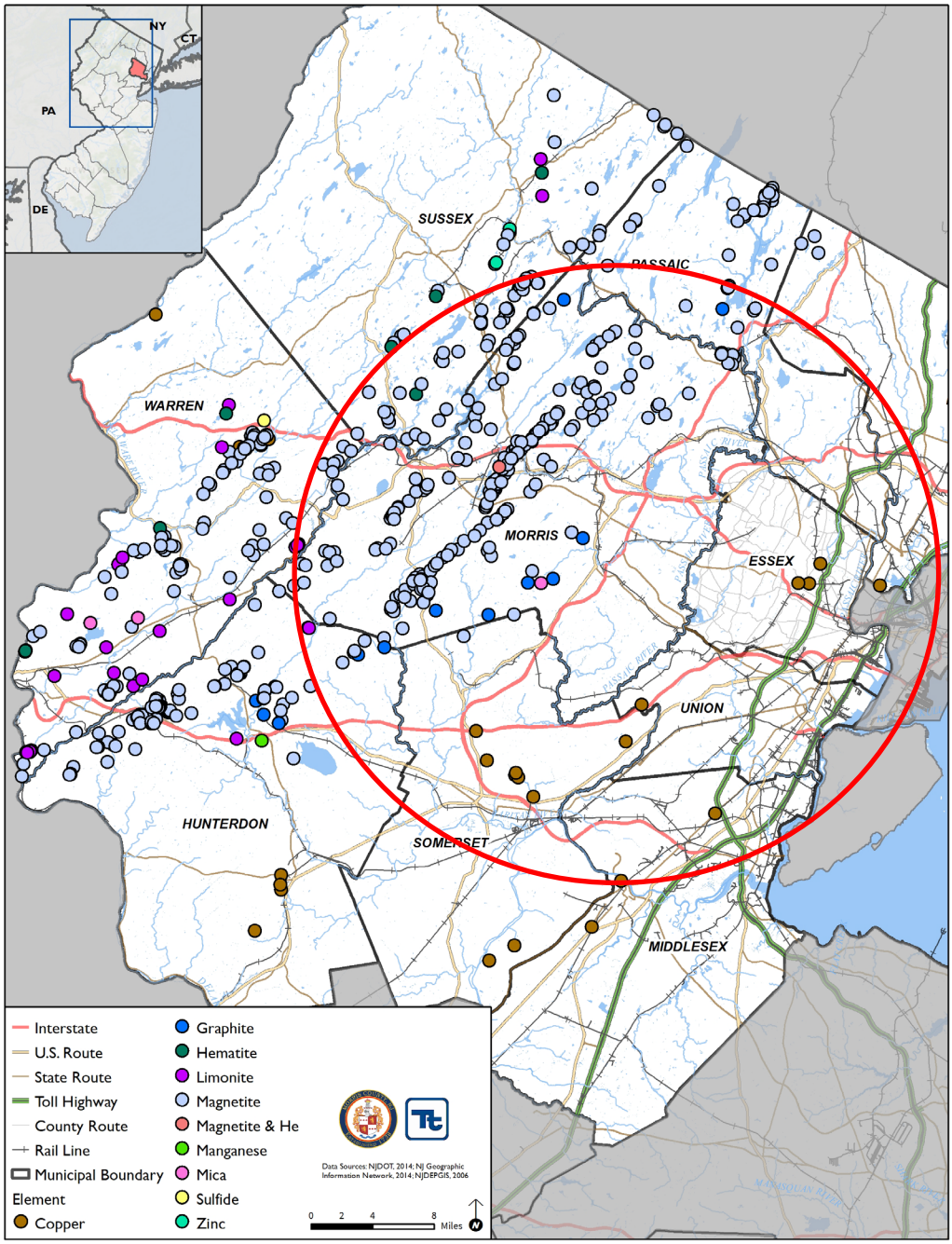


Source: 2020 Morris County Hazard Mitigation Plan

1.1.1.1 SUBSIDENCE/SINKHOLES

Figure 37 shows the location of the mapped abandoned mines in New Jersey. The data from NJGWS and the figure indicate that Morris County has more than 100 abandoned mines. Most of the mines in Morris County were magnetite mines with several mica and graphite mines. Abandoned mines are largely located in the northwestern half of the County.

Figure 37. Abandoned Mines in New Jersey



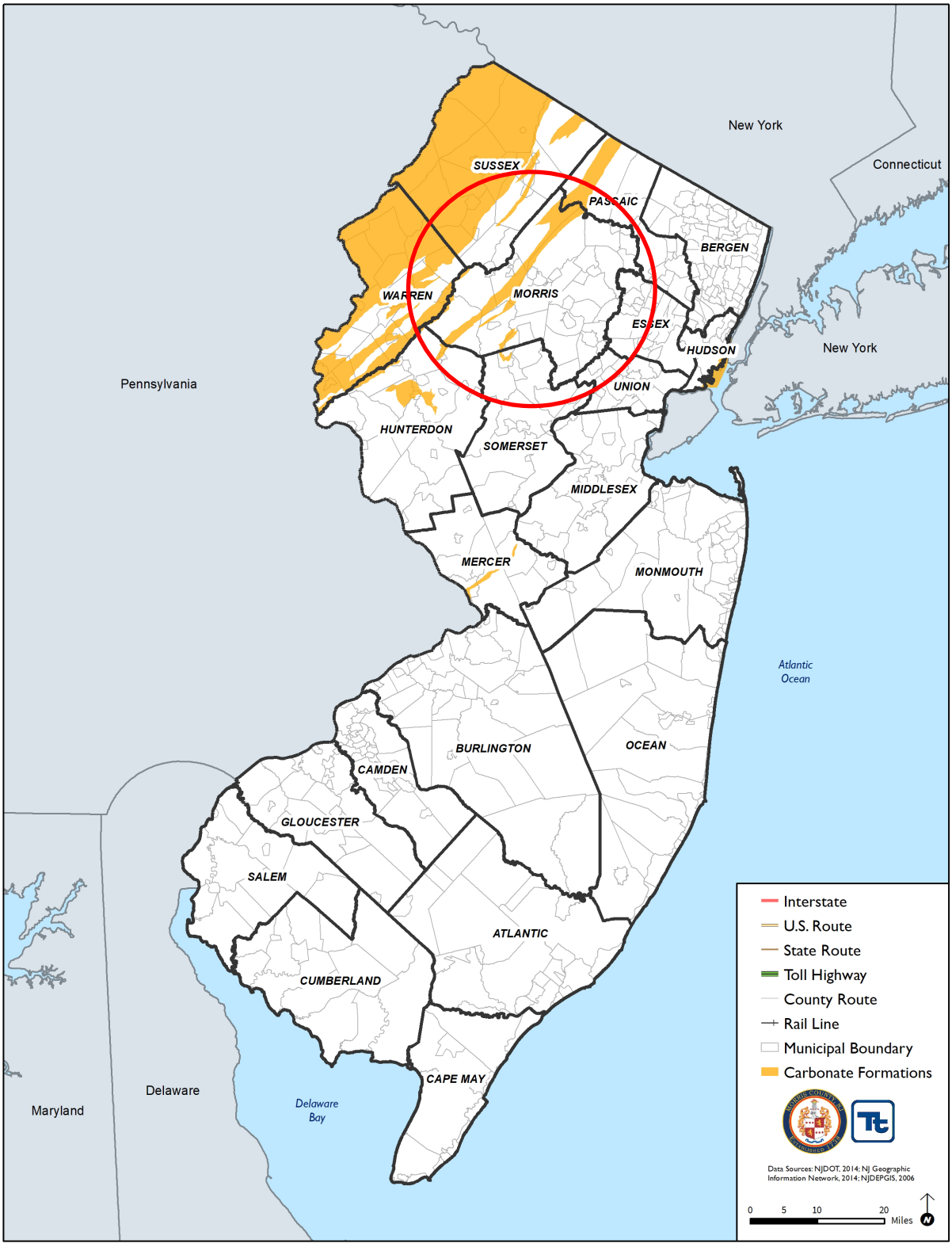
Source: *2020 Morris County Hazard Mitigation Plan*

Note: *The red circle indicates the location of Morris County.*

Naturally occurring subsidence and sinkholes in New Jersey occur within bands of carbonate bedrock. In northern New Jersey, there are more than 225 square miles that are underlain by limestone, dolomite, and marble. No collapsed sinkholes have been identified; however, there are some features which could be either very shallow solution depressions or wind blowout features. Sinkholes in New Jersey are generally concentrated in the northwestern part of the State.

Figure 38 illustrates the locations of carbonate-bearing geologic formations of New Jersey. Morris County contains carbonate rock formations in a narrow area running from the southwest to the northeast in the western portion of the County. The municipalities containing carbonate rock formations are Township of Jefferson, Rockaway Township, Township of Roxbury, Township of Mount Olive, Township of Washington, and Chester Township.

Figure 38. Carbonate Rock Regions of New Jersey



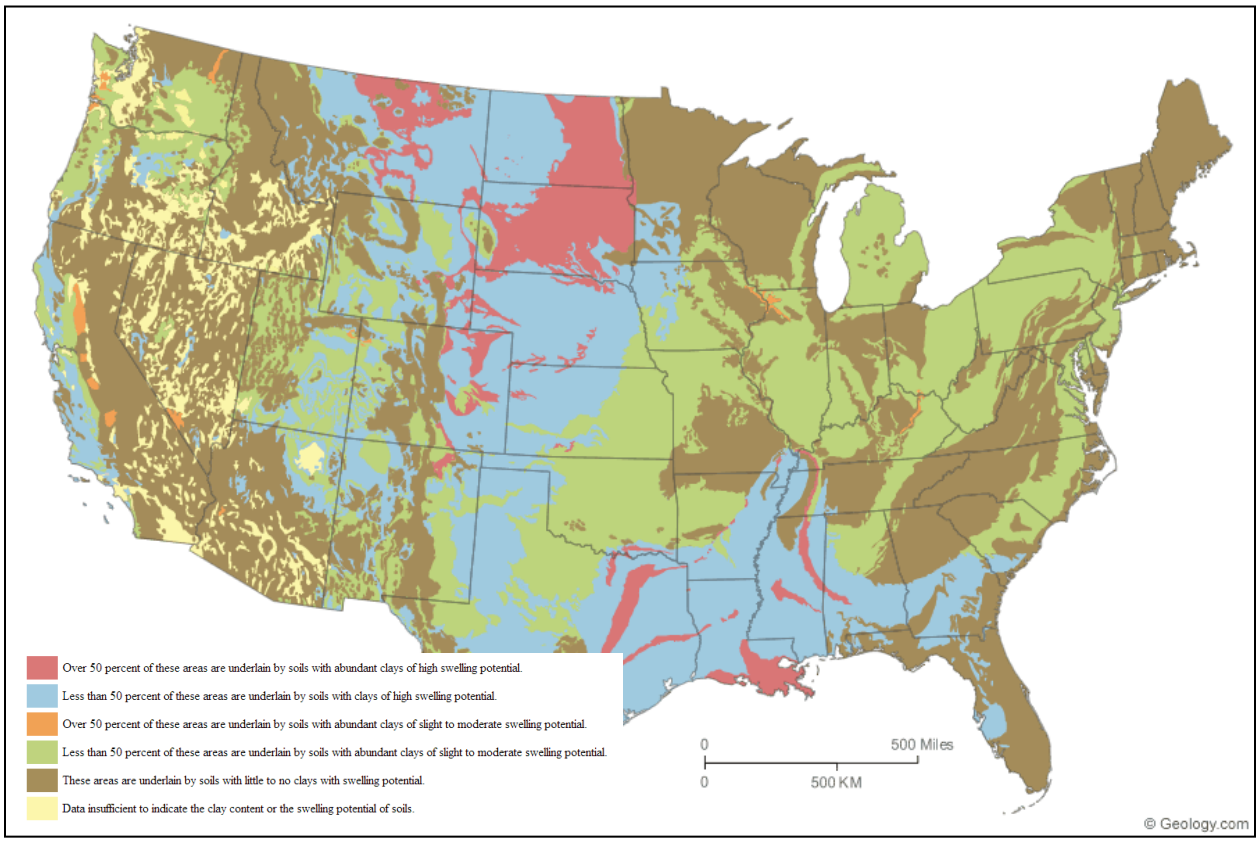
Source: *2020 Morris County Hazard Mitigation Plan*
Note: *The red circle indicates the location of Morris County.*

Leaking water pipes or structures that convey stormwater runoff may also result in areas of subsidence as the water dissolves substantial amounts of rock over time. In some cases, construction, land grading, or earthmoving activities that cause changes in stormwater flow can trigger sinkhole events. Subsidence or sinkhole events may occur in the presence of mining activity, especially in areas where the cover of a mine is thin, even in areas where bedrock is not necessarily conducive to their formation.

3.9.3.2 EXPANSIVE SOILS

Portions of New Jersey are underlain by soils with little to no clays with swelling potential. Morris County is mainly underlain by areas with little to no clays with swelling potential with some areas of less than 50 percent of the area underlain by soils with abundant clays of slight to moderate swelling potential located in the eastern portions of the County.

Figure 39. Expansive Soils of the United States



Source: Geology.com

3.9.4 EXTENT

3.9.4.1 LANDSLIDE

To determine the extent of a landslide hazard, the affected areas need to be identified and the probability of the landslide occurring within some time period needs to be assessed. Natural variables that contribute to the overall extent of potential landslide activity in any particular area include soil properties, topographic position and slope, and historical incidence. Predicting a landslide is difficult, even under ideal conditions and with reliable

information. As a result, the landslide hazard is often represented by landslide incidence and/or susceptibility, as defined below:

- Landslide incidence is the number of landslides that have occurred in a given geographic area. High incidence means greater than 15% of a given area has been involved in sliding; medium incidence means that 1.5 to 15% of an area has been involved; and low incidence means that less than 1.5% of an area has been involved.
- Landslide susceptibility is defined as the probable degree of response of geologic formations to natural or artificial cutting, to loading of slopes, or to unusually high precipitation. It can be assumed that unusually high precipitation or changes in existing conditions can initiate landslide movement in areas where rocks and soils have experienced 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 sliding.

3.9.4.2 SUBSIDENCE/SINKHOLES

Subsidence and sinkholes can occur gradually or suddenly due to natural processes, like karst sinkholes in areas with soluble bedrock, or as a result of human activities. In the U.S., subsidence has directly impacted over 17,000 square miles in 45 states, with estimated annual costs of about $125 million. The primary causes of subsidence include aquifer-system compaction, organic soil drainage, underground mining, hydrocompaction, natural compaction, sinkholes, and thawing permafrost.

Various methods are used to measure land subsidence. One commonly employed technique is the Global Positioning System (GPS), which monitors subsidence on a regional scale. Geodetic stations, spaced approximately four miles apart, serve as benchmarks for this monitoring.

Another increasingly popular method is Interferometric Synthetic Aperture Radar (InSAR), a remote sensing technique using radar signals to track changes in land surface elevation. InSAR offers a cost-effective solution for measuring land surface deformation with high spatial detail and resolution for a particular region.

3.9.4.3 EXPANSIVE SOILS

The plasticity index (PI) is expressed as the numerical difference between the plastic limit (the percent moisture content at which clay passes from the solid to the plastic state) and the liquid limit (the percent moisture content at which clay passes from the plastic to liquid state). The PI bears a direct relation to the amount and type of clay minerals present and to the orientation and size of clay particles. Other factors remain constant, the PI increases with amount of clay minerals, decreases with degree of parallel orientation of the clay minerals, and decreases with clay particle size.

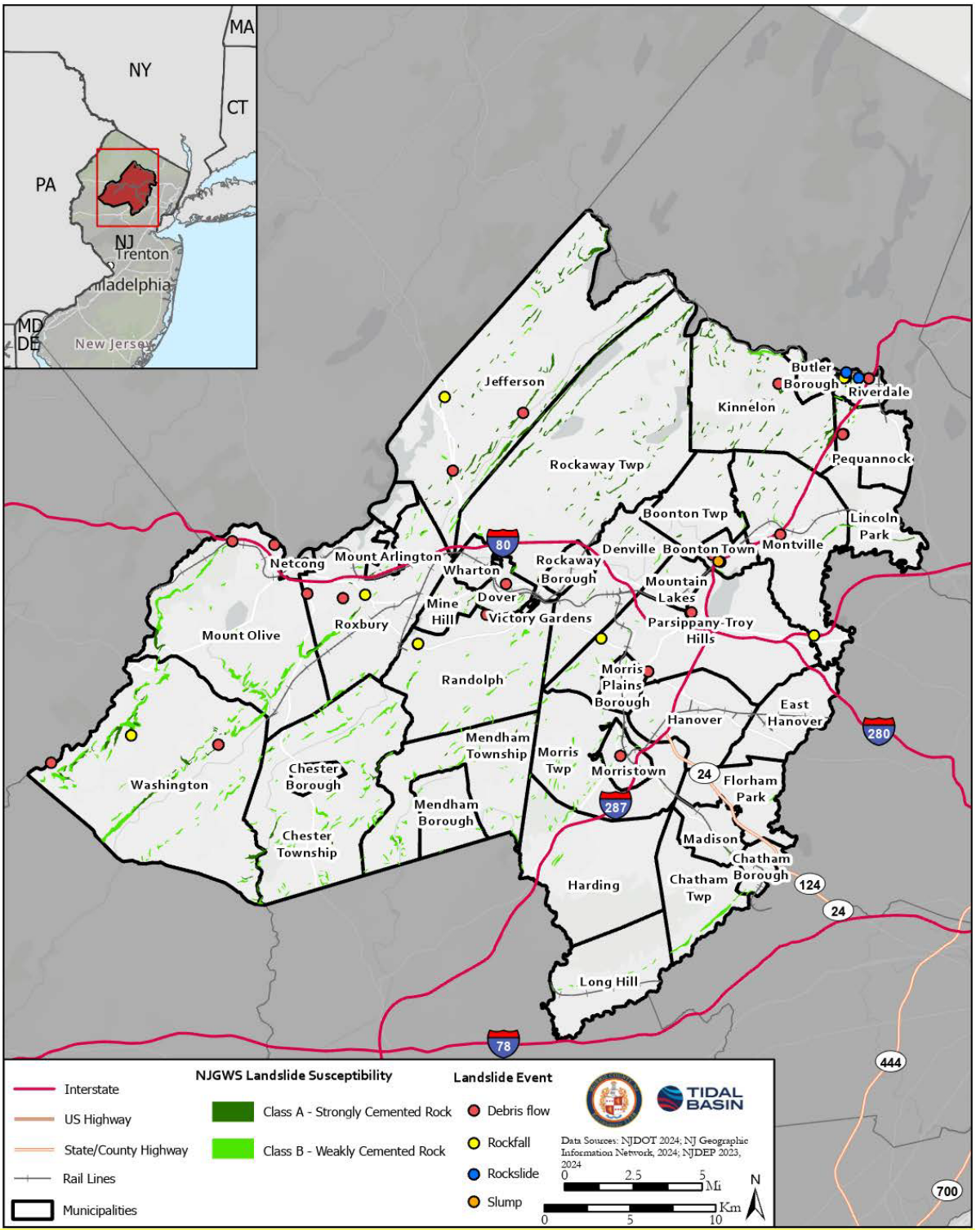
The PI is generally a good indicator of swelling potential. Scientists have found the PI to be one of the most useful indicators of swelling potential. Expansive soils can be recognized either by visual inspection in the field or by conducting laboratory analyses.

