



1. INTRODUCTION

Hudson County has developed a hazard mitigation plan (HMP) to reduce risks from disasters to the people, property, economy, and environment within the County. Developed by the County and 17 participating local jurisdictions (the Planning Partners), this HMP updates the 2020 Hudson County HMP. The updated 2025 HMP (also referred to as “the plan”) includes countywide analysis and assessment of hazards, risk, and capabilities.

1.1 Overview of Hazard Mitigation Planning

1.1.1 What Is Hazard Mitigation?

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

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

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

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

1.1.2 Regulatory Framework

The federal government encourages communities to assess their vulnerability to various hazards before disaster strikes and then take actions to reduce or eliminate potential risks. A disaster-resistant community can rebound from a natural disaster with less loss of property or human injury, at much lower cost and, consequently, more quickly. Moreover, other costs associated with disasters are minimized, such as the time lost from productive activity by businesses and industries.

The federal Disaster Mitigation Act of 2000 (DMA 2000) encourages states, tribes, and local governments to undertake mitigation planning. Under DMA 2000, communities seeking certain hazard-related federal funding must have a plan that identifies actions to mitigate hazards, risks, and vulnerabilities and establishes a strategy to implement those actions. The HMP must identify potential natural hazards to the health, safety, and well-being of its residents and



identify actions that the community can take to mitigate those hazards before disaster strikes. States and local governments must update HMPs every 5 years to remain eligible for funding.

Regulations implementing the intent and requirements of DMA 2000 are included in Title 44 of the Code of Federal Regulations, Section 201 (44 CFR 201). One goal of the federal regulations is to facilitate cooperation between state and local authorities, prompting them to work together. This enhanced planning process enables local and state governments to better articulate accurate needs for mitigation, resulting in faster allocation of funding and more effective risk reduction projects. In New Jersey, responsibility for fulfilling the requirements of DMA 2000 and 44 CFR 201 has been delegated to the New Jersey Office of Emergency Management (NJOEM).

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

Table 1-1. FEMA Local Mitigation Plan Review Crosswalk

Plan Criteria	Primary Location in Plan
Prerequisites	
Adoption by the Local Governing Body: §201.6(c)(5)	Chapter 2; Appendix A
Planning Process	
Documentation of the Planning Process: §201.6(b) and §201.6(c)(1)	Chapter 2
Risk Assessment	
Identifying Hazards: §201.6(c)(2)(i)	Chapter 4, 5
Profiling Hazards: §201.6(c)(2)(i)	Chapters 4 – 14
Assessing Vulnerability: Overview: §201.6(c)(2)(ii)	Chapters 6 – 13
Assessing Vulnerability: Identifying Structures: §201.6(c)(2)(ii)(A)	Chapters 6 – 13
Assessing Vulnerability: Estimating Potential Losses: §201.6(c)(2)(ii)(B)	Chapters 6 – 13
Assessing Vulnerability: Analyzing Development Trends: §201.6(c)(2)(ii)(C)	Chapters 6 – 13
Mitigation Strategy	
Local Hazard Mitigation Goals: §201.6(c)(3)(i)	Chapter 16; Volume II Annexes
Identification and Analysis of Mitigation Actions: §201.6(c)(3)(ii)	Chapter 16; Volume II Annexes
Implementation of Mitigation Actions: §201.6(c)(3)(iii)	Chapter 16; Volume II Annexes
Multi-Jurisdictional Mitigation Actions: §201.6(c)(3)(iv)	Chapter 16; Volume II Annexes
Plan Maintenance Process	
Monitoring, Evaluating, and Updating the Plan: §201.6(c)(4)(i)	Chapter 17
Incorporation into Existing Planning Mechanisms: §201.6(c)(4)(ii)	Chapter 17; Volume II Annexes
Continued Public Involvement: §201.6(c)(4)(iii)	Chapter 17

1.1.3 Specialized Terms and Concepts

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



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



- **Stakeholder**—individuals or groups that a mitigation action or policy affects, including businesses, private organizations and residents (FEMA 2023).
- **Vulnerability**—a description of which assets within locations identified to be hazard prone are at risk from the effects of the hazard (FEMA 2023).