3.9.5 PREVIOUS OCCURRENCES

Between 1954 and 2024, FEMA issued one disaster (DR) or emergency (EM) declaration for the State of New Jersey for one geological hazard-related event, classified as a mudslide. Morris County was included in this declaration. DR-1337 was declared for severe storms, flooding, and mudslides which took place from August 12-21, 2000.

Figure 40 illustrates historic events landslide events in Morris County. This dataset is dated from 1782 to 2018 and does not reflect more recent events. According to the NJ State HMP and other databases researched, there are no recent geological hazard events that have impacted Morris County. Smaller scale geologic events may not be documented in databases available for this HMP update.

Figure 40. Landslide Susceptibility Areas and Historic Landslide Incidents



A sinkhole formed on Interstate 80 near Wharton on December 26, 2024. The incident was caused by the collapse of an abandoned mine shaft. As of the writing of this plan, cleanup is still underway, with repairs expected to be completed in March 2025.

3.9.6 PROBABILITY

Based upon risk factors for and past occurrences, it is likely that geological hazards will occur in Morris County in the future, though it's also highly likely that widespread, direct impacts will be rare. It is estimated that Morris County will continue to experience direct and indirect impacts of geological hazards and its impacts on occasion, with the secondary effects causing potential disruption or damage to communities (i.e., roads, infrastructure, buildings). While

3.9.7 CLIMATE CHANGE IMPACTS

Future climate change may impact storm patterns, increasing the probability of more frequent, intense storms with varying duration, which in turn can exacerbate conditions necessary for landslides and subsidence. Increases in global temperature could affect the snowpack and its ability to hold and store water. Warming temperatures also could increase the occurrence and duration of droughts, which could increase the probability of wildfire, reducing the vegetation that helps to support steep slopes.

As the climate changes and temperatures increase, soils have the potential to dry out, resulting in expansive soils shrinking and failing. This could lead to a big problem in residential areas where buildings have shallow foundations; the soils will be unable to support the weights of a building. When expansive soils get dry, they begin to repel moisture instead of soaking it up. The water is more likely to run off, creating flash floods.

3.9.8 VULNERABILITY ASSESSMENT

3.9.8.1 IMPACT TO LIFE, HEALTH, AND SAFETY

Generally, a landslide or subsidence event would be an isolated incidence and impact the populations within the immediate area of the incident. Specifically, the population located downslope of identified landslide hazard areas are particularly vulnerable to this hazard. In addition to causing damages to residential buildings and displacing residents, landslides and subsidence events can impact major roadways and inhibit travel for emergency responders or populations trying to evacuate the area.

Table 36 summarizes the population located in Class A, Class B landslide susceptible areas, and carbonate rock susceptible to natural subsidence/sinkholes. The Town of Morristown has the greatest number of persons living in the landslide susceptible Class A area (50 people which is less than 1% of the Town's total population). The Township of Washington has the greatest number of persons living in the landslide susceptible Class B area (262 people or 1.4% of the Township's total population), and the Township of Roxbury has the great number of persons residing in structures built on carbonate rock (7,328 people or 31.2-percent of the Township's total population).

Table 36. Estimated Population Located in the Geologic Hazard Area

Municipality	American Community Survey (2013-2017) Population	Class A Landslide Susceptibility Area	Percent (%) Total	Class B Landslide Susceptibility Area	Percent (%) Total	Carbonate Rock	Percent (%) of Total
Town of Boonton	8,390	0	0.0%	44	0.5%	0	0.0%
Township of Boonton	4,353	0	0.0%	36	0.8%	0	0.0%
Borough of Butler	7,780	0	0.0%	6	0.1%	0	0.0%
Chatham Borough	9,003	0	0.0%	32	0.4%	0	0.0%

Municipality	American Community Survey (2013-2017) Population	Class A Landslide Susceptibility Area	Percent (%) Total	Class B Landslide Susceptibility Area	Percent (%) Total	Carbonate Rock	Percent (%) of Total
Chatham Township	10,507	0	0.0%	240	2.3%	0	0.0%
Chester Borough	1,540	0	0.0%	0	0.0%	0	0.0%
Chester Township	7,931	3	0.0%	65	0.8%	538	6.8%
Denville Township	16,822	18	0.1%	65	0.4%	0	0.0%
Town of Dover	18,307	0	0.0%	62	0.3%	0	0.0%
Township of East Hanover	11,241	0	0.0%	0	0.0%	0	0.0%
Borough of Florham Park	11,792	0	0.0%	68	0.6%	0	0.0%
Township of Hanover	14,436	0	0.0%	0	0.0%	0	0.0%
Township of Harding	3,887	0	0.0%	95	2.4%	0	0.0%
Township of Jefferson	21,440	26	0.1%	35	0.2%	1,013	4.7%
Borough of Kinnelon	10,242	63	0.6%	3	0.0%	0	0.0%
Borough of Lincoln Park	10,464	101	1.0%	0	0.0%	0	0.0%
Township of Long Hill	8,763	0	0.0%	154	1.8%	0	0.0%
Borough of Madison	16,080	0	0.0%	0	0.0%	0	0.0%
Borough of Mendham	4,992	0	0.0%	14	0.3%	3	0.1%
Township of Mendham	5,877	13	0.2%	80	1.4%	311	5.3%
Township of Mine Hill	3,609	0	0.0%	0	0.0%	545	15.1%
Township of Montville	21,739	68	0.3%	13	0.1%	0	0.0%
Township of Morris	22,498	0	0.0%	94	0.4%	0	0.0%
Borough of Morris Plains	5,605	0	0.0%	0	0.0%	0	0.0%
Town of Morristown	18,833	150	0.8%	60	0.3%	0	0.0%
Borough of Mount Arlington	5,405	0	0.0%	0	0.0%	0	0.0%
Township of Mount Olive	29,010	0	0.0%	212	0.7%	6,446	22.2%
Borough of Mountain Lakes	4,309	0	0.0%	0	0.0%	0	0.0%
Netcong Borough	3,245	0	0.0%	0	0.0%	0	0.0%
Township of Parsippany-Troy Hills	53,444	0	0.0%	39	0.1%	0	0.0%
Township of Pequannock	15,499	0	0.0%	20	0.1%	0	0.0%
Township of Randolph	25,918	3	0.0%	178	0.7%	325	1.3%
Borough of Riverdale	4,238	13	0.3%	0	0.0%	1,261	29.7%

Municipality	American Community Survey (2013-2017) Population	Class A Landslide Susceptibility Area	Percent (%) Total	Class B Landslide Susceptibility Area	Percent (%) Total	Carbonate Rock	Percent (%) of Total
Borough of Rockaway	6,473	0	0.0%	0	0.0%	0	0.0%
Township of Rockaway	24,758	13	0.1%	26	0.1%	86	0.3%
Township of Roxbury	23,458	7	0.0%	19	0.1%	7,328	31.2%
Borough of Victory Gardens	1,655	0	0.0%	0	0.0%	0	0.0%
Township of Washington	18,713	14	0.1%	262	1.4%	3,664	19.6%
Borough of Wharton	6,591	0	0.0%	0	0.0%	0	0.0%
Morris County (Total)	**498,847**	**491**	**0.1%**	**1,920**	**0.4%**	**21,519**	**4.3%**

Sources: *American Community Survey 5-year Estimate, 2017; NJGWS, 2015*
Note: *Class A includes classes AII, AIV, AVI which is strongly cemented rock at varying slope angles. Class B includes classes BIII, BIV, BV, and BVI which includes weakly cemented rock and soil at varying slope angles.*
NJGWS New Jersey Geological Water Survey

Socially vulnerable populations (e.g., the elderly and low-income populations) are particularly vulnerable to a hazard event. Within Class A areas, there are approximately 72 people over the age of 65 and 24 people below the poverty level. As for populations within Class B areas, there are approximately 283 people over the age 65 and 80 people considered low-income populations.

3.9.8.2 IMPACT ON GENERAL BUILDING STOCK

In general, the built environment located in the high landslide susceptibility area and the population, structures and infrastructure located downslope are vulnerable to this hazard. Landslides also have the potential of destabilizing the foundation of structures, which may result in monetary losses to businesses and residents. There are 189,129 buildings with a replacement cost value of $127 billion located in these landslide hazard areas countywide. The Borough of Lincoln Park has the greatest number of buildings located in Class A areas with 34 buildings (less than 1% of the Borough's total number of buildings) with an estimated replacement cost of $11.8 million, while the Township of Washington has the greatest number of buildings located in Class B areas with 110 buildings (1.4% of the Township's total) with an estimated replacement cost of $56 million. Table 37 summarizes the exposed building stock located in Class A and Class B landslide susceptibility areas by municipality.

Table 37. Number of Failing Buildings in the Class A and Class B Landslide Hazard Area by Municipality

Municipality	Total # of Buildings	Total Replacement Cost Value (RCV)	Class A				Class B			
			Number of Buildings - Class A	% of Total	RCV - Class A	% of Total	Number of Buildings - Class B	% of Total	RCV - Class B	% of Total
Town of Boonton	3,262	$1,832,625,537	0	0.0%	$0	0.0%	16	0.5%	$6,219,298	0.3%
Township of Boonton	1,898	$1,388,780,135	0	0.0%	$0	0.0%	14	0.7%	$4,669,558	0.3%
Borough of Butler	2,701	$1,489,686,071	0	0.0%	$0	0.0%	2	0.1%	$935,998	0.1%

Municipality	Total # of Buildings	Total Replacement Cost Value (RCV)	Class A				Class B			
			Number of Buildings - Class A	% of Total	RCV - Class A	% of Total	Number of Buildings - Class B	% of Total	RCV - Class B	% of Total
Chatham Borough	3,286	$1,673,960,469	0	0.0%	$0	0.0%	11	0.3%	$6,678,513	0.4%
Chatham Township	4,080	$2,300,237,613	0	0.0%	$0	0.0%	78	1.9%	$63,220,964	2.7%
Chester Borough	853	$694,668,411	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%
Chester Township	3,680	$2,782,631,274	1	0.0%	$853,072	0.0%	30	0.8%	$16,388,570	0.6%
Denville Township	7,198	$4,397,845,504	7	0.1%	$2,101,954	0.0%	21	0.3%	$14,975,859	0.3%
Town of Dover	4,514	$2,640,787,978	0	0.0%	$0	0.0%	14	0.3%	$5,262,947	0.2%
Township of East Hanover	4,848	$4,740,072,304	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%
Borough of Florham Park	3,805	$3,768,421,982	0	0.0%	$0	0.0%	17	0.4%	$14,433,510	0.4%
Township of Hanover	7,090	$5,609,469,027	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%
Township of Harding	2,230	$1,808,255,972	0	0.0%	$0	0.0%	43	1.9%	$21,314,927	1.2%
Township of Jefferson	9,625	$4,421,074,958	14	0.1%	$4,334,836	0.1%	14	0.1%	$4,512,106	0.1%
Borough of Kinnelon	4,093	$2,858,766,250	27	0.7%	$20,831,575	0.7%	1	0.0%	$1,410,001	0.0%
Borough of Lincoln Park	4,166	$2,125,371,898	34	0.8%	$11,871,322	0.6%	0	0.0%	$0	0.0%
Township of Long Hill	3,643	$2,253,461,094	0	0.0%	$0	0.0%	54	1.5%	$25,652,702	1.1%
Borough of Madison	6,301	$3,066,320,935	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%
Borough of Mendham	2,139	$1,479,178,043	0	0.0%	$0	0.0%	5	0.2%	$5,985,022	0.4%
Township of Mendham	2,667	$2,099,041,883	5	0.2%	$2,050,578	0.1%	34	1.3%	$33,243,377	1.6%
Township of Mine Hill	1,590	$766,971,485	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%
Township of Montville	8,179	$6,714,034,036	25	0.3%	$12,859,883	0.2%	5	0.1%	$3,434,347	0.1%
Township of Morris	9,713	$6,091,077,654	0	0.0%	$0	0.0%	36	0.4%	$26,562,465	0.4%
Borough of Morris Plains	2,378	$1,738,775,034	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%
Town of Morristown	4,413	$2,945,511,672	25	0.6%	$7,711,229	0.3%	14	0.3%	$22,927,023	0.8%
Borough of Mount Arlington	2,333	$1,065,424,961	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%
Township of Mount Olive	9,115	$7,181,400,421	0	0.0%	$0	0.0%	60	0.7%	$37,536,480	0.5%
Borough of Mountain Lakes	1,642	$1,183,405,498	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%

Municipality	Total # of Buildings	Total Replacement Cost Value (RCV)	Class A				Class B			
			Number of Buildings - Class A	% of Total	RCV - Class A	% of Total	Number of Buildings - Class B	% of Total	RCV - Class B	% of Total
Netcong Borough	1,100	$695,081,980	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%
Township of Parsippany-Troy Hills	17,064	$11,747,551,200	0	0.0%	$0	0.0%	10	0.1%	$3,955,495	0.0%
Township of Pequannock	5,642	$3,911,039,941	0	0.0%	$0	0.0%	6	0.1%	$1,715,180	0.0%
Township of Randolph	8,600	$6,709,486,516	1	0.0%	$1,034,098	0.0%	58	0.7%	$33,162,659	0.5%
Borough of Riverdale	1,183	$1,165,082,666	3	0.3%	$1,321,762	0.1%	1	0.1%	$1,087,914	0.1%
Borough of Rockaway	2,617	$1,612,749,951	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%
Township of Rockaway	11,485	$7,225,058,745	9	0.1%	$3,891,595	0.1%	10	0.1%	$4,214,865	0.1%
Township of Roxbury	9,544	$5,918,169,131	2	0.0%	$1,494,182	0.0%	9	0.1%	$5,665,590	0.1%
Borough of Victory Gardens	339	$163,035,099	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%
Township of Washington	8,062	$5,265,032,309	7	0.1%	$4,539,320	0.1%	110	1.4%	$56,195,921	1.1%
Borough of Wharton	2,051	$1,539,335,501	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%
Morris County (Total)	**189,129**	**$127,068,881,137**	**160**	**0.1%**	**$74,895,407**	**0.1%**	**673**	**0.4%**	**$421,361,291**	**0.3%**

Sources: Morris County 2019; Microsoft, 2018, Open Street Map, 2019; NJOIT, 2018; NJGWS, 2015

Note: NJGWS New Jersey Geological Water Survey
RCV Replacement Cost Value
Class A includes classes AI, AII, AIV, AVI which is strongly cemented rock at varying slope angles. Class B includes classes BIII, BIV, and BV which includes weakly cemented rock and soil at varying slope angles.

Table 38 summarizes the building stock constructed on carbonate rock by municipality and potentially susceptible to natural subsidence/sinkholes. In total, there are 9,382 buildings are located on carbonate rock countywide. This is equal to approximately $7.8 billion of the total replacement costs for buildings in Morris County. The Township of Roxbury has the greatest number of buildings constructed on carbonate rock (39.1% of the Township's total number of buildings) with an estimated replacement cost of approximately $2.6 billion.

Table 38. Number of Buildings on Carbonate Rock by Municipality

Municipality	Total Number of Buildings	Total Replacement Cost Value (RCV)	Carbonate Rock			
			Number of Buildings - Carbonate	% of Total	RCV - Carbonate	% of Total
Town of Boonton	3,262	$1,832,625,537	0	0.0%	$0	0.0%
Township of Boonton	1,898	$1,388,780,135	0	0.0%	$0	0.0%
Borough of Butler	2,701	$1,489,686,071	0	0.0%	$0	0.0%
Chatham Borough	3,286	$1,673,960,469	0	0.0%	$0	0.0%

Municipality	Total Number of Buildings	Total Replacement Cost Value (RCV)	Carbonate Rock			
			Number of Buildings - Carbonate	% of Total	RCV - Carbonate	% of Total
Chatham Township	4,080	$2,300,237,613	0	0.0%	$0	0.0%
Chester Borough	853	$694,668,411	0	0.0%	$0	0.0%
Chester Township	3,680	$2,782,631,274	266	7.2%	$238,625,868	8.6%
Denville Township	7,198	$4,397,845,504	0	0.0%	$0	0.0%
Town of Dover	4,514	$2,640,787,978	0	0.0%	$0	0.0%
Township of East Hanover	4,848	$4,740,072,304	0	0.0%	$0	0.0%
Borough of Florham Park	3,805	$3,768,421,982	0	0.0%	$0	0.0%
Township of Hanover	7,090	$5,609,469,027	0	0.0%	$0	0.0%
Township of Harding	2,230	$1,808,255,972	0	0.0%	$0	0.0%
Township of Jefferson	9,625	$4,421,074,958	410	4.3%	$173,839,550	3.9%
Borough of Kinnelon	4,093	$2,858,766,250	0	0.0%	$0	0.0%
Borough of Lincoln Park	4,166	$2,125,371,898	0	0.0%	$0	0.0%
Township of Long Hill	3,643	$2,253,461,094	0	0.0%	$0	0.0%
Borough of Madison	6,301	$3,066,320,935	0	0.0%	$0	0.0%
Borough of Mendham	2,139	$1,479,178,043	7	0.3%	$1,846,877	0.1%
Township of Mendham	2,667	$2,099,041,883	163	6.1%	$146,701,758	7.0%
Township of Mine Hill	1,590	$766,971,485	228	14.3%	$67,867,046	8.8%
Township of Montville	8,179	$6,714,034,036	0	0.0%	$0	0.0%
Township of Morris	9,713	$6,091,077,654	0	0.0%	$0	0.0%
Borough of Morris Plains	2,378	$1,738,775,034	0	0.0%	$0	0.0%
Town of Morristown	4,413	$2,945,511,672	0	0.0%	$0	0.0%
Borough of Mount Arlington	2,333	$1,065,424,961	0	0.0%	$0	0.0%
Township of Mount Olive	9,115	$7,181,400,421	1,962	21.5%	$1,848,104,162	25.7%
Borough of Mountain Lakes	1,642	$1,183,405,498	0	0.0%	$0	0.0%
Netcong Borough	1,100	$695,081,980	0	0.0%	$0	0.0%
Township of Parsippany-Troy Hills	17,064	$11,747,551,200	0	0.0%	$0	0.0%
Township of Pequannock	5,642	$3,911,039,941	0	0.0%	$0	0.0%
Township of Randolph	8,600	$6,709,486,516	145	1.7%	$431,935,389	6.4%

Municipality	Total Number of Buildings	Total Replacement Cost Value (RCV)	Carbonate Rock			
			Number of Buildings - Carbonate	% of Total	RCV - Carbonate	% of Total
Borough of Riverdale	1,183	$1,165,082,666	330	27.9%	$171,719,149	14.7%
Borough of Rockaway	2,617	$1,612,749,951	0	0.0%	$0	0.0%
Township of Rockaway	11,485	$7,225,058,745	231	2.0%	$577,508,792	8.0%
Township of Roxbury	9,544	$5,918,169,131	3,730	39.1%	$2,579,739,945	43.6%
Borough of Victory Gardens	339	$163,035,099	0	0.0%	$0	0.0%
Township of Washington	8,062	$5,265,032,309	1,910	23.7%	$1,550,901,735	29.5%
Borough of Wharton	2,051	$1,539,335,501	0	0.0%	$0	0.0%
Morris County (Total)	**189,129**	**$127,068,881,137**	**9,382**	**5.0%**	**$7,788,790,272**	**6.1%**

Sources: Morris County 2019; Microsoft, 2018, Open Street Map, 2019; NJOIT, 2018; NJGWS, 1999

Note: NJGWS New Jersey Geological Water Survey
RCV Replacement Cost Value

3.9.8.3 IMPACT ON CRITICAL FACILITIES

The spatial analysis shows that there are three critical facilities located in the identified landslide susceptibility hazard areas in the County. Two of these critical facilities are dams and one is a wastewater facility. In addition to critical facilities, a significant amount of infrastructure can be exposed to mass movements of geological material:

- Roads—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, causing isolation for neighborhoods, traffic problems, and delays for public and private transportation. This can result in economic losses for businesses.
- Bridges—Landslides can significantly impact road bridges. Mass movements can knock out bridge abutments or significantly weaken the soil supporting them, making them hazardous for use.
- Power Lines—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.
- Rail Lines – 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 Philadelphia and New York City, and a landslide event could prevent travel to and from work.

An exposure analysis was completed to assess the number of miles that major highways intersect the geologic hazard areas. The analysis found that 3.2 miles of highway, 3.4 miles of highway, and 13.2 miles of highway are constructed on landslide susceptible soils Classes A and Class B, and carbonate rock (natural subsidence/sinkhole), respectively. This includes the following major roadways: I-80, US 46, US 206, NJ 10, NJ 23, NJ 15, I-287, and US 202.

3.9.8.4 IMPACT ON THE ECONOMY

Geologic hazards can impose direct and indirect impacts on society. Direct costs include the actual damage sustained by buildings, property and infrastructure. Indirect costs, such as clean-up costs, business interruption, loss of tax revenues, reduced property values, and loss of productivity are difficult to measure. Additionally, ground failure threatens transportation corridors, fuel and energy conduits, and communication lines. Estimated potential damages to general building stock can be quantified as discussed above.

3.9.8.5 IMPACT ON THE ENVIRONMENT

A landslide or sinkhole/subsidence event will alter the landscape. In addition to changes in topography, vegetation and wildlife habitats may be damaged or destroyed, and soil and sediment runoff will accumulate downslope potentially blocking waterways and roadways and impacting quality of streams and other water bodies. Additional environmental impacts include loss of forest productivity.

Furthermore, soil and sediment runoff can accumulate downslope potentially blocking waterways and roadways and impacting quality of streams and other water bodies. Mudflows that erode into downstream waterways can threaten the life of freshwater and/or coastal species. The impacts of eroded landscape can travel for miles downstream into adjacent waterways and create issues for surrounding watersheds.

A majority of the County is not susceptible to landslides, however there are small areas throughout the County that are susceptible to landslide events (Class AI, AII, AIV, AVI, BIII, BIV, and BV). An exposure analysis found that 46.6 square miles of Morris County is susceptible to the geologic hazard (4.7 square miles located in the Class A landslide susceptibility area; 6.9 square miles located in the Class B landslide susceptibility area, and 35.0 square miles located over carbonate rock and potentially susceptible to natural subsidence/sinkholes).

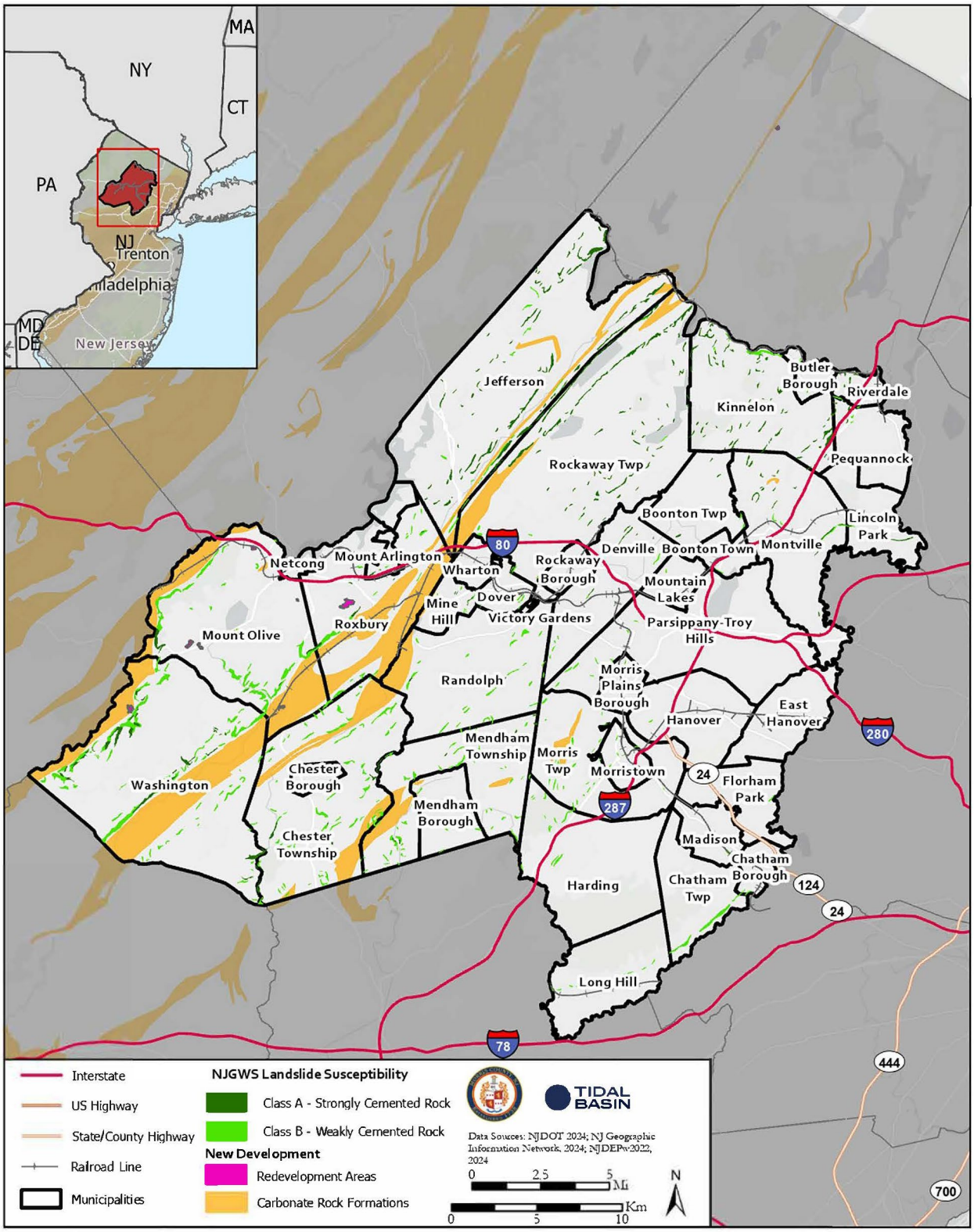
3.9.9 FUTURE CHANGES THAT MAY IMPACT VULNERABILITY

3.9.9.1 PROJECTED DEVELOPMENT

Any areas of growth could be potentially impacted by the geologic hazard if located within the identified hazard areas or downslope. In general, development of slopes is not recommended due to the increased risk of erosion, stormwater runoff and flooding potential. The additional runoff results in sedimentation of down slope surface waters, which damages habitat and has the potential to damage property. The sloping land increases the rate of runoff, which reduces the rate of groundwater infiltration.

Each municipality identified areas of recent development and proposed development in their community. Developments that could be located using an address or Parcel ID were geocoded and overlain with the landslide hazard areas to determine vulnerability to flooding. Four proposed new development locations may be susceptible to the landslide. Figure 41 illustrates the proposed new development and the geologic hazard areas.

Figure 41. Potential New Development and Landslide Hazard Areas



3.9.9.2 PROJECTED CHANGES IN POPULATION

Morris County has been experiencing and is projected to continue experiencing a growth in population. As discussed above, several major roadways through the County are exposed to the geologic hazard, and an increasing population in the County and surrounding areas that utilize these roadways will result in a greater number of people exposed on a daily basis.

3.9.9.3 CLIMATE CHANGE

Climate change may increase the likelihood of landslides. Warming temperatures resulting in wildfires would reduce vegetative cover along steep slopes and destabilize the soils due to destruction of the root system; increased intensity of rainfall events would increase saturation of soils on steep slopes. Under these future conditions, the County's assets located on or at the base of these steep slopes will have an increased risk to landslides. Roadways and other transportation infrastructure located in these areas will also be at an increased risk of closure, which would impact the County's risk as described above.

Higher temperatures and the possibility of more intense, less frequent summer rainfall may lead to changes in water resource availability. The projection in the increase of average temperatures may lead to an increase in the frequency of droughts. Sinkhole activity intensifies in some karst areas increases during periods of drought. With an increase in drought periods, the number of sinkholes can increase. Additionally, changes to the water balance of an area including over-withdrawal of groundwater, diverting surface water from a large area and concentrating it in a single point, artificially creating ponds of surface water, and drilling new water wells will cause sinkholes. These actions can also serve to accelerate the natural processes of bedrock degradation, which can have a direct impact on sinkhole creation.

3.9.10 VULNERABILITY CHANGE SINCE THE 2020 HMP

The entire County continues to be vulnerable to the geological hazard. Overall, the hazard area delineations remained unchanged, so any signification increase in vulnerability would be attributed to population growth and new development.

3.10 HAZARDOUS MATERIALS

3.10.1 2025 HMP CHANGES

- All subsections have been updated using best available data.
- Previous events between 2019 and 2023 were researched.

3.10.2 PROFILE

Hazardous substances are materials that are considered severely harmful to human health and the environment, as defined by the United States Environmental Protection Agency (USEPA) Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (Superfund Law). Many are commonly used substances which are harmless in their normal uses but are 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 the circumstances of their release. Superfund's definition of a hazardous substance includes the following:

- 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. There are over 400 substances designated as either hazardous or toxic under 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, as amended. There are over 200 substances listed as hazardous air pollutants under the Clean Air Act (CAA).
- Any imminently hazardous chemical substance or mixture which the EPA Administrator has "taken action under" section 7 of the Toxic Substances Control Act.

If released or misused, hazardous substances can cause death, serious injury, long-lasting health effects, and damage to structures and other properties, as well as the environment. Many products containing hazardous substances are used and stored in homes and these products are shipped daily on highways, railroads, waterways, and pipelines.

Transportation of hazardous substances on highways involves tanker trucks or trailers, which are responsible for the greatest number of hazard substance release incidents. New Jersey is composed of approximately 39,000 miles of federal, state, and local roadways, many of which are used to transport hazardous substances. These roads cross rivers and streams at many points; hazardous substance spills on roads have the potential to pollute watersheds that serve as domestic water supplies for parts of the state. Potential also exists for hazardous substance releases to occur along rail lines as collisions and derailments of train cars can result in large spills.

Pipelines can also transport hazardous liquids and flammable substances such as natural gas and petroleum. Incidents can occur when pipes corrode, when they are damaged during excavation, incorrectly operated, or damaged by other forces. In New Jersey, most of the large pipeline leaks have been caused by marine traffic hitting or the anchors of ships effecting pipelines in the waterways. In addition, hazardous substances can be transported by aircraft or by watercraft. Crashes, spills of materials, and fires on these vessels can pose a hazard.

3.10.3 LOCATION

The following provides information regarding the location of hazardous substance incidents.

3.10.3.1 FIXED SITES

Years ago, numerous wastes were dumped on the ground, in rivers, or left out in the open. As a result, thousands of uncontrolled or abandoned contaminated sites were created. These sites included abandoned warehouses, manufacturing facilities, processing plants, and landfills. In response to concerns regarding health and environmental risks, Congress established the Superfund program in 1980 to clean up these sites. The Superfund program is administered by the USEPA in cooperation with individual states.

In New Jersey, the Department of Environmental Protection (NJDEP) Site Remediation Program oversees the Superfund program. With 115 hazardous waste sites as of May 2023, New Jersey has more Superfund sites than any other state. An estimated 50% of New Jersey's population lives within three miles of a Superfund site. Morris County is home to 11 Superfund sites.

Table 39. Superfund Sites in Morris County

Superfund Site	Location
Rolling Knolls	Green Village
Dayco Corp Le Carpenter	Wharton Borough
Rockaway Borough Well Field	Rockaway Township

Superfund Site	Location
Radiation Technology, Inc.	Rockaway Township
Picatinny arsenal U.S. Army	Dover
Rockaway Township Wells	Rockaway Township
Sharkey Landfill	Parsippany
Dover Municipal Well 4	Dover
Combe Fill South Landfill	Chester Township
Combe Fill North Landfill	Mount Olive Township
Pepe Field	Boonton

Source: Superfund

Fixed-site facilities that use, manufacture, or store hazardous substances in New Jersey pose a risk and must comply with Title III of the federal SARA, which is linked to N.J.S.A. 34:5A, the New Jersey Worker and Community Right to Know Act. SARA requires the governor of each state to establish a State Emergency Response Commission (SERC), which was established in New Jersey in 1987. SARA also requires that emergency planning districts be established by the SERC. The Act specified that these districts can be existing political subdivisions. The function of the emergency planning district is to facilitate preparation and implementation of emergency plans. In New Jersey, all municipalities and counties have been designated emergency planning districts (total of 585). The Local Emergency Planning Committees (LEPC) is the policy body for the emergency planning district.

The State enacted the Toxic Catastrophe Prevention Act (TCPA), N.J.S.A. 13:1K-19 et seq. Currently, implementation of the requirements established under this Act is facilitated by the TCPA Program. Certain industrial facilities using materials considered extraordinarily hazardous must take steps to prevent releases and protect public safety. New Jersey has also mandated that facilities storing large quantities of hazardous substances take preventative measures to reduce the likelihood of a leak or discharge. Established under the New Jersey Spill Compensation and Control Act (N.J.S.A. 58:10-23.11), these requirements include testing and inspection of storage tanks, training of employees, and emergency response planning. The Discharge Prevention Containment and Countermeasure (DPCC) program facilitates implementing these requirements. Regulations related to reporting of chemical and petroleum discharges are also administered under this program.

The Community Right to Know (CRTK) program collects, processes, and disseminates the chemical inventory, environmental release and materials accounting data required to be reported under the New Jersey Worker and Community Right to Know Act, N.J.S.A.34:5A and the federal Emergency Planning and Community Right to Know Act of 1986 (EPCRA). EPCRA is also known as Title III of the SARA. This information is used by the public, emergency planners, and first responders to determine the chemical hazards in the community.

The U.S. EPA Biennial Hazardous Waste Report collects data on the generation, management, and minimization of hazardous waste. This report provides detailed data on generating hazardous waste from large-quantity generators and data on waste management practices from treatment, storage, and disposal facilities. This report lists 46 facilities in Morris County.

New Jersey employers with specific North American Industry Classification System (NAICS) codes must submit CRTK surveys listing environmental hazardous substances (EHSs) exceeding 500 pounds. Federal facilities and private sector facilities under OSHA's Hazard Communication Standard must report chemical inventories over 10,000 pounds unless it's an Extremely Hazardous Substance with a lower reporting threshold.

The NJDEP maintains a list of Known Contaminated Sites of New Jersey (KCSNJ), which is an inventory that includes all sites in the State where contamination is known to exist. The remediation for these sites is active or pending in the NJDEP's Site Remediation Program (SRP). There are 607 KCSNJ sites in Morris County, an increase of almost 100 sites since 2017. Facilities are listed by jurisdiction in Table 40.

Table 40. KCSNJ Sites in Morris County

Jurisdiction	Number of Sites	Jurisdiction	Number of Sites
Boonton	24	Mine Hill Township	6
Boonton Township	5	Montville Township	26
Butler Borough	11	Morris Plains Borough	6
Chatham Borough	14	Morristown Township	40
Chatham Township	9	Morris Township	19
Chester Borough	6	Mountain Lakes Borough	6
Chester Township	8	Mount Arlington Borough	1
Denville Township	24	Mount Olive Township	14
Dover Township	35	Netcong Borough	10
East Hanover Township	32	Parsippany-Troy Hills	41
Florham Park Borough	14	Pequannock Township	10
Hanover Township	54	Randolph Township	18
Harding Township	2	Riverdale Borough	5
Jefferson Township	17	Rockaway Borough	21
Kinnelon Borough	5	Rockaway Township	22
Lincoln Park Borough	5	Roxbury Township	39
Long Hill Township	14	Washington Township	10
Madison Borough	16	Wharton Borough	11
Mendham Borough	3		
Mendham Township	4		

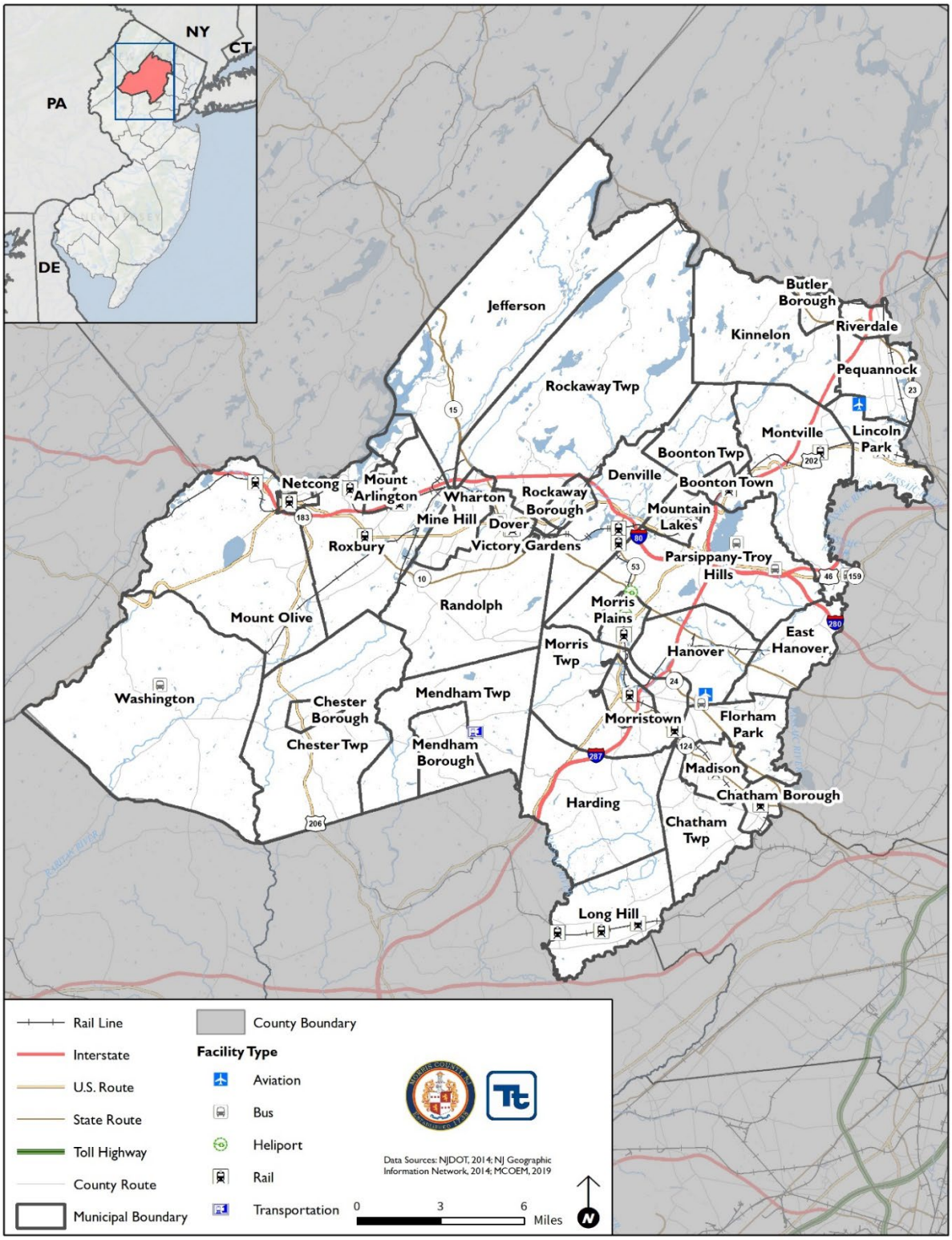
Source: NJDEP

3.10.3.2 SUBSTANCES IN TRANSIT

Incidents involving hazardous substances in transit can occur anywhere in Morris County. Major highways in the County over which hazardous materials are transported daily include Interstates 80, 280 and 287; U.S. Highways 46, 202, and 206; and State Highways 10, 23, and 53. Figure 41 shows the major transportation routes in the County.