1.2 History of Hazard Mitigation Planning in Hudson County

1.2.1 Previous Hudson County HMPs

Hudson County has been included in 30 federal hazard-related declarations (major disaster, fire management, and emergency) since 1954. The County prepared and adopted its first hazard mitigation plan in 2009. The plan has been regularly updated since then, with updates adopted in 2015 and 2020. The most recent update identified the following as the greatest hazards of concern in Hudson County:

- Coastal erosion and sea level rise
- Coastal storm
- Dam and levee failure
- Drought
- Earthquake
- Extreme temperature
- Flood
- Geologic
- Severe weather
- Severe winter storm
- Wildfire

1.2.2 Key Changes in the Current Update

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

- The 2020 HMP presented the identification of hazards of concern, risk assessment methodology and tools, hazards of concern profiles, and hazard ranking in Section 4 as part of the overall risk assessment. For the 2025 HMP update, each of these sections was expanded and presented as standalone chapters (Chapters 4 through 14).
- The 2025 Hudson County HMP Steering Committee emphasized the importance of public and stakeholder involvement for this plan update by hosting working group meetings to procure sector-specific feedback on the plan and the preliminary risk assessment and mitigation strategies.



1.3 Plan Organization

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

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

- Chapter 1: Introduction
- Chapter 2: Planning Process—A description of the plan methodology and development process, committee and stakeholder roles and activities, and how the plan will be incorporated into existing programs. Information regarding the adoption of the plan by each participating jurisdiction.
- Chapter 3: County Profile—An overview of Hudson County, including general information and physical conditions, land use patterns and trends, population and demographics, economy, general building stock inventory, community lifelines, and natural, historic, and cultural resources
- Chapter 4: Risk Assessment Methodology—Description of the methodology used to assess hazard risk and the status of local data.
- Chapter 5: Identification of Hazards of Concern—Documentation of the process of identifying the natural hazards of concern for further profiling and evaluation.
- Chapters 6 – 13: Hazard Profiles and Findings of the Risk Assessment—Estimates of the impact of hazard events on life, safety, and health; general building stock; critical facilities; the economy, and natural, historic, and cultural resources).
- Chapter 14: Hazard Ranking—Description and summary of the hazard ranking process.
- Chapter 15: Capability Assessment—A summary and description of the existing plans, programs, and regulatory mechanisms at all levels of government (federal, state, county, local) that support hazard mitigation within the County.
- Chapter 16: Mitigation Strategy—Information regarding the mitigation goals and objectives identified by the Steering Committee in response to priority hazards of concern, and the process by which County and local mitigation strategies have been developed or updated.
- Chapter 17: Plan Maintenance Procedures—A system to continue to monitor, evaluate, maintain, and update the plan.

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

Appendices include the following:



- **Appendix A**—Sample Resolution of Plan Adoption: Documentation that supports the plan approval signatures included in Chapter 1 of this plan.
- **Appendix B**—Meeting Documentation: Agendas, attendance sheets, minutes, and other documentation (as available and applicable) of planning meetings convened during the development of the plan.
- **Appendix C**—Public and Stakeholder Outreach Documentation: Documentation of the public and stakeholder outreach effort including webpages, informational materials, public and stakeholder meetings and presentations, surveys, and other methods used to receive and incorporate public and stakeholder comment and input to the plan update process.
- **Appendix D**—Participation Matrix
- **Appendix E**—Action Worksheet Template and Instructions
- **Appendix F**—Plan Maintenance Tools: Examples of plan review templates available to support annual plan review and example FEMA Guidance Worksheets (FEMA 386-4).
- **Appendix G**—Critical Facility Inventory
- **Appendix H**—Risk Assessment Supplementary Data: Details regarding past hazard events since those documented in the 2020 plan.
- **Appendix I**—State of New Jersey Office of Emergency Management Planning Standards: Includes planning standards and guidelines for hazard mitigation planning.
- **Appendix J**—Linkage Procedures
- **Appendix K**—Dam Supplement: This appendix contains information on high hazard dams within Hudson County