Hazardous substances incidents may also occur along railways in Morris County. The NJDOT has a vital interest in preserving and improving the rail freight part of its transportation network. Rail shipments allow cost-effective movement of goods with less stress on the State's highway system. Major commodities shipped by rail entail petrochemicals, construction materials, food products, raw materials, and finished goods for manufacturers. Of concern for this hazard are rail cars carrying hazardous substances. An accident or release could pose a public safety hazard to the community.

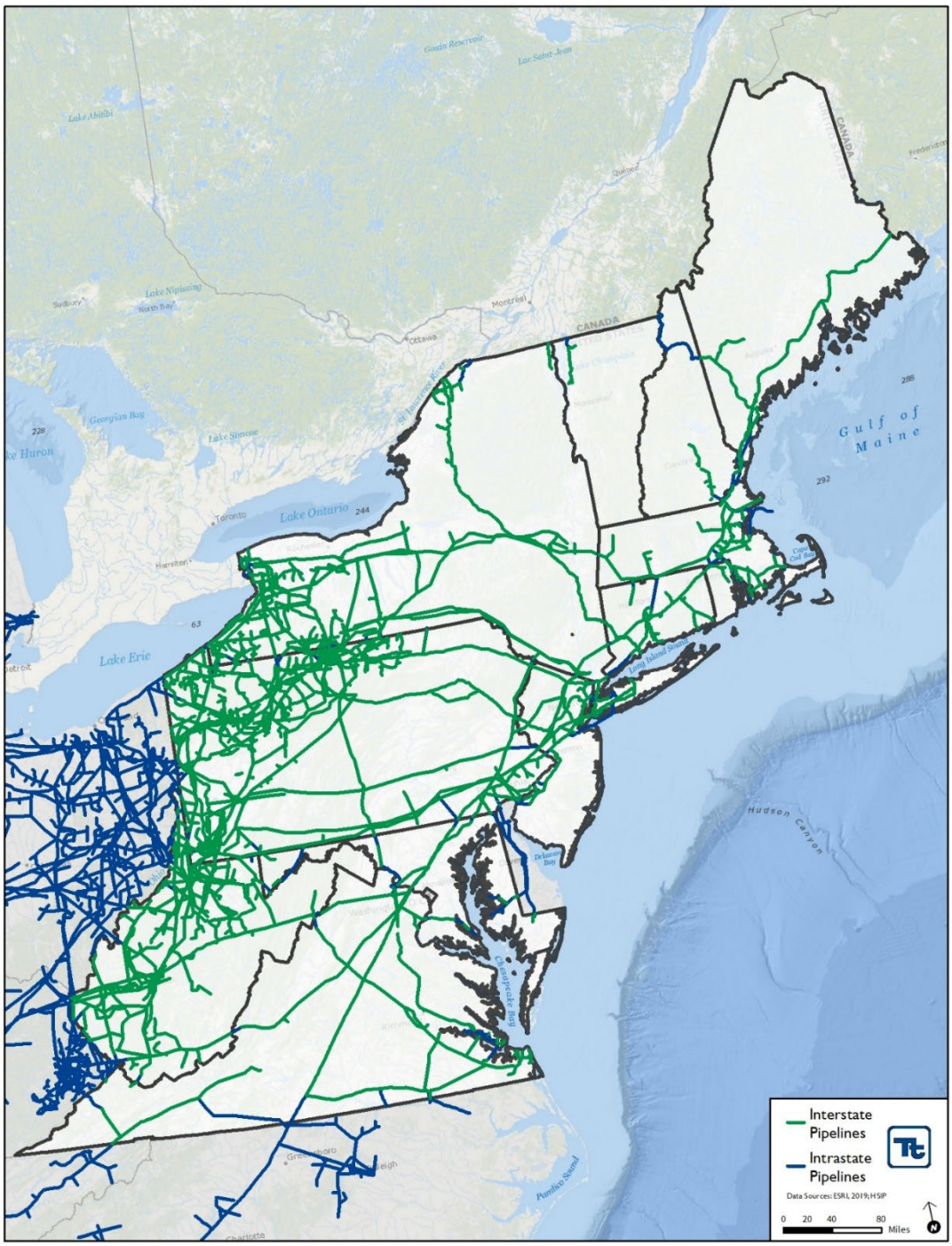
Figure 42. Major Transportation Routes in Morris County



Source: Morris County 2020 HMP

Hazardous substances can also be transported via pipeline across the State. New Jersey has an extensive network of natural gas and petroleum pipelines. Several of the petroleum pipelines originate in the Gulf Coast region (Colonial Pipeline and Buckeye Pipeline). Figure 43 shows the extent and locations of pipelines throughout the northeastern United States.

Figure 43. Interstate National Gas Pipelines in the Northeast



Source: Morris County HMP 2020

3.10.4 EXTENT

The extent of a hazardous substance release will depend on whether it is from a fixed or mobile source, the size of impact, the toxicity and properties of the substance, duration of the release, and the environmental conditions (for example, wind and precipitation, terrain, etc.).

Hazardous substance releases can contaminate air, water, and soils. Dispersion can take place 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. When caused by natural hazards, these incidents are known as secondary events. Hazardous substances can include toxic chemicals, radioactive substances, infectious substances, and hazardous wastes. Such releases can affect nearby populations and contaminate critical or sensitive environmental areas.

With a hazardous substance release, whether accidental or intentional, several potentially exacerbating or mitigating circumstances will affect its severity or impact. Mitigating conditions are precautionary measures taken in advance to reduce the impact of a release on the surrounding environment. Primary and secondary containment or shielding by sheltering-in-place measures 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:

- Weather conditions, which affect how the hazard occurs and develops
- Micro-meteorological effects of buildings and terrain, which alters dispersion of hazardous substances on-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

3.10.5 PREVIOUS OCCURRENCES

Many sources provided historical information regarding previous occurrences and losses associated with hazardous substance incidents throughout the State of New Jersey and Morris County. With so many sources reviewed for the purpose of this HMP, loss and impact information for many events could vary depending on the source. Therefore, the accuracy of monetary figures discussed is based only on the available information identified during research for this HMP.

Between 1954 and 2024, the State of New Jersey was not included in any FEMA declared disasters (DR) or emergencies (EM) related to hazardous substances incidents. According to the U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration, between 2020 and 2023, there have been 56 highway accidents involving hazardous material in the County. Between 2020 and 2023, the County had a total of over 165,000 gallons of chemical released on-site and 100,000 gallons released off-site.

3.10.6 PROBABILITY

Predicting future hazardous substance incidents in Morris County is difficult. Incidents can be sudden without any warning or slowly develop. Small spills, both fixed site and in-transit, occur throughout the year and the probability for these events are high. The risk of major incidents in a given year is rare.

3.10.7 CLIMATE CHANGE IMPACTS

Hazardous substance incidents are non-natural incidents; therefore, there are no implications for impacts from climate change.

3.10.8 VULNERABILITY ASSESSMENT

3.10.8.1 IMPACT TO LIFE, HEALTH AND SAFETY

Depending on the type and quantity of chemicals released and the weather conditions, an incident can affect larger areas that cross jurisdictional boundaries. When hazardous substances are released in 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 hazardous substances release through inhalation, ingestion or dermal exposure. Exposure may be either acute or chronic, depending upon the nature of the substance and extent of release and contamination.

3.10.8.2 IMPACT ON GENERAL BUILDING STOCK

Potential losses to the general building stock caused by a hazardous substance release is difficult to quantify. The degree of damages 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. The closure of waterways, railroads, airports and highways as a result of a hazardous substance 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.

3.10.8.3 IMPACT ON CRITICAL FACILITIES

Potential losses to critical facilities caused by a hazardous substance release are difficult to quantify. Potential losses may include inaccessibility, loss of service, contamination and/or potential structural and content losses if an explosion occurs.

3.10.8.4 IMPACT ON THE ECONOMY

If a significant hazardous substances incident occurred, not only would life, safety, and building stock be at risk, but the economy of Morris County would be affected as well. A significant incident in an urban area may force businesses to close for an extended period of time because on contamination or direct damage caused by an explosion, if one occurred. The exact impact on the economy is difficult to determine, given the uncertain nature of the size and scope of incidents.

Hazardous substance release incidents have the potential to lead to major transportation route closures in Morris County. If an incident occurred that would require one of the State's major highways to close, the impact on the economy could be significant. Given the scope and importance of New Jersey's transportation routes to the greater northeastern United States, the vulnerability of New Jersey's economy is significant.

3.10.9 FUTURE CHANGES THAT MAY IMPACT VULNERABILITY

3.10.9.1 PROJECTED DEVELOPMENT AND POPULATION

Projected changes in population and development could impact the avenues of how hazardous substances are spread. Areas that are more congested or built up near major transportation routes may be more vulnerable to impacts from hazardous substances because the hazardous wastes are carried along these routes.

3.10.9.2 CLIMATE CHANGE

As temperatures change, excessive heat on containers that contain hazardous materials may alter the material properties. In addition, hazardous substances stored at fixed locations in the floodplain may experience an increase in flood events due to the project changes in increased precipitation events; magnitude and frequency.

3.10.10 VULNERABILITY CHANGE SINCE THE 2020 HMP

Overall, the county's vulnerability has not changed, and the entire county will continue to be exposed and vulnerable to hazardous substance releases.

3.11 SEVERE WEATHER

3.11.1 2025 HMP CHANGES

2025 HMP Changes

- All subsections have been updated using best available data.
- Previous occurrences were updated with events that occurred between 2019 and 2023.

3.11.2 PROFILE

The severe weather hazard includes hurricanes, tropical storms, thunderstorms, lightning, hailstorms, windstorms, and tornadoes.

3.11.2.1 HURRICANES AND TROPICAL STORMS

A tropical cyclone is characterized by a low-pressure center and numerous thunderstorms that produce strong winds, storm surge flooding, and heavy rains that can lead to inland flooding, tornadoes, and rip currents. Tropical depressions, tropical storms, and hurricanes are all considered tropical cyclones. Tropical cyclones strengthen when water evaporated from the ocean is released as the saturated air rises, resulting in condensation of water vapor contained in the moist air. Almost all tropical storms and hurricanes in the Atlantic basin, which includes the Gulf of Mexico and Caribbean Sea, form between June 1 and November 30 (hurricane season), although they can appear at any time.

The National Weather Service (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. The following are the definitions of the watches and warnings:

A *Hurricane Warning* is issued when sustained winds of 74 mph or higher are expected somewhere within the specified area in association with a tropical, subtropical, or post-tropical cyclone. Because hurricane preparedness activities become difficult once winds reach tropical storm force, the warning is issued 36 hours in advance of the anticipated onset of tropical storm force winds. The warning can remain in effect when dangerously high water or combination of dangerously high water and waves continue, even though winds may be less than hurricane force.

A *Hurricane Watch* is issued when sustained winds of 74 mph or higher are possible within the specified area in association with a tropical, subtropical, or post-tropical cyclone. Because hurricane preparedness activities become difficult once winds reach tropical storm force, the hurricane watch is issued 48 hours prior to the anticipated onset of tropical storm force winds.

A *Tropical Storm Warning* is issued when sustained winds of 39 to 73 mph are expected somewhere within the specified area within 36 hours in association with a tropical, subtropical, or post-tropical storm.

A *Tropical Storm Watch* is issued when sustained winds of 39 to 73 mph are possible within the specified area within 48 hours in association with a tropical, sub-tropical, or post-tropical storm (NWS 2013a).

3.11.2.2 THUNDERSTORMS

A thunderstorm is a rain-bearing cloud that also produces lightning (NWS). All thunderstorms are dangerous.

Thunderstorms can lead to landslides, strong winds, tornadoes, hail, lightning, and flash flooding. Flash flooding is responsible for more fatalities – more than 140 annually – than any other thunderstorm-associated hazard. Roads may become impassable from flooding, downed trees or power lines, or a landslide. Downed power lines can lead to loss of utility services, such as water, phone, and electricity. During the summer, thunderstorms are responsible for most of the rainfall.

3.11.2.3 LIGHTNING

Lightning is a bright flash of electrical energy produced by a thunderstorm. All thunderstorms produce lightning and are very dangerous. Lightning ranks as one of the top weather killers in the U.S., where an average of 300 people are injured and 80 are killed each year. Lightning can occur anywhere there is a thunderstorm, often strikes outside the heavy rain in a thunderstorm, and may occur as far as 10 miles away from any rainfall.

3.11.2.4 HAILSTORMS

Hail forms inside a thunderstorm or other storms with 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 degrees Fahrenheit (°F) or colder. As the frozen droplet begins to fall, it may thaw as it moves into warmer air toward the bottom of the thunderstorm. However, the droplet may be picked up again by another updraft and carried back into the cold air and refreeze. 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. Most hail is small and typically less than two inches in diameter.

3.11.2.5 WINDSTORMS

Wind begins with differences in air pressures and occurs through rough horizontal movement of air caused by uneven heating of the earth's surface. Wind occurs at all scales, from local breezes lasting a few minutes to global winds resulting from solar heating of the earth. High winds are often associated with other severe weather events such as thunderstorms, tornadoes, nor'easters, hurricanes, and tropical storms.

3.11.2.6 TORNADOES

A tornado appears as a rotating, funnel-shaped cloud that extends from a thunderstorm to the ground with whirling winds that can reach 250 miles per hour (mph). Damage paths can be greater than one mile wide and 50 miles long. Tornadoes develop from either a severe thunderstorm or hurricane as cool air rapidly overrides a layer of warm air. Tornadoes move at speeds between 30 and 125 mph and can generate combined wind speeds (forward motion and speed of the whirling winds) exceeding 300 mph. Tornadoes can last from several seconds to more than an hour. They are most common in the spring and summer but can occur on any day of the year.

3.11.3 LOCATION

All of Morris County is exposed to the severe weather described in this section.

3.11.4 EXTENT

Different weather patterns related to severe weather have different rating scales.

Hailstones are sized every half inch in diameter and compared to an object of corresponding size. The smallest hailstones are less that .5 inches in diameter and are compared to the size of a pea. The largest hailstones are 10 inches in diameter and are compared to the size of a melon. The most substantial hailstorm documented by NCEI for Morris County took place in the northwestern region, featuring hailstones with a diameter of 2.75 inches, equivalent to the size of a walnut.

Wind is measured against a few different scales, including the Saffir-Simpson wind scale and the Beaufort wind scale. The highest wind gust recorded by the NCEI in Morris County occurred on May 20, 1963 registering at a speed of 80.6 mph.

Hurricanes are categorized using the Saffir-Simpson Wind Scale based only on a hurricane's maximum sustained wind speed. While all hurricanes produce life-threatening winds, hurricanes rated Category 3 and higher are known as major hurricanes The scale does not consider other potentially impactful hazards such as storm surge, rainfall flooding, and tornadoes. Table 41 shows hurricane categorization.

Table 41. Hurricane Categorization

Category	Wind Speed (Saffir Simpson)	Damage Description
1	74-95 mph	Very dangerous winds will produce some damage: downed trees, roof damage
2	96-110 mph	Extremely dangerous winds will cause extensive damage
3	111-129 mph	Devastating damage will occur
4	130-156 mph	Catastrophic damage will occur
5	Over 157 mph	Catastrophic damage will occur

Source: National Weather Service

Tornadoes are ranked on the Enhanced Fujita Scale or EF Scale is used to assign a tornado a 'rating' based on estimated wind speeds and related damage as shown in Table 42.

Table 42. Enhanced Fujita (EF) Scale

EF-scale	Class	Wind Speed (mph)	Description
EF-0	Weak	65-85	Gale
EF-1	Weak	86-110	Moderate
EF-2	Strong	111-135	Significant
EF-3	Strong	136-165	Severe
EF-4	Violent	166-200	Devastating
EF-5	Violent	>200	Incredible

Source: National Weather Service

1.1.2 PREVIOUS OCCURRENCES

Between 1954 and 2024, Morris County has been included in 17 declarations for severe storm-related events classified as one or a combination of the following disaster types: severe storm, straight-line winds, tornado, or hurricane. Table 43 lists these events.

Table 43. Severe Storm-Related FEMA Disaster Declarations

Declaration	Event Date	Declaration Date	Event Description
DR-1145	October 18-23, 1996	November 19, 1996	Severe Storms & Flooding
EM-3148	September 16-18, 1999	September 17, 1999	Hurricane: Hurricane Floyd Emergency Declarations
DR-1295	September 16-18, 1999	September 18, 1999	Hurricane: Hurricane Floyd Major Disaster Declarations
DR-1337	August 12-21, 2000	August 17, 2000	Severe Storms, Flooding & Mudslides
DR 1588	April 1-3, 2005	April 19, 2005	Severe Storm(s): Severe Storms and Flooding
DR-1694	April 14-20, 2007	April 26, 2007	Severe Storm(s): Severe Storms and Inland and Coastal Flooding
DR-1897	March 12-April 15, 2010	April 2, 2010	Severe Storm(s): Severe Storms and Flooding
EM-3332	August 26-September 5, 2011	August 27, 2011	Hurricane: Hurricane Irene
DR-4021	August 27-September 5, 2011	August 31, 2011	Hurricane: Hurricane Irene
DR-4048	October 29, 2011	November 30, 2011	Severe Storm
EM-3354	October 26-November 8, 2012	October 28, 2012	Hurricane: Hurricane Sandy
DR-4086	October 26-November 8, 2012	October 31, 2012	Hurricane: Hurricane Sandy
DR-4574	August 4, 2020	December 11, 2020	Tropical Storm Isaias Major Disaster Declaration
EM-3573	September 1-September 3, 2021	September 2, 2021	Hurricane: Remnants of Hurricane Ida Emergency Declaration
DR-4614	September 1-September 3, 2021	September 5, 2021	Hurricane: Remnants of Hurricane Ida Major Disaster Declaration

Source: FEMA 2023

3.11.5 PROBABILITY

Morris County is expected to continue experiencing direct and indirect impacts of severe weather annually. These storms may also induce secondary hazards such as flooding and utility failure. Since 1861, 33 tropical storms or cyclones have come within 50 miles of Morris County. Based on these statistics, Morris County can expect the impacts of a nearby hurricane or tropical storm every 16 years.

3.11.6 CLIMATE CHANGE IMPACTS

New Jersey has become wetter over the past century. Northern New Jersey's 1971-2000 precipitation average was over five inches (12%) greater than the average from 1895-1970 (Sustainable Jersey Climate Change Adaptation Task Force [CATF] 2011). The heaviest 1% of daily rainfalls have increased by approximately 70% between 1958 and 2011 in the Northeast (Horton et al. 2015). Average annual precipitation is projected to increase in the region by 4 to 11% by the 2050s and 5 to 13-percent by the 2080s, according to the New York City Panel on Climate Change (NPCC).