2. PLANNING PROCESS

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

- The plan will be multi-jurisdictional, including all municipalities in the County. Hudson County invited all jurisdictions in the County to join in the planning process. To date, all 17 local municipal governments in the County (the Planning Partnership) have participated in the 2025 plan update process:
 - Hudson County
 - City of Bayonne
 - Borough of East Newark
 - Town of Guttenberg
 - Town of Harrison
 - City of Hoboken
 - City of Jersey City
 - Jersey City MUA
 - Town of Kearny
 - Kearny MUA
 - Township of North Bergen
 - North Bergen MUA
 - North Hudson Sewerage Authority
 - Town of Secaucus
 - Secaucus MUA
 - City of Union City
 - Township of Weehawken
 - Town of West New York
- The format of this plan is such that other entities can easily join at a later date as part of the regulatory five-year- plan update process.
- The plan considers all natural hazards that pose a risk to the area, as required by 44 Code of Federal Regulations (CFR) 201.
- The plan was developed following FEMA regulations and prevailing FEMA and state guidance. This ensures that all the requirements are met and supports plan review. In addition, this plan will meet criteria for the National Flood Insurance Program (NFIP) Community Rating System (CRS) and the Flood Mitigation Assistance (FMA) programs.

Hudson County was awarded Hazard Mitigation Assistance funds to support this plan update under the COVID-19 pandemic disaster declaration (DR-4488-NJ). Grant administration was the responsibility of the Hudson County Department of Roads and Public Property's Office of Emergency Management.

2.1 General Mitigation Planning Approach

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

- FEMA Mitigation Planning How-to Series (FEMA 386-1 through 4, 2002)
- FEMA How-To Guide for Using Hazus for Risk Assessment FEMA Document No. 433, February 2004.
- FEMA Local Mitigation Plan Review Guide, October 1, 2011.
- FEMA Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards, January 2013.
- FEMA Integrating Hazard Mitigation into Local Planning, March 1, 2013.



- FEMA Plan Integration: Linking Local Planning Efforts, July 2015.
- FEMA Local Mitigation Planning Policy Guide, April 19, 2022.
- FEMA Local Mitigation Planning Handbook, May 2023.
- DMA 2000 (Public Law 106-390, October 30, 2000).
- 44 CFR 201 and 206 (including: Feb. 26, 2002, Oct. 1, 2002, Oct. 28, 2003, and Sept. 13, 2004, Interim Final Rules).
- NJOEM Hazard Mitigation Planning Guidance, 2019
- State of New Jersey Hazard Mitigation Plan, 2024.

2.2 Organization of Planning Process

2.2.1 Planning Process Participants

PROJECT MANAGEMENT AND PLANNING CONSULTANT

Project management was the responsibility of the Hudson County Department of Roads and Public Property's Office of Emergency Management. A contract planning consultant (Tetra Tech) was tasked with the following:

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

PLANNING PARTNERSHIP

In January 2024, the County notified all municipalities in the County of the pending planning process and invited them to formally participate. Jurisdictions were asked to formally notify the County of their intent to participate via a letter of intent (LOIP) and to identify planning points of contact to facilitate their participation and represent the interests of their communities. All participating jurisdictions, including the County, are recognized as Planning Partners and belong to the Planning Partnership for this HMP. The Planning Partnership was charged with the following responsibilities:

- Representing their jurisdiction throughout the planning process



- Ensuring participation of all departments and functions within their jurisdiction that have a stake in mitigation (e.g., planning, engineering, code enforcement, police and emergency services, public works), specifically including the jurisdiction's NFIP floodplain administrator
- Assist in stakeholder identification within their jurisdiction that should be informed and potentially involved with the planning process
- Assisting in gathering information for inclusion in the HMP update, including the use of previously developed reports and data
- Supporting and promoting the public involvement process
- Reporting on progress of mitigation actions identified in prior or existing HMPs, as applicable
- Identifying, developing, and prioritizing appropriate mitigation actions
- Reporting on progress of integration of prior or existing HMPs into other planning processes and municipal operations
- Supporting and developing a jurisdictional annex
- Reviewing, amending, and approving all sections of the plan update
- Adopting, implementing, and maintaining the plan update

Table 2-1 shows the current members of the Planning Partnership as of the time of publication of this plan update.

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

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

Appendix D (Participation Matrix) identifies how each individual who represented the jurisdictions during this planning effort contributed to the planning process.

It is noted that all municipalities in the County actively participate in the NFIP and have a designated floodplain administrator. All floodplain administrators have been informed of the planning process, reviewed the plan documents, and provided direct input to the plan update. Local floodplain administrators are identified as part of each jurisdiction's hazard mitigation planning team, as presented in the jurisdictional annexes in Volume II, as well as in Appendix D (Participation Matrix).