As the climate changes, temperatures and the amount of moisture in the air will both increase, thus leading to an increase in the severity of thunderstorms which can lead to derechos and tornadoes. Studies have shown that an increase in greenhouse gases in the atmosphere would significantly increase the number of days that severe thunderstorms occur in the southern and eastern United States.

3.11.7 VULNERABILITY ASSESSMENT

3.11.7.1 IMPACT TO LIFE, HEALTH, AND SAFETY

The impact of severe weather on life, health and safety is dependent upon several factors including the severity of the event and whether adequate warning time was provided to residents. The entire population of Morris County is exposed to this hazard.

Lightning can be responsible for deaths, injuries, and property damage. Lightning-based deaths and injuries typically involve heart damage, inflated lungs, or brain damage, as well as loss of consciousness, amnesia, paralysis, and burns, depending on the severity of the strike. Additionally, most people struck by lightning survive, although they may have severe burns and internal damage. People located outdoors (e.g., recreational activities and farming) are considered most vulnerable to hailstorms, thunderstorms, and tornadoes because there is little to no warning, and shelter might not be available. Moving to a lower risk location will decrease a person's vulnerability.

As a result of severe storm events, residents can be displaced or require temporary to long-term sheltering. The HAZUS-MH results for the 100-year and 500-year MRP hurricane wind events show that no households will be displaced, and no persons will need to seek shelter. However, downed trees, damaged buildings, and debris carried by high winds from hurricanes, tropical storms, or tornadoes can lead to injury or loss of life. Socially vulnerable populations are most susceptible, based on several factors, including their physical and financial ability to react or respond during a hazard and the location and construction quality of their housing.

Economically disadvantaged populations are more vulnerable because they often evaluate evacuation needs and make decisions based on the economic impact to their family. Population over the age of 65 (86,640) is also vulnerable, can physically have difficulty evacuating, and are more likely to seek or need medical attention, which may not be available due to isolation during a storm event. Additionally, the unhoused are threatened due to lack of shelter.

3.11.7.2 IMPACT ON GENERAL BUILDING STOCK

Damage to buildings is dependent upon several factors, including wind speed, storm duration, and path of the storm track. Building construction also plays a major role in the extent of damage resulting from a storm. Due to differences in construction, residential structures are generally more susceptible to wind damage than commercial and industrial structures. Wood and masonry buildings, in general, regardless of their occupancy class, tend to experience more damage than concrete or steel buildings.

To better understand these risks, HAZUS-MH v4.2 was used to estimate the expected wind-related building damages. The analysis shows that the annualized losses caused by hurricane wind damage for Morris County is $1.7 million. Annualized losses combine estimated losses associated with hurricane wind events for six return periods: 10-, 20-, 50-, 100-, 200-, 500-, and 1,000-year. Table 44 summarizes the definition of the damage categories. Specific types of wind damages are also summarized in HAZUS-MH v4.2 at the following wind damage categories: no damage/very minor damage, minor damage, moderate damage, severe damage, and total destruction.

Table 44. Damage Category Descriptions

Qualitative Damage Description	Roof Cover Failure	Window Door Failures	Roof Deck	Missile Impacts on Walls	Roof Structure Failure	Wall Structure Failure
No Damage or Very Minor Damage Little or no visible damage from the outside. No broken windows, or failed roof deck. Minimal loss of roof over, with no or very Limited water penetration.	≤2%	No	No	No	No	No
Minor Damage Maximum of one broken window, door or garage door. Moderate roof cover loss that can be covered to prevent additional water entering the building. Marks or dents on walls requiring painting or patching for repair.	>2% and ≤15%	One window, door, or garage door failure	No	<5 impacts	No	No
Moderate Damage Major roof cover damage, moderate window breakage. Minor roof sheathing failure. Some resulting damage to interior of building from water.	>15% and ≤50%	> one and ≤ the larger of 20% & 3	1 to 3 panels	Typically 5 to 10 impacts	No	No
Severe Damage Major window damage or roof sheathing loss. Major roof cover loss. Extensive damage to interior from water.	>50%	> the larger of 20% & 3 and ≤50%	>3 and ≤25%	Typically 10 to 20 impacts	No	No
Destruction Complete roof failure and/or, failure of wall frame. Loss of more than 50% of roof sheathing.	Typically >50%	>50%	>25%	Typically >20 impacts	Yes	Yes

Source: HAZUS-MH Hurricane Technical Manual

Table 45 shows that there is an estimated loss of $34 million and $200 million for building stock in Morris County for the 100-year event and 500-year event, respectively. A majority of these losses are for residential structures.

Table 45. Estimated Building Value Damages by the 100-Year and 500-Year MRP Hurricane-Related Winds

Municipality	Estimated Total Damages*			Estimated Residential Damage		Estimated Commercial Damage	
	Annualized Loss	100-Year	500-Year	100-Year	500-Year	100-Year	500-Year
Town of Boonton	$21,320	$289,316	$1,885,891	$250,976	$1,807,181	$11,030	$23,475
Township of Boonton	$17,847	$265,215	$1,901,377	$250,402	$1,845,758	$5,532	$16,585
Borough of Butler	$23,556	$325,905	$2,145,547	$294,113	$2,078,108	$12,757	$29,369

Municipality	Estimated Total Damages*			Estimated Residential Damage		Estimated Commercial Damage	
	Annualized Loss	100-Year	500-Year	100-Year	500-Year	100-Year	500-Year
Chatham Borough	$43,308	$531,113	$2,423,318	$501,510	$2,364,113	$14,268	$28,536
Chatham Township	$58,837	$692,144	$3,825,302	$670,804	$3,780,156	$5,553	$11,243
Chester Borough	$5,056	$170,820	$1,012,529	$150,446	$894,909	$15,641	$89,613
Chester Township	$31,682	$1,040,181	$6,021,590	$1,009,552	$5,748,764	$6,741	$33,255
Denville Township	$56,323	$1,209,275	$6,699,314	$1,112,349	$6,433,397	$27,000	$84,339
Town of Dover	$23,850	$648,924	$3,780,186	$580,748	$3,504,050	$23,747	$101,261
Township of East Hanover	$76,369	$1,000,830	$4,858,030	$863,766	$4,569,358	$71,259	$157,061
Borough of Florham Park	$61,312	$808,636	$3,981,205	$715,254	$3,790,223	$41,236	$86,426
Township of Hanover	$65,824	$992,102	$5,221,370	$813,382	$4,850,441	$48,714	$109,845
Township of Harding	$33,319	$553,839	$2,853,318	$542,019	$2,785,282	$5,376	$12,363
Township of Jefferson	$56,923	$1,697,501	$11,377,823	$1,640,721	$11,129,895	$22,339	$104,920
Borough of Kinnelon	$43,544	$601,242	$4,417,059	$582,151	$4,374,098	$6,371	$13,852
Borough of Lincoln Park	$41,395	$407,992	$2,586,313	$364,202	$2,490,959	$8,750	$17,575
Township of Long Hill	$46,064	$768,933	$3,534,721	$730,694	$3,456,580	$14,600	$29,256
Borough of Madison	$54,722	$650,791	$3,522,953	$593,423	$3,407,667	$22,283	$45,117
Borough of Mendham	$21,718	$546,883	$3,044,778	$526,961	$2,935,099	$7,786	$31,959
Township of Mendham	$27,893	$656,750	$3,950,545	$646,114	$3,858,213	$1,400	$4,863
Township of Mine Hill	$8,573	$244,507	$1,650,993	$231,406	$1,587,612	$3,935	$21,237
Township of Montville	$107,081	$1,136,979	$7,884,694	$1,020,331	$7,641,557	$19,449	$41,085
Township of Morris	$82,842	$1,441,351	$8,259,568	$1,324,207	$7,970,553	$40,400	$86,417
Borough of Morris Plains	$21,127	$404,347	$2,168,112	$360,735	$2,058,765	$16,740	$52,456
Town of Morristown	$35,752	$584,535	$3,130,215	$504,391	$2,912,942	$41,632	$129,031
Borough of Mount Arlington	$11,425	$376,504	$2,687,270	$358,824	$2,582,602	$4,258	$29,280

Municipality	Estimated Total Damages*			Estimated Residential Damage		Estimated Commercial Damage	
	Annualized Loss	100-Year	500-Year	100-Year	500-Year	100-Year	500-Year
Township of Mount Olive	$58,638	$2,524,101	$15,382,022	$2,348,206	$14,242,473	$32,718	$217,329
Borough of Mountain Lakes	$18,587	$290,372	$1,823,888	$270,042	$1,779,851	$7,979	$18,252
Netcong Borough	$7,604	$324,050	$1,998,030	$310,079	$1,894,445	$5,722	$45,921
Township of Parsippany-Troy Hills	$155,051	$2,345,617	$13,187,086	$2,041,477	$12,490,565	$139,741	$338,885
Township of Pequannock	$76,141	$832,154	$5,029,598	$762,084	$4,847,481	$31,317	$62,690
Township of Randolph	$74,162	$1,964,780	$11,948,734	$1,838,588	$11,452,045	$50,078	$239,004
Borough of Riverdale	$13,343	$165,906	$970,896	$127,779	$889,826	$18,176	$41,092
Borough of Rockaway	$17,814	$410,675	$2,376,893	$369,126	$2,247,793	$21,268	$66,330
Township of Rockaway	$62,790	$1,483,600	$9,302,555	$1,290,119	$8,669,450	$49,155	$196,493
Township of Roxbury	$67,664	$2,535,761	$15,138,768	$2,408,763	$14,411,006	$60,913	$358,689
Borough of Victory Gardens	$1,371	$27,593	$203,666	$23,771	$191,453	$648	$2,591
Township of Washington	$60,154	$2,775,170	$15,462,040	$2,710,812	$14,470,817	$11,998	$89,600
Borough of Wharton	$14,311	$431,896	$2,354,198	$383,711	$2,160,799	$10,110	$46,143
Morris County (Total)	**$1,705,291**	**$34,158,287**	**$200,002,398**	**$31,524,036**	**$190,606,284**	**$938,617**	**$3,113,437**

Source: HAZUS-MH Hurricane Technical Manual

Table 46. Estimated Building Value Damages by the 100-Year and 500-Year MRP Hurricane-Related Winds

Municipality	Estimated Total Damages*			Estimated Residential Damage		Estimated Commercial Damage	
	Annualized Loss	100-Year	500-Year	100-Year	500-Year	100-Year	500-Year
Town of Boonton	$21,320	$289,316	$1,885,891	$250,976	$1,807,181	$11,030	$23,475
Township of Boonton	$17,847	$265,215	$1,901,377	$250,402	$1,845,758	$5,532	$16,585
Borough of Butler	$23,556	$325,905	$2,145,547	$294,113	$2,078,108	$12,757	$29,369
Chatham Borough	$43,308	$531,113	$2,423,318	$501,510	$2,364,113	$14,268	$28,536
Chatham Township	$58,837	$692,144	$3,825,302	$670,804	$3,780,156	$5,553	$11,243
Chester Borough	$5,056	$170,820	$1,012,529	$150,446	$894,909	$15,641	$89,613

Municipality	Estimated Total Damages*			Estimated Residential Damage		Estimated Commercial Damage	
	Annualized Loss	100-Year	500-Year	100-Year	500-Year	100-Year	500-Year
Chester Township	$31,682	$1,040,181	$6,021,590	$1,009,552	$5,748,764	$6,741	$33,255
Denville Township	$56,323	$1,209,275	$6,699,314	$1,112,349	$6,433,397	$27,000	$84,339
Town of Dover	$23,850	$648,924	$3,780,186	$580,748	$3,504,050	$23,747	$101,261
Township of East Hanover	$76,369	$1,000,830	$4,858,030	$863,766	$4,569,358	$71,259	$157,061
Borough of Florham Park	$61,312	$808,636	$3,981,205	$715,254	$3,790,223	$41,236	$86,426
Township of Hanover	$65,824	$992,102	$5,221,370	$813,382	$4,850,441	$48,714	$109,845
Township of Harding	$33,319	$553,839	$2,853,318	$542,019	$2,785,282	$5,376	$12,363
Township of Jefferson	$56,923	$1,697,501	$11,377,823	$1,640,721	$11,129,895	$22,339	$104,920
Borough of Kinnelon	$43,544	$601,242	$4,417,059	$582,151	$4,374,098	$6,371	$13,852
Borough of Lincoln Park	$41,395	$407,992	$2,586,313	$364,202	$2,490,959	$8,750	$17,575
Township of Long Hill	$46,064	$768,933	$3,534,721	$730,694	$3,456,580	$14,600	$29,256
Borough of Madison	$54,722	$650,791	$3,522,953	$593,423	$3,407,667	$22,283	$45,117
Borough of Mendham	$21,718	$546,883	$3,044,778	$526,961	$2,935,099	$7,786	$31,959
Township of Mendham	$27,893	$656,750	$3,950,545	$646,114	$3,858,213	$1,400	$4,863
Township of Mine Hill	$8,573	$244,507	$1,650,993	$231,406	$1,587,612	$3,935	$21,237
Township of Montville	$107,081	$1,136,979	$7,884,694	$1,020,331	$7,641,557	$19,449	$41,085
Township of Morris	$82,842	$1,441,351	$8,259,568	$1,324,207	$7,970,553	$40,400	$86,417
Borough of Morris Plains	$21,127	$404,347	$2,168,112	$360,735	$2,058,765	$16,740	$52,456
Town of Morristown	$35,752	$584,535	$3,130,215	$504,391	$2,912,942	$41,632	$129,031
Borough of Mount Arlington	$11,425	$376,504	$2,687,270	$358,824	$2,582,602	$4,258	$29,280
Township of Mount Olive	$58,638	$2,524,101	$15,382,022	$2,348,206	$14,242,473	$32,718	$217,329
Borough of Mountain Lakes	$18,587	$290,372	$1,823,888	$270,042	$1,779,851	$7,979	$18,252
Netcong Borough	$7,604	$324,050	$1,998,030	$310,079	$1,894,445	$5,722	$45,921
Township of Parsippany-Troy Hills	$155,051	$2,345,617	$13,187,086	$2,041,477	$12,490,565	$139,741	$338,885
Township of Pequannock	$76,141	$832,154	$5,029,598	$762,084	$4,847,481	$31,317	$62,690

Municipality	Estimated Total Damages*			Estimated Residential Damage		Estimated Commercial Damage	
	Annualized Loss	100-Year	500-Year	100-Year	500-Year	100-Year	500-Year
Township of Randolph	$74,162	$1,964,780	$11,948,734	$1,838,588	$11,452,045	$50,078	$239,004
Borough of Riverdale	$13,343	$165,906	$970,896	$127,779	$889,826	$18,176	$41,092
Borough of Rockaway	$17,814	$410,675	$2,376,893	$369,126	$2,247,793	$21,268	$66,330
Township of Rockaway	$62,790	$1,483,600	$9,302,555	$1,290,119	$8,669,450	$49,155	$196,493
Township of Roxbury	$67,664	$2,535,761	$15,138,768	$2,408,763	$14,411,006	$60,913	$358,689
Borough of Victory Gardens	$1,371	$27,593	$203,666	$23,771	$191,453	$648	$2,591
Township of Washington	$60,154	$2,775,170	$15,462,040	$2,710,812	$14,470,817	$11,998	$89,600
Borough of Wharton	$14,311	$431,896	$2,354,198	$383,711	$2,160,799	$10,110	$46,143
Morris County (Total)	**$1,705,291**	**$34,158,287**	**$200,002,398**	**$31,524,036**	**$190,606,284**	**$938,617**	**$3,113,437**

Since 1950, the Storm Events Database has recorded over $10.34 million damages to property in Morris County due to severe weather events including high wind, thunderstorm wind, strong wind, lightning, and hail. High wind events created the greatest value of property damage out of this total ($4.54 million). Table 47 summarizes severe weather events that have reported property damage in Morris County. It should be noted that there are over 500 severe weather events recorded for Morris County, but only 53 have recorded property damages. This discrepancy suggests that a significant number of severe weather incidents may not have been associated with reported property damages. Therefore, the actual value of losses could potentially be much higher than what is currently reflected in the recorded data.

Table 47. Historical Severe Weather Incidents in Morris County with Property Damages

Type of Event	Number of Times Event Occurred (1950 – 2023)	Total Value of Losses
Hail	1	$5,000
High Wind	9	$4,535,000
Lightning	20	$1,041,000
Strong Wind	78	$1,522,000
Thunderstorm Wind	12	$2,214,000
Tornado	4	$1,025,000
Total	**124**	**$10,342,000**

Source: NOAA Storm Events Database

3.11.7.3 IMPACT ON CRITICAL FACILITIES

Critical facilities are at risk of being impacted by high winds associated with structural damage or falling tree limbs/flying debris, which can result in the loss of power. Power loss can greatly impact households, business operations, public utilities, and emergency personnel. Emergency personnel such as police, fire, and 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.

3.11.7.4 IMPACT ON THE ECONOMY

Severe storm events can have short- and long-lasting impacts on the economy. When a business is closed during storm recovery, there is lost economic activity in the form of day-to-day business and wages to employees. Overall, economic impacts include the loss of business function (e.g., tourism, recreation), damage to inventory, relocation costs, wage loss and rental loss due to the repair/replacement of buildings. Hurricane Sandy, for example, resulted in the loss of millions of dollars in wages and economic activity in the State of New Jersey, including Morris County

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 as well as heating or cooling provision to the population.

HAZUS-MH estimates the total economic loss associated with each storm scenario (direct building losses and business interruption losses). Direct building losses are the estimated costs to repair or replace the damage caused to the building. This is reported in the "Impact on General Building Stock" section discussed earlier. Business interruption losses are the losses associated with the inability to operate a business because of the wind damage sustained during the storm or the temporary living expenses for those displaced from their home because of the event.

For the 100-year MRP wind event, HAZUS-MH estimates approximately $155,199 business interruption losses. For the 500-year MRP wind only event, HAZUS-MH estimates approximately $13.6 million in business interruption losses for the County, which includes loss of income, relocation costs, rental costs and lost wages, in addition to $117,982 in inventory losses. Table 48 provides a summary of these losses.

Table 48. Approximate Estimated Business Interruption Losses for Morris County for Mean Return Period Hurricane Wind Incidents

Mean Return Period (MRP)	Inventory Loss	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	Total Loss
100-year MRP	$0	$92,429	$0	$0	$22,770	**$115,199**
500-year MRP	$117,982	$8,643,483	$92	$2,531	$4,883,954	**$13,648,043**

Source: HAZUS-MH v4.2

Debris management can be costly and may also impact the local economy. HAZUS-MH estimates the amount of building and tree debris that may be produced as result of the 100- and 500-year MRP wind events. Because the estimated debris production does not include flooding, this is likely a conservative estimate and may be higher if multiple impacts occur. According to the HAZUS-MH Hurricane User Manual, estimates of weight and volume of eligible tree debris consist of downed trees that would likely be collected and disposed at public expense. Refer to the User Manual for additional details regarding these estimates. Table 49 summarizes debris production estimates for the 100- and 500-year MRP wind events.

Table 49. Debris Production for 100- and 500-Year Mean Return Period Hurricane-Related Winds

Municipality	Brick and Wood (tons)		Concrete and Steel (tons)		Tree (tons)		Eligible Tree Volume (cubic yards)	
	100-Year	500-Year	100-Year	500-Year	100-Year	500-Year	100-Year	500-Year
Town of Boonton	0	0	120	0	13	204	199	1,595
Township of Boonton	0	0	97	0	100	1,144	272	3,026
Borough of Butler	0	0	88	0	64	306	673	2,710
Chatham Borough	1	0	91	0	71	298	627	2,231
Chatham Township	1	0	156	0	259	1,211	698	2,807
Chester Borough	5	0	78	0	43	474	151	1,919
Chester Township	22	0	405	0	537	9,570	545	10,557
Denville Township	0	0	335	0	228	2,526	1,263	11,598
Town of Dover	11	0	286	0	86	723	780	5,110
Township of East Hanover	2	0	212	0	382	1,376	1,870	6,636
Borough of Florham Park	0	0	211	0	337	1,265	1,559	5,585
Township of Hanover	2	0	276	0	525	1,999	2,125	8,099
Township of Harding	1	0	136	0	403	2,726	446	3,037
Township of Jefferson	16	0	646	0	634	15,608	2,217	29,245
Borough of Kinnelon	0	0	213	0	101	1,752	346	3,537
Borough of Lincoln Park	0	0	97	0	265	919	1,139	3,556
Township of Long Hill	0	0	131	0	354	1,751	953	4,465
Borough of Madison	0	0	182	0	75	342	599	2,599
Borough of Mendham	10	0	184	0	137	1,622	479	4,820
Township of Mendham	11	0	245	0	125	4,854	311	7,163
Township of Mine Hill	4	0	108	0	59	904	290	3,557
Township of Montville	3	0	394	0	355	1,604	1,774	7,201
Township of Morris	1	0	451	0	230	2,562	1,078	11,008
Borough of Morris Plains	1	0	128	0	53	380	469	3,024
Town of Morristown	4	0	248	0	91	526	772	4,267
Borough of Mount Arlington	7	0	221	0	23	690	230	4,207
Township of Mount Olive	68	0	1,271	0	993	11,569	2,846	26,313
Borough of Mountain Lakes	0	0	78	0	42	410	251	2,124
Netcong Borough	12	0	172	0	61	332	517	2,600
Township of Parsippany-Troy Hills	10	0	785	0	671	3,890	3,764	18,853
Township of Pequannock	2	0	193	0	333	1,030	2,060	6,147
Township of Randolph	50	0	784	0	540	6,609	1,520	22,425
Borough of Riverdale	1	0	46	0	67	296	564	2,123
Borough of Rockaway	1	0	145	0	71	514	580	3,877
Township of Rockaway	0	0	599	0	431	12,302	1,244	21,391

Municipality	Brick and Wood (tons)		Concrete and Steel (tons)		Tree (tons)		Eligible Tree Volume (cubic yards)	
	100-Year	500-Year	100-Year	500-Year	100-Year	500-Year	100-Year	500-Year
Township of Roxbury	35	0	942	0	871	7,896	4,100	27,425
Borough of Victory Gardens	0	0	22	0	1	31	11	288
Township of Washington	60	0	1,045	0	1,367	16,148	2,305	23,325
Borough of Wharton	11	0	156	0	123	685	935	4,297
Morris County (Total)	**352**	**0**	**11,977**	**0**	**11,121**	**119,048**	**42,562**	**314,746**

Source: HAZUS-MH v4.2

According to the State of New Jersey 2019 HMP, hail alone causes $2 billion worth of crop and property damage on an annual basis in the United States. Even though New Jersey is estimated to experience an average of two hailstorm events per year, the outcome of these events could be detrimental depending on the cost it would take for the community to recover from the damages. Likewise, these costs can add up for other severe weather events such as tornados destroying key infrastructure and level local businesses, or extreme rain events flooding out shopping centers or transportation hubs. Several severe weather events have historically caused tens of thousands to hundreds of thousands of dollars' worth of damage.

3.11.7.5 IMPACT ON THE ENVIRONMENT

The impact of severe weather events on the environment varies, but researchers are finding that the long-term impacts of more severe weather can be destructive to the natural and local environment. National organizations such as USGS and NOAA have been studying and monitoring the impacts of extreme weather phenomena as it impacts long term climate change, streamflow, river levels, reservoir elevations, rainfall, floods, landslides, erosion, etc. For example, severe weather that creates longer periods of rainfall can erode natural banks along waterways and degrade soil stability for terrestrial species. Tornadoes can tear apart habitats causing fragmentation across ecosystems. Researchers also believe that a greater number of diseases will spread across ecosystems because of impacts that severe weather and climate change will have on water supplies. 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 Morris County.

3.11.8 FUTURE CHANGES THAT MAY IMPACT VULNERABILITY

Understanding future changes that affect vulnerability in the County can assist in planning for future development and ensure establishment of appropriate mitigation, planning, and preparedness measures. Morris County considered the following factors to examine potential conditions that may affect hazard vulnerability:

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

3.11.8.1 PROJECTED DEVELOPMENT

Any areas of growth could be potentially impacted by the severe storm hazard because the entire County is exposed and vulnerable. However, due to increased standards and codes, new development may be less vulnerable to the severe storm hazard compared with the aging building stock in the County.

3.11.8.2 PROJECTED CHANGES IN POPULATION

The anticipated growth in Morris County population may eventually be influenced by severe weather events as these occurrences can impact infrastructure, housing, and overall community resilience. The aftermath of severe weather might lead to disruptions in economic activities, potential property damage, and displacement, which could, in turn, affect population trends.

3.11.8.3 CLIMATE CHANGE

As discussed earlier, studies project that the State of New Jersey will see an increase in average annual temperatures and precipitation. More frequent and severe storms will increase the County's vulnerability to each of the identified severe storm hazards.

3.11.9 VULNERABILITY CHANGE SINCE THE 2020 HMP

Overall, the County's vulnerability has not changed, and the entire County will continue to be exposed and vulnerable to severe weather events.

3.12 SEVERE WINTER STORM

3.12.1 2025 HMP CHANGES

- All subsections have been updated using best available data.
- Previous occurrences were updated with events that occurred between 2019 and 2023.

3.12.2 PROFILE

Severe winter weather is defined as a storm that brings significant snowfall, ice, and/or freezing rain. Blizzards are storms with considerable falling and/or blowing snow combined with sustained winds or frequent wind gusts of 35 mph or greater that frequently reduce visibility to less than 0.25 mile for at least three hours. In Morris County, winter storms include blizzards, snowstorms, Nor'Easters and ice storms. Extreme cold temperatures and wind chills are also associated with winter storms, which is discussed further in Section 1.8.

Some winter storms are large enough to immobilize an entire region while others may only affect a single community. Winter storms are typically 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/or blocked roadways, downed utility lines, and power outages.

3.12.2.1 HEAVY SNOW/BLIZZARD

Snow is precipitation that occurs when temperatures are below the freezing point (32°F), when water vapor in the atmosphere condenses directly into ice without going through the liquid stage. A heavy snowstorm is defined as accumulations of 4 inches or more of snow in a 6-hour period, or 6 inches of snow in a 12-hour period.

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. These conditions must be predominant over a 3-hour period to be considered a blizzard. The hazard is created by the combination of snow, wind, and low visibility and significantly increases with temperatures 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 miles.

3.12.2.2 FREEZING RAIN/SLEET/ICE STORMS

Freezing rain occurs when rain falls into areas that are below freezing. For this to occur, ground-level temperatures must be colder than temperatures aloft. Freezing rain can also occur when the air temperature is slightly above freezing, but the surface that the rain lands upon is still below freezing from prior cold air temperatures.

Sleet is made up of drops of rain that freeze into ice as they fall. They are usually smaller than 0.30 inch in diameter. A sleet storm involves significant accumulations of solid pellets, which form from the freezing of raindrops or partially melted snowflakes, causing slippery surfaces and posing a hazard to pedestrians and motorists.

An ice storm is an event caused by damaging accumulations of ice during freezing rain events. An ice storm involves significant accumulation of rain or drizzle freezing on objects (trees, power lines, roadways, etc.) as it strikes them, causing slippery surfaces and damage from sheer weight of ice accumulations. Significant ice accumulations are typically 0.25 inch or greater.

3.12.2.3 NOR'EASTER

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 strongest and most frequent between September and April, bringing winter weather and the potential for flooding. 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.

3.12.3 LOCATION

The trajectory of the storm center—whether it passes close to the New Jersey coast or at a distance—largely determines both the intensity and the duration of the snowfall over the state. Winter storms tend to have the heaviest snowfall within a 150-mile wide swath to the northwest of what are generally southwest to northeast moving storms. Depending on whether all or a portion of New Jersey falls within this swath, the trajectory determines which portion of the state (or all of the state) receives the heaviest amount of snow. According to the Office of the New Jersey State Climatologist (ONJSC), Morris County's average seasonal snowfall is 36.54 inches with the lowest snowfall in the southeast and the highest amount in the northwest.

All areas of Morris County are subject to severe winter storms.

3.12.4 EXTENT

The magnitude or severity of a severe winter storm 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 (for example, weekday versus weekend), and time of season. While sleet accumulation is measured and tracked in a method similar to snow events, the extent or severity of freezing rain or an ice storm requires a different and sometimes more challenging process.

The National Oceanic and Atmospheric Administration's (NOAA) National Centers for Environmental Information (NCEI) produces 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 Category 1 to 5, which is similar to the Enhanced Fujita scale for tornadoes or the Saffir-Simpson scale for hurricanes. RSI is based on the spatial extent of

the storm, the amount of snowfall, and the combination of the extent and snowfall totals with population (based on the 2000 Census). The NCEI has analyzed and assigned RSI values to over 500 storms since 1900. Table 50 summarizes the five RSI ranking categories.

Table 50. Regional Snowfall Index (RSI) Ranking Categories

Category	RSI Value	Description
1	1-3	Notable
2	3-6	Significant
3	6-10	Major
4	10-18	Crippling
5	18.0+	Extreme

Source: NOAA-NCEI 2024

The NWS operates a widespread network of observation 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 future weather, ranging from hours to days. The models are then analyzed by NWS meteorologists who then write and disseminate forecasts. While winter weather is normal during the winter season for Morris County, 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.

- A ***winter storm watch*** is issued when severe winter conditions (heavy snow, ice, etc.) may affect a certain area, but its occurrence, location, and timing are uncertain. A watch is issued to provide 24 to 72 hours of notice of the possibility of severe winter weather.
- A ***winter storm warning*** is issued when a significant combination of hazardous winter weather is imminent or occurring. A warning is usually issued 12 to 24 hours before the event is expected to begin.
- A ***winter weather advisory*** is issued for any amount of freezing rain or when 2 to 4 inches of snow (alone or in combination with sleet and freezing rain) is expected to cause a significant inconvenience but not serious enough to warrant a warning.
- NWS may also issue a ***blizzard warning*** when snow and strong winds combine to produce the potential for blinding snow, deep drifts, and wind chill within the next 12 to 18 hours.

3.12.5 PREVIOUS OCCURRENCES

Between 1954 and 2023 the Federal Emergency Management Agency (FEMA) included Morris County in seven winter storm-related DR or EM declarations classified as one or a combination of the following disaster types: severe winter storm, snowstorm, snow, ice storm, winter storm, and blizzard. Table 51 summarizes winter storm events and FEMA disaster declarations that occurred between 2014 and 2024.

Table 51. Winter Weather Related Disaster (DR) and Emergency (EM) Declarations

Declaration	Event Date	Declaration Date	Event Description
EM-3106	March 13-17, 1993	March 17, 1993	Snow: Severe Blizzard
DR-1088	January 7-12, 1996	January 13, 1996	Snow: Blizzard of 96 (Severe Snow Storm)
EM-3181	February 16-17, 2003	March 20, 2003	Snow: Snow
EM-1954	December 26-27-2010	February 4, 2011	Snow: Severe Winter Storm and Snowstorm
DR-4264	January 22-24, 2016	March 14, 2016	Severe Storm(s): Severe Winter Storm and Snowstorm

Declaration	Event Date	Declaration Date	Event Description
DR-4368	March 6-7, 2018	June 8, 2018	Severe Storm(s): Severe Winter Storm and Snowstorm
DR-4597	January 31, 2021 – February 2, 2021	April 28, 2021	Severe Winter Storm and Snowstorm

Source: FEMA

According to the Storm Events Database as illustrated in Table 52, Morris County has experienced 298 severe winter storm events from 1950 to 2024 with no reported deaths, injuries, or crop damages. The events resulted in $3.575 million in property damages.

Table 52. Severe Winter Storm Events in Morris County 1950 - 2024

Hazard Type	Number of Occurrences Between 1950 and 2023	Total Fatalities	Total Injuries	Total Property Damage ($)	Total Crop Damage ($)
Blizzard	3	0	0	$1.5M	$0
Heavy Snow	39	0	0	$2.0M	$0
Ice Storm	3	0	0	$0	$0
Sleet	5	0	0	$0	$0
Winter Storm	63	0	0	$75K	$0
Winter Weather	185	0	0	$0	$0
Total	**298**	**0**	**0**	**$3.575M**	**$0**

Source: NOAA-NCEI

1.1.3 PROBABILITY

Morris County is estimated to continue experiencing direct and indirect impacts of severe winter storms annually. Table 53 provides the probability of occurrences of severe winter storm events, based on incidents recorded in the NOAA-NCEI storm events database.

Table 53. Severe Winter Storm Events in Morris County 1950-2024

Hazard Type	Number of Occurrences Between 1950 and 2023	Percent (%) Chance of Event Occurring in Any Given Year
Blizzard	3	4.1
Heavy Snow	39	53.4
Ice Storm	3	4.1
Sleet	5	6.8
Winter Storm	63	84.9
Winter Weather	185	100.0

Source: NOAA-NCEI 2024

3.12.6 CLIMATE CHANGE IMPACTS

In terms of snowfall and ice storms, there is a lack of quantitative data to predict how future climate change will affect this hazard. It is likely that the number of winter weather events may decrease, and the winter weather season may shorten; however, it is also possible that the intensity of winter storms may increase. The exact effect on winter weather is still highly uncertain.

Average annual temperatures have increased by 4°F in New Jersey since 1900, roughly twice the global average. Summer 2022 was the third warmest summer on record in New Jersey. Sea level at Atlantic City rose about 18.2 inches since 1911, more than double the global average. According to NOAA, New Jersey had their warmest January on record in 2023.

Due to the increase in temperature, snow cover and sea ice extent are predicted to likely decrease over the next century and the snow season length is very likely to decrease over North America. However, warming of the lower atmosphere could potentially lead to more ice storms by allowing snow to more frequently melt as it falls and then refreeze near or at surface.

3.12.7 VULNERABILITY ASSESSMENT

3.12.7.1 IMPACT TO LIFE, HEALTH, AND SAFETY

The entire population of Morris County is exposed to severe winter weather events. The homeless and elderly are considered most susceptible to this hazard; the homeless due to their lack of shelter and the elderly due to their increased risk of injuries and death from falls and overexertion or hypothermia from attempts to clear snow and ice.

According to the 2021 ACS 5-Year Population Estimate, 17.8% of the population in Morris County is over 65 years in age. Severe winter storm events can reduce the ability of these populations to access emergency services. Furthermore, the homeless and residents below the poverty level might not have access to housing or their housing could be less able to withstand cold temperatures (e.g., homes with poor insulation and heating supply). Residents with low incomes might not have access to housing or their housing can be less able to withstand cold temperatures (e.g., homes with poor insulation and heating supply). In Morris County, 5.7% of the population has annual incomes below the Census-defined poverty level. Though significantly lower than noted in the 2020 Hazard Mitigation Plan (24.6%), Victory Gardens Borough still has the greatest percent of persons in poverty to its total population (18.8%).

3.12.7.2 IMPACT ON GENERAL BUILDING STOCK

All buildings in Morris County are exposed to the severe winter weather hazard; however, properties in poor condition may be more vulnerable to impacts. In general, structural impacts include damage to roofs and building frames rather than building content. A specific area that is vulnerable to the severe winter storm hazard is the floodplain. Severe winter storms can cause flooding through blockage of streams or through snow melt. Current modeling tools are not available to estimate specific losses for this hazard due to the variety of contributing factors.

3.12.7.3 IMPACT ON CRITICAL FACILITIES

Full functionality of critical facilities such as police, fire and medical facilities is essential for response during and after a severe winter storm event. These critical facility structures are largely constructed of concrete and masonry; therefore, they should only suffer minimal structural damage from severe winter storm events. Because

power interruption can occur, backup power is recommended. Infrastructure at risk for this hazard includes roadways that could be damaged due to the application of salt and intermittent freezing and warming conditions that can damage roads over time. Severe snowfall requires the clearing roadways and alerting citizens to dangerous conditions; following the winter season, resources for road maintenance and repair are required.

3.12.7.4 IMPACT ON THE ECONOMY

The cost of snow and ice removal and repair of roads from the freeze/thaw process can drain local financial resources. Impacts on the economy also include commuter difficulties into or out of the area for work or school. The loss of power and closure of roads prevent commuters within the County. Most recently for the 2020-2021 winter season, the State of New Jersey Department of Transportation budgeted winter maintenance expenditures at $127.2 million, which includes costs for salt (217,245 tons), liquid calcium chloride (356,822 gallons), and brine (105,910 gallons).

3.12.7.5 IMPACT ON THE ENVIRONMENT

Severe winter weather can have a major impact on the environment. Not only does winter weather create changes in natural processes, the residual impacts of a community's methods to maintain its infrastructure through winter weather maintenance may also have an impact on the environment. 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.

3.12.8 FUTURE CHANGES THAT MAY IMPACT VULNERABILITY

3.12.8.1 PROJECTED DEVELOPMENT

Any areas of growth could be potentially impacted by the severe winter storm hazard because the entire planning area is exposed and vulnerable. Due to increased standards and codes, new development may be less vulnerable to the severe winter weather hazard compared with the aging building stock in the County.

3.12.8.2 PROJECTED CHANGES IN POPULATION

Morris County's population has been increasing and is projected to continue to increase in coming decades. In addition, the population is aging. As the aging population grows, so too will the number of persons vulnerable to severe winter weather and extreme cold temperatures.

3.12.8.3 CLIMATE CHANGE

As temperatures rise, there is an increased likelihood of more intense and erratic winter weather events, such as heavy snowfall, freezing rain, and powerful winter storms. However, the exact effect on winter weather is still highly uncertain. These changes may pose challenges for infrastructure, transportation, and community resilience in Morris County. The evolving nature of severe winter weather due to climate change also contributes to future vulnerabilities, highlighting the importance of proactive planning and resource allocation to enhance overall preparedness and resilience.

3.12.9 VULNERABILITY CHANGE SINCE THE 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.

3.13 WILDFIRE

3.13.1 2025 HMP UPDATES

- All subsections have been updated using best available data.
- Previous occurrences were updated with events that occurred between 2019 and 2023.
- The vulnerability assessment was conducted using updated population, building and critical facility/lifeline spatial data to determine exposure to the wildfire hazard.

3.13.2 PROFILE

A wildland fire is any nonstructural fire that occurs in forested, semi-forested, or less developed areas. Wildfire may be naturally occurring (lightning), human-caused (carelessness or arson), or prescribed fire, any of which may be destructive and difficult to control. Most frequently, wildland fires in the state of New Jersey are caused by humans.

Wildfires can increase the probability of other natural disasters, specifically floods and mudflows. Large-scale fires can dramatically alter the terrain and ground conditions, making land already devastated by fire susceptible to floods and mudflow. Normally, vegetation absorbs rainfall, reducing runoff. However, wildfires leave the ground charred, barren, and unable to absorb water, thus creating conditions susceptible to flash flooding and mudflows. Flood risk in these impacted areas remains significantly higher until vegetation is restored, which can take up to five years after a wildfire.

The height of wildland fire season in New Jersey is typically in spring (March through May) and culminates in early May, corresponding with the driest live fuel moisture periods of the year. Although the spring months are the most severe, the summer and fall months may also experience extensive fires in the state. While the spring season is historically the period in which wildfire danger is the highest, wildland fires can occur every month of the year. Drought, snowpack, and local weather conditions can expand the length of the fire season. The early and late shoulders of the fire season usually are associated with human-caused fires. Lightning generally is the cause of most fires in the peak season.

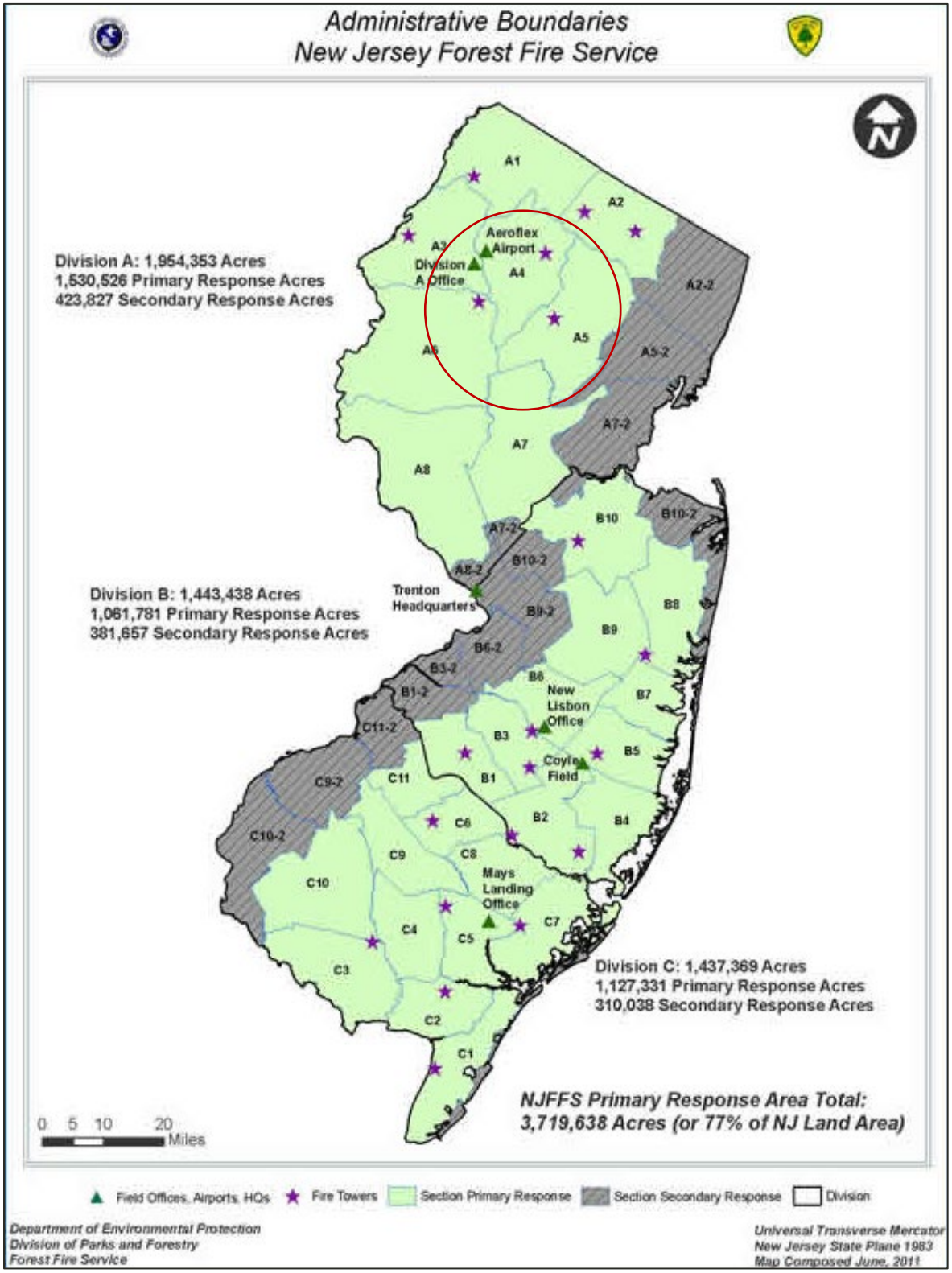
In the state of New Jersey, each year, an average of 1,500 wildfires damage or destroy 7,000 acres of the state's forests. Wildfires not only damage woodlands but threaten homeowners who live within or adjacent to forest environments.

3.13.3 LOCATION

According to the U.S. Fire Administration (USFA), the fire problem in the U.S. varies from region to region. This often is a result of climate, poverty, education, demographics, and other causal factors. Wildfires occur in virtually all of the U.S. In Morris County, wildfires have the potential to occur anywhere in the county.

The New Jersey Forest Fire Service (NJFFS), a division of the New Jersey Department of Environmental Protection (NJDEP), is responsible for protecting the 3.25 million acres of wildland in the State. NJFFS is under the direction of the State fire warden and is headquartered in Trenton. NJFFS divides the State into three regions (Northern, Central, Southern) each totaling about 1,250,000 acres. Morris County is part of Division A (Northern NJ), as illustrated in Figure 44.

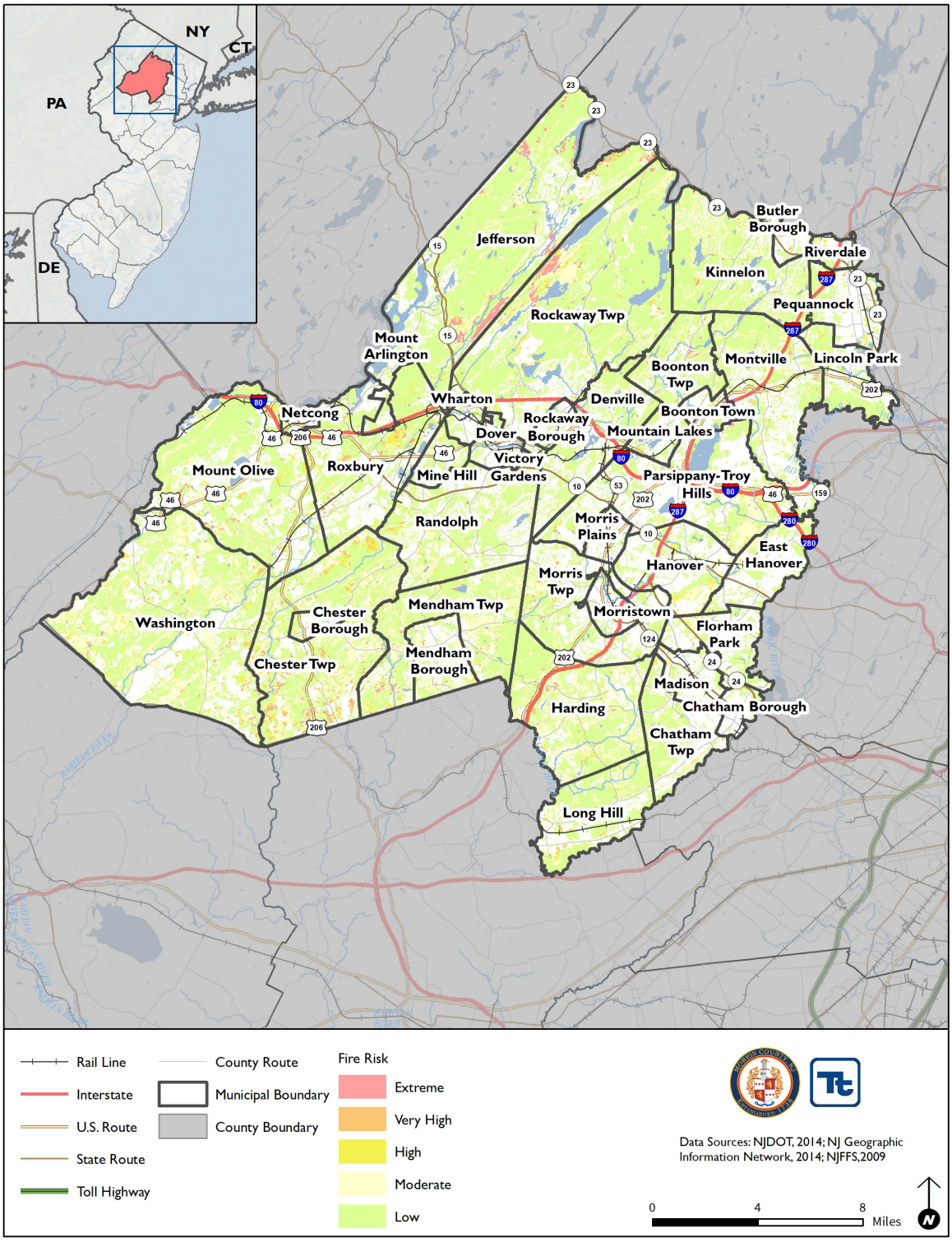
Figure 44. NJ Forest Service Administrative Boundaries



Source: *NJDEP*
Note: *The red circle indicates the location of Morris County.*

Figure 45 shows areas of fire risk across Morris County. The vast majority of the county has relatively low risk for wildfire, though pockets of elevated risk are located throughout.

Figure 45. Fire Risk in Morris County



Source: 2020 Morris County Hazard Mitigation Plan

Table 54. Approximate Area in the Wildfire Fuel Hazard Ranking Zones in Morris County

Municipality	Total Area (Square Miles)	NJ Forest Fire Service Risk Areas (square miles)			
		Low to Moderate	% in Low to Moderate Hazard Area	High to Extreme	% in High to Extreme Hazard Area
Boonton Town	2.5	0.59	23.7%	0.12	5.0%
Boonton Township	8.5	6.40	75.3%	0.25	2.9%
Butler Borough	2.1	0.53	25.7%	0.02	0.9%
Chatham Borough	2.4	0.61	25.7%	0.02	0.9%
Chatham Township	9.3	5.84	62.5%	0.22	2.3%
Chester Borough	1.6	0.65	40.6%	0.07	4.4%
Chester Township	29.2	21.65	74.1%	2.82	9.6%
Denville Township	12.7	6.98	54.8%	0.15	1.2%
Dover Town	2.7	0.80	29.3%	0.04	1.4%
East Hanover Township	8.1	3.55	43.8%	0.10	1.2%
Florham Park Borough	7.5	3.22	43.0%	0.08	1.1%
Hanover Township	10.7	3.99	37.1%	0.41	3.9%
Harding Township	20.6	16.73	81.4%	0.48	2.3%
Jefferson Township	42.8	30.74	71.8%	2.18	5.1%
Kinnelon Borough	19.2	14.90	77.5%	0.42	2.2%
Lincoln Park Borough	6.9	3.95	57.1%	0.19	2.7%
Long Hill Township	12.1	8.16	67.7%	0.37	3.1%
Madison Borough	4.3	1.04	24.1%	0.08	1.9%
Mendham Borough	6.0	3.79	63.3%	0.14	2.4%
Mendham Township	18.0	14.78	82.0%	0.68	3.8%
Mine Hill Township	3.0	1.76	58.6%	0.04	1.3%
Montville Township	19.1	10.86	56.8%	0.50	2.6%
Morris Plains Borough	2.6	0.74	28.4%	0.02	0.7%
Morris Township	15.8	7.94	50.2%	0.38	2.4%
Morristown Town	3.0	0.73	24.2%	0.01	0.2%
Mount Arlington Borough	2.8	1.05	37.5%	0.05	1.8%
Mount Olive Township	31.2	19.04	61.0%	1.32	4.2%
Mountain Lakes Borough	2.9	1.25	42.9%	0.01	0.3%
Netcong Borough	1.0	0.23	24.4%	0.00	0.3%
Parsippany-Troy Hills Township	25.3	10.07	39.7%	0.76	3.0%
Pequannock Township	7.1	2.73	38.5%	0.16	2.3%
Randolph Township	21.2	12.07	57.1%	0.51	2.4%
Riverdale Borough	2.1	0.75	36.1%	0.08	4.1%
Rockaway Borough	2.1	0.61	29.0%	0.02	1.0%

Municipality	Total Area (Square Miles)	NJ Forest Fire Service Risk Areas (square miles)			
		Low to Moderate	% in Low to Moderate Hazard Area	High to Extreme	% in High to Extreme Hazard Area
Rockaway Township	45.9	32.44	70.7%	1.78	3.9%
Roxbury Township	21.9	12.01	54.8%	1.28	5.8%
Victory Gardens Borough	0.1	0.01	4.3%	0.00	0.4%
Washington Township	44.9	30.27	67.4%	1.95	4.4%
Wharton Borough	2.1	0.76	35.6%	0.06	2.7%
Morris County Total	**481.4**	**294.20**	**61.1%**	**17.77**	**3.7%**

Source: NJFFS

3.13.4 EXTENT

The extent of wildfires depends on weather (dryness/drought) and human activity. To determine the potential for wildfires, the NJFFS uses two indices to measure and monitor the dryness of forest fuels and the possibility of fire ignitions becoming wildfires. This includes the National Fire Danger Rating Systems Buildup Index and the Keetch-Byram Drought Index (KBDI). Both are used for fire preparedness planning, which includes the following initiatives: campfire and burning restrictions, fire patrol assignments, staffing of fire lookout towers, and readiness status for both observation and firefighting aircraft.

- The *Buildup Index* is a number that reflects the combined cumulative effects of daily drying and precipitation fuels with a 10-day time lag constant. It is a rating of the total amount of fuel available for combustion.
- The *KBDI* is an index used to determining forest fire potential. The drought index is based on a daily water balance, where a drought factor is balanced with precipitation and soil moisture (assumed to have a maximum storage capacity of 8-inches) and is expressed in hundredths of an inch of soil moisture depletion.

In addition to the two indices, the NJFFS uses the National Fire Danger Rating System (NFDRS) to provide a measure of relative seriousness of burning conditions and threat of fire in the State. It allows the NJFFS to estimate the daily fire danger for a given area. The NFDRS uses a five-color coded system to help the public understand fire potential. The NJFFS slightly adapted the color system for their purposes. The NFDRS with the NFFS color scheme is shown in Table 55.

Table 55. Danger Rating and Color Code

Fire Danger Rating and Color Code	Description
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.

Fire Danger Rating and Color Code	Description
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.
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.
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 bum into heavier fuels.
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.

Source: NJFFS

3.13.5 PREVIOUS OCCURRENCES

Between 1954 and 2024, New Jersey was included in one FEMA Fire Management Assistance (FMA) declaration. Generally, these disasters cover a wide range of the state; therefore, the disaster may have impacted many counties. Morris County was not included in this FMA declaration.

Based on all sources used to research and identify wildfires in the County, there have been no wildfire incidents in Morris County between 2014 and 2023. Any small brush fires were managed locally with little impacts.

Dry conditions during the Fall season of 2024 saw multiple wildfires break out in Rockaway Township. On October 19, 2024, the Microwave Fire ignited in the area of Jacobs Road. The fire initially threatened 13 structures in the Township, though it was contained in a few days. No evacuations were ordered in conjunction with this fire. Shortly after, the Craigmeur Lookout Wildfire ignited in the area of Notch Road and Green Pond Road on October 31, 2024. Sixteen structures were threatened and eight residences were evacuated due to this fire, though all residents were allowed back to their homes and no buildings were damaged during this fire. Approximately 280 acres were burned between the two fires.

3.13.6 PROBABILITY

Estimating the approximate number of urban fires and wildfires to occur in Morris County is difficult to predict in a probabilistic manner. Based on available data, urban fires and wildfires will continue to present a risk to Morris 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 daily basis.

During discussions at the second planning meeting, attendees noted that while daily fires do happen, they are mostly smaller in nature and easier to contain. Large scale fires are exceedingly rare.

3.13.7 CLIMATE CHANGE IMPACTS

Warmer temperatures may lead to longer dry seasons and multi-year droughts, creating triggers for wildfires, insects, and invasive species. Increased temperature and change in precipitation will also affect fuel moisture during wildfire season and the length of time during while wildfires can burn during a given year. Climate change may also increase the frequency of lightning strikes; a warmer atmosphere holds more moisture which is one of the key items for triggering a lightning strike. Lightning strikes cause approximately half the wildfires in the United States. If the frequency of lightning strikes increases, the potential for wildfires from these strikes also increases. Wildfire incidents are predicted to increase throughout the United States due to climate change, causing at least a doubling of areas burned within the next century.

According to NOAA, average annual temperatures have increased by 3°F in New Jersey over the past century. By 2050, the temperature is projected to increase 4.1°F to 5.7°F. As for precipitation, Northern New Jersey's 1971-2000 precipitation average was over five inches (12%) greater than the average from 1895-1970 according to data from the Office of the New Jersey State Climatologist. Average annual precipitation is projected to increase in the region from 6%-9% by 2100. Most of the additional precipitation is expected to come during the winter months.

As stated above, according to the temperature projections for Northern New Jersey, including Morris County, this area can expect warmer and drier conditions which may increase the frequency and intensity of wildfires. Higher temperatures are expected to increase the amount of moisture that evaporates from land and water. These changes have the potential to lead to more frequent and severe droughts, which, in turn, increases the likelihood of wildfires.

3.13.8 VULNERABILITY ASSESSMENT

3.13.8.1 IMPACT ON LIFE, HEALTH, AND SAFETY

Potential losses from wildfire include impacts to human health and life of residents and responders, structures, infrastructure and natural resources. In addition, wildfire events can have major economic impacts on a community from the initial loss of structures and the subsequent loss of revenue from destroyed businesses. 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.

Of the population exposed, the most vulnerable include the economically disadvantaged and the population over age 65. Economically disadvantaged populations are more vulnerable because they are likely to evaluate their risk and make decisions to evacuate based on net economic impacts on their families. The population over age 65 is also more vulnerable because they are more likely to seek or need medical attention that may not be available due to isolation during a wildfire event, and they may have more difficulty evacuating.

3.13.8.2 IMPACT ON GENERAL BUILDING STOCK

Buildings located within the NJFFS identified extreme, very high or high fuel 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, stone or concrete. Less than 1-percent ($686 million) of the County's building replacement cost value is located in the extreme/very high/high hazard area.

1.1.3.1 IMPACT ON CRITICAL FACILITIES

In Morris County, there are 11 critical facilities located in the wildfire hazard area. Three of these critical facilities are community lifelines. Table 56 provides data on critical facilities located in the wildfire hazard area.

Table 56. Number and Types of Critical Facilities Located in the Wildfire Hazard Area in Morris County

Type of Critical Facility	Number of Critical Facilities
Dam	5
Hazmat	2
Sewer Pump	1
Sewer Utility	1
Water	1
Well	1
Total	**11**

Source: NJFFS

Roads and bridges in areas of fire risk are extremely important because they provide ingress and egress to large areas and, in some cases, to isolated neighborhoods. According to the exposure analysis conducted in 2020, 2.5 miles of major highway fall within wildfire hazard areas: NJ 124, US 46, US 206, NJ 53, NJ 15, and US 202.

Fires can create conditions that block or prevent access and can isolate residents and emergency service providers. Areas surrounding any dams located in wooded areas or other areas adjacent to the wildfire hazard areas are particularly vulnerable to additional impacts from a wildfire.

3.13.8.3 IMPACT ON THE ECONOMY

Wildfire events can have major economic impacts on a community including the loss of tax base and business revenue from destroyed structures. Depending upon the scale of the event, wildfires can cost thousands of taxpayer dollars to suppress and control and involve hundreds of operating hours on fire apparatus and thousands of volunteer man hours from the volunteer firefighters. There are also many direct and indirect costs to local businesses that excuse volunteers from working to fight these fires.

Due to a lack of data regarding past structural and economic losses specific to Morris County or its municipalities, it is not possible to estimate potential future economic losses due to wildfire events currently.

3.13.8.4 IMPACT ON THE ENVIRONMENT

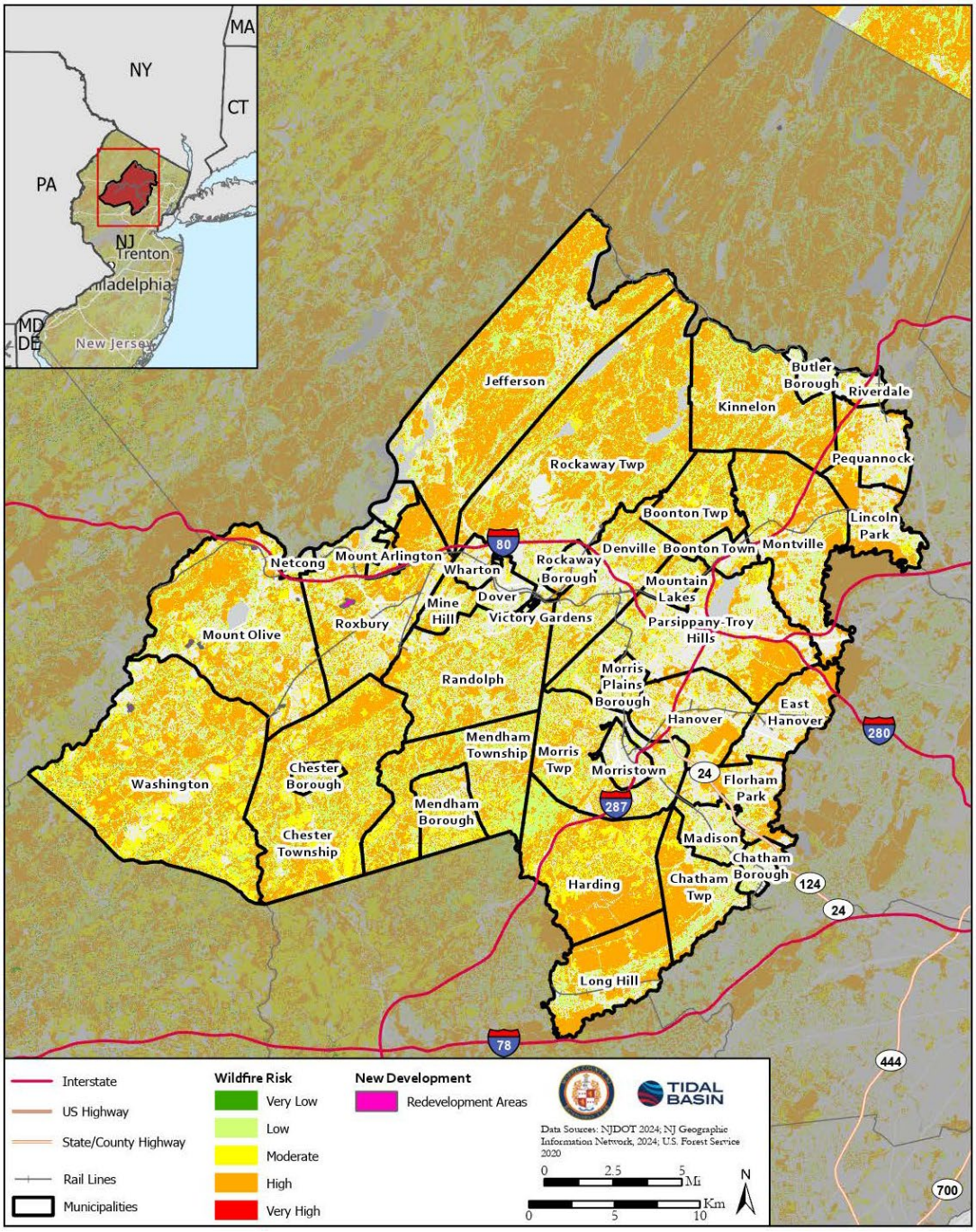
Wildfire can have many impacts on the environment, not the least which is the direct destruction of natural habitats. According to the USGS, post-fire runoff polluted with debris and contaminates can be extremely harmful to ecosystem and aquatic life. Studies show that urban fires in particular are more harmful to the environment compared to forest fires. The age and density of the infrastructure within Morris County implies that a fire can have exacerbated consequences on the environment because of the increased amount of chemicals and contaminates that would be released from burning infrastructure.

3.13.9 FUTURE CHANGES THAT MAY IMPACT DEVELOPMENT

3.13.9.1 PROJECTED DEVELOPMENT

It is anticipated that any new development and new residents in the wildfire hazard area will be exposed to some level of risk from the wildfire hazard. Figure 46 shows an overlay of projected development over the fire risk zones in Morris County.

Figure 46. Fire Risk Zones and Projected Development



1.1.3.1.1 Projected Changes in Population

Overall, the county's population has been increasing and is projected to continue to increase the next few decades. As the population expands and new development is constructed, vulnerability to this hazard will depend upon the location of the new construction and its proximity to wildfire fuels.

3.13.9.2 CLIMATE CHANGE

As discussed earlier, temperatures are anticipated to increase, therefore, suitability of habitats for specific types of trees potentially changes, altering the fire regime and resulting in more frequent fire events and changes in intensity. Prolonged and more frequent heat waves have the potential to increase the likelihood of a wildfire. The increased potential combined with stronger winds can increase the County's vulnerability. If stronger winds occur near a wildfire and emergency services are unable to initially contain the event, the fast-moving fire can spread to nearby developments. This can directly impact the County's population and built environment in the vicinity of the fire, and also indirectly affect those served by utility infrastructure that can be damaged by a fire.

3.13.10 VULNERABILITY CHANGE SINCE THE 2020 HMP

The entire County continues to be vulnerable to the wildfire hazard; however, areas with heavier development in wooded areas have a greater exposure and vulnerability to fire.

3.14 COMMUNITY HAZARD VULNERABILITY OVERVIEW

Where concrete analysis was able to be tabulated, it is included in the hazard chapters themselves. These analyses lend themselves to hazards with more of a defined footprint. For hazards without a defined impact area, a more general accounting of vulnerabilities is presented. These vulnerabilities are highly dependent on the specific hazard scenario presented, and can be overlaid against specific community characteristics included in the county profile, community-specific annexes and relevant appendices.

Table 57 provides a roll-up of potential vulnerabilities and impacts for each hazard. It is assumed that these general impacts are true for each jurisdiction.

Table 57. Community Vulnerabilities

Hazard	Impact on Life, Health and Safety	General Building Stock	Critical Facilities	Economy	Environment
Drought	Water quality degradation, water supply impacts, air quality issues, heat stress, increased fire hazard	Minimal direct impacts, soil shrinkage, increased fire vulnerability	Strain on water supplies, impacts to fire and emergency response, impacts to healthcare	Impacts on agriculture, impacts on utility costs	Damage to ecosystems
Earthquake	Injury and fatality risk, disruption of critical services	Widespread building vulnerability and potential impacts, damage to historical buildings	Building and infrastructure impacts, including critical service disruptions and infrastructure closures	Direct property damage, business interruption, workforce disruption, rebuilding costs	Localized land movement, wildlife and habitat disruption
Extreme Temperatures	Public health risks and heat related illnesses, increased mortality, impacts on vulnerable populations	Minimal direct impacts	Risk of power outages	Increased energy costs, impacts to outdoor workforce	Tree and crop stress
Flood	Injury and fatality risk, contaminated water, resident displacement	Direct structural damage including total loss	Direct structural damage for facilities located in risk area, potential disruption in services	Direct damages, business disruption, real estate and insurance impacts, recovery costs	Erosion and sedimentation, wetland degradation, ecosystem stress, vegetation loss
Geological Hazards	Localized direct injury or fatality risk	Localized property damage	Potential damage to infrastructure and utilities, lifeline network impacts, potential transit disruption	Localized property damage and recovery costs, potential business impacts, costs to repair public infrastructure	Localized impacts, increased erosion, soil and vegetation loss
Hazardous Materials	Exposure to materials and potential injury and death, mass casualty potential, evacuation and sheltering	Direct damage and contamination from exposure to materials	Hospitals may be overwhelmed, potential direct impacts to other facilities based on incident location	Clean-up costs, liability costs, business interruption and property value loss	Soil and groundwater contamination, wildlife and habitat impacts
Severe Weather	Injuries and fatalities for those unprotected from incident	Direct wind and hail damage, impacts to buildings	Direct facility impacts, service disruptions	Business interruptions, property damage costs, agriculture impacts, cleanup costs	Tree damage and habitat loss, soil erosion
Severe Winter Storm	Direct injury and fatality risk, including risk of auto accidents, cold exposure	Structural stress and roof collapse, frozen and burst pipes, ice dams, utility damage and disruption	Power and utility outages, critical service impacts, transportation system impacts	Potential power outages, business interruption, supply chain delays	Tree damage

Hazard	Impact on Life, Health and Safety	General Building Stock	Critical Facilities	Economy	Environment
Wildfire	Smoke inhalation and burns, fatalities, respiratory and cardiovascular impacts, evacuations and displacement	Structural damage and loss within burn area	Impacts to firefighting resources, increased potential for patient surge at hospitals, impacts to infrastructure, direct damage and loss to structures in burn area	Fire suppression costs, rebuilding costs, business disruption, potential for increased insurance costs	Air quality degradation, soil erosion and water absorption impacts, habitat loss and alteration

SECTION 4: HAZARD MITIGATION STRATEGY

4.1 PLAN GOALS

The planning process included a review and update of the prior mitigation goals and objectives as a basis for the planning process and selection of appropriate mitigation actions addressing all hazards of concern. Upon consideration, participating jurisdictions opted not to change the goals from the 2020 plan update. The goals remain:

Goal 1. Reduce the impacts of hazards on people, property, the environment and the economy.

Goal 2. Improve education and outreach efforts regarding potential impacts of hazards and the identification of specific measures that can be taken to reduce their impact.

Goal 3. Improve data collection, use and sharing to reduce the impact of hazards.

Goal 4. Improve capabilities, coordination and opportunities at municipal and county levels to plan and implement hazard mitigation projects, programs and activities.

Goal 5. Pursue opportunities to mitigate repetitive loss properties and other appropriate hazard mitigation projects, programs and activities.

Communities were encouraged to use these goals as guideposts when reviewing, updating and adding new hazard mitigation actions.

4.2 STRATEGY DEVELOPMENT

Using the updated goals as a planning tool to guide mitigation planning efforts, the LPC collaborated to identify a 2025 hazard mitigation strategy that is both effective and feasible for the county and participating communities. As part of the process, the group reviewed the mitigation strategy from the previous plan and reported on the status of specific hazard mitigation actions. These actions were divided into three categories. Completed actions are those activities that Morris County and its communities have implemented over the life of the previous plan; these are located in Section 4.4. Deleted actions are those activities that the committee reviewed and decided to remove from the new hazard mitigation strategy; these are located in Section 4.5. Continued actions are those actions that have either not been started yet or are in the process of being implemented; elements of each action are included in respective community-specific annexes. Implementation and maintenance procedures for the hazard mitigation strategy are included in Chapter 5 of this plan.

At the beginning of the planning process, the planning team set out participation requirements for jurisdictions to be considered full participants in the hazard mitigation plan. Among these requirements, the planning committee asked that each jurisdiction that wanted to be considered a full participant in the update identify at least one new or continuing hazard mitigation action to reduce risk in their community.

4.3 2020 MITIGATION ACTION REPORTING

Communities were asked to review and update the hazard mitigation actions that were identified in the 2020 plan to better understand the progress that they had made, and to identify actions that they wanted to keep for the 2025 plan update. Communities reviewed each action and identified it in one of four categories:

- **Completed.** The action has been completed.
- **Not started.** The action has not been started but should be included in the updated strategy.

- **In progress.** The action has been started but should still be included in the updated strategy.
- **Cancelled.** The action is no longer relevant and should be cancelled.

4.4 COMPLETED ACTIONS

Completed hazard mitigation actions are found in each community-specific strategy.

4.5 CANCELLED ACTIONS

Cancelled hazard mitigation actions are found in each community-specific strategy.

4.6 ACTIONS OVER 10 YEARS OLD

As part of the final plan review process, communities were asked to review all actions that had been in the mitigation plan longer than 10 years and verify that those actions remained a community priority. Communities reported a variety of reasons for lack of progress on actions, with the vast majority noting lack of funding as the primary reason for delays on projects.

4.7 2025 HAZARD MITIGATION STRATEGY ELEMENTS

For all new and continuing actions, communities were asked to provide background information on the action. Each action includes:

- Mitigation action name
- What is the problem the action is solving?
- How does the action solve the problem?
- Action status
- Hazards the action helps mitigate
- Plan goal(s) the action helps implement
- Lead and support agencies for each action
- Potential funding sources to support each action
- Benefits of implementing the action
- Estimated cost of the action
- Estimated timeline for the action

4.8 ACTION PRIORITIZATION

Action prioritization was streamlined from the methodology used in the previous plan. Communities were asked to score each action on a set of metrics. These metrics were:

- Potential for lives saved
- Potential for reduced property damages
- Potential for reduced response actions
- Whether the benefits of the action exceed the costs
- Internal community action priority ranking

Each metric was scored on a scale of 1 – 3, and the total scores were tallied up to identify a final priority ranking. Final rankings were based on a minimum score of 5 and a maximum score of 15.

5 – 8	Low Priority
9 – 12	Medium Priority
13 – 15	High Priority

Once scoring was tallied, they were presented to the LPC and communities during the internal plan review process, along with the invitation to review and edit scores and prioritization as warranted based on specific community needs. Committee members were invited to review the scoring further during the committee plan review period and provide any additional comments or concerns on action prioritization; any comments received were reviewed and incorporated.

4.9 2025 HAZARD MITIGATION STRATEGY

The 2025 Hazard Mitigation Strategy is found in each community-specific annex.

SECTION 5: PLAN IMPLEMENTATION, INTEGRATION AND MAINTENANCE

Maintaining and ensuring the plan is kept up to date are integral components of the hazard mitigation plan life cycle. A structured process for these updates keeps the HMP current, informs any changes in risk, and maintains eligibility to applicable funding sources for Morris County and its communities. Plan maintenance will be coordinated by:

- The Morris County Hazard Mitigation Plan Coordinator, as assigned.
- The Morris County Local Planning Team, made up of representatives from each participating jurisdiction in Morris County.

5.1 PLAN IMPLEMENTATION

5.1.1 FORMAL ADOPTION

Formally adopting the Morris County HMP secures buy-in, raises awareness of the HMP, and formalizes the HMP's implementation. Each jurisdiction participating in this plan will adopt it following all jurisdictional procedures. A copy of the generic resolution and the executed copies are included in the appendices.

5.1.2 IMPLEMENTATION

Once the plan is adopted, each participating community may begin implementing the hazard mitigation strategy in Section 4 and Community Specific Annexes of this document. The mitigation strategy identifies responsible agencies and entities, general timelines, prioritization, and potential funding sources to assist in strategy implementation.

5.1.3 INTEGRATION WITH OTHER COUNTY AND COMMUNITY INITIATIVES

During the HMP annual review process, each participating municipality will be asked to document how they are utilizing and incorporating the Morris County HMP in tandem to their day-to-day operations and planning and regulatory processes. Additionally, each municipality will identify additional policies, programs, practices, and procedures that could be modified to accommodate hazard mitigation actions.

5.1.4 CONTINUED PUBLIC INVOLVEMENT

Morris County and participating jurisdictions are committed to the continued involvement of the public in the hazard mitigation process. Public outreach and dissemination of the HMP will include:

- Links to the plan on municipal websites of each jurisdiction with that capability.
- Continued utilization of existing social media outlets to inform the public of natural hazard events. Educate the public via jurisdictional websites on how these applications can be used in an emergency.
- Development of annual articles or workshops on flood hazards to educate the public and keep them aware of the dangers of flooding.

5.2 MONITORING, EVALUATING AND UPDATING THE PLAN

The Morris County HMP Coordinator is assigned to manage the maintenance and update of the plan during its performance period. The HMP Coordinator will chair the LPC and be the prime point of contact for questions regarding the plan and its implementation as well as to coordinate incorporation of additional information into the

plan. Each jurisdiction is expected to maintain a representative on the Planning Team throughout the plan performance period (five years from the date of plan adoption).

Regarding the composition of the team, it is recognized that individual commitments change over time, and it shall be the responsibility of each jurisdiction and its representatives to inform the HMP Coordinator of any changes in representation. The HMP Coordinator will strive to keep the committee makeup as a uniform representation of planning partners and stakeholders within the planning area.

5.2.1 MONITORING

Each year, beginning one year after plan development, Morris County and local community representatives will collect and process information from the departments, agencies and organizations involved in implementing mitigation projects or activities identified in their jurisdictional annexes by contacting persons responsible for initiating and/or overseeing the mitigation projects.

In addition to progress on the implementation of mitigation actions, including efforts to obtain outside funding; and obstacles or impediments to implementation of actions, the information that Planning Partnership representatives shall be expected to document, as needed and appropriate include:

- Any grant applications filed on behalf of any of the participating jurisdictions.
- Hazard events and losses occurring in their jurisdiction.
- Additional mitigation actions believed to be appropriate and feasible.
- Public and stakeholder input.

5.2.2 EVALUATION

The evaluation of the mitigation plan is an assessment of whether the planning process and actions have been effective, if the HMP goals are being achieved, and whether changes are needed. The HMP will be evaluated on an annual basis to determine the effectiveness of the programs, 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. At least two weeks before the annual plan review meeting, the Morris County HMP Coordinator will advise the Planning Partnership of the meeting date, agenda and expectations of the members.

The Morris County HMP Coordinator will be responsible for calling and coordinating the annual plan review meeting and soliciting input regarding progress toward meeting plan goals and objectives. Plan evaluation will focus on four key areas:

- Changes in capabilities
- Changes in hazard threat, vulnerability and consequences
- Progress on achieving plan goals
- Monitoring the implementation of the mitigation strategy, including project closeout

Morris County will utilize an Annual Review Tool to assist in this process. This reporting tool allows for continual tracking of evolving risks to Morris County as well as progress toward the mitigation of the risks and impacts.

The HMP will also be evaluated and revised following any major disasters, to determine if the recommended actions remain relevant and appropriate.

5.2.3 PLAN UPDATES

Local hazard mitigation plans must be reviewed, revised as appropriate, and resubmitted for approval in order to remain eligible for benefits awarded under the DMA 2000. It is the intent of Morris County to update this plan on a five-year cycle from the date of initial plan adoption.