After plan completion, implementation and ongoing maintenance will become a function of the Planning Partnership as described in Chapter 17 (Plan Maintenance). The Planning Partnership will be responsible for reviewing the draft plan and soliciting public comment as part of an annual review and as part of the five-year mitigation plan updates.

**Table 2-1. Hudson County Hazard Mitigation Planning Partnership Members**

Jurisdiction	Primary Point of Contact	Title	Alternate Point of Contact	Title
City of Bayonne	Suzanne Mack	City Planner	Joseph Anderson	OEM Coordinator
Borough of East Newark	Dina Grilo	Mayor, OEM Coordinator	Robert Tomasko	Deputy OEM Coordinator/Police
Town of Guttenberg	Richard Delafuente	OEM Coordinator	Cosmo Cirillo	Business Administrator
Town of Harrison	Harold G. Stahl	OEM Coordinator	Henry Richard	Fire Chief/Deputy OEM Coordinator
City of Hoboken	RJ Theofield	Capital Planning Manager	Caleb Stratton	Resilience Officer/Assistant Business Administrator
City of Jersey City	Walter Kierce	OEM Coordinator	Martin Valenti	Deputy Coordinator
Town of Kearny	Rich Poplaski Jr.	Kearny Police Department/Deputy OEM Coordinator	Joseph P. Mastandrea	Kearny Fire Department Deputy OEM Coordinator
Township of North Bergen	Dave Ricigliano	OEM Coordinator	Dan Peschetti	Deputy OEM Coordinator
Town of Secaucus	Vince T. Massaro	Fire Official/OEM Coordinator	Gerry Jeffas	Administrator
City of Union City	Carl O'Brien	City Engineer	Tammy Zucca	CFO
Township of Weehawken	Gio Ahmed	Business Administrator/Deputy OEM Coordinator	Jeff Fulcher	Deputy Director Department of Public Safety
Town of West New York	William Bringas	Deputy OEM Coordinator	Brian Velazquez	Deputy OEM Coordinator
Kearny Municipal Utilities Authority	JoVann Quinones	Executive Director	Mark Coimbra	Authority Engineer
Jersey City Municipal Utilities Authority	Richard Haytas	Chief Engineer	Ruth Mogro	Staff Engineer
North Bergen Municipal Utilities Authority	Carlos Torres	Director of Operations & Maintenance	Frank Pestana	Executive Director
North Hudson Sewerage Authority	Richard Wolff	Executive Director	Amanda Martino	Project Specialist (Consultant)
Secaucus Municipal Utilities Authority	Brian Biglar	Executive Director	Glenn Beckmeyer	Engineer

STEERING COMMITTEE

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

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

**Table 2-2. Hudson County Hazard Mitigation Steering Committee Members**

Affiliation	Name	Title
Rutgers University	Ashlyn Spector	Unit Manager
Hudson County	Bob Grewe	OEM Emergency Response Specialist
NJOEM	Cansu Yerdelenli*	Disaster Recovery Analyst
Hudson Regional Health Commission	Carrie Nawrocki	Executive Director
Hudson County Prosecutor's Office	Chin Micko	County Prosecutor's Office Joint Terrorism Task Force
Hudson County Office of Digital Information	Daryl Karsnuk	Director
Township of North Bergen	Dave Ricigliano	OEM Coordinator
Hudson County Office of the County Administrator	David Drumeler	Deputy Administrator
Hudson County Department of Planning & Business Opportunity	Francesca Giarratana	Deputy Director
Hudson County Department of Emergency Management	George Johns	OEM Deputy Coordinator
Hudson County Department of Emergency Management	Jeffery Brzozowski	OEM Planner
Hudson County Department of Emergency Management	Jim Woods	OEM Coordinator
NJOEM	John Walsh	NJOEM Liaison
Town of Kearny	Joseph P. Mastandrea	Kearny Fire Department Deputy OEM Coordinator
Hudson County Office of Emergency Management	Michael Kenny	Domestic Preparedness Planner
Hudson County Improvement Authority	Norman Guerra	Chief Executive Officer
Hudson County Department of Emergency Management	Peter Nevins	OEM Planner
Hudson County Department of Roads and Public Property	Ralph Sax	Deputy Director
City of Hoboken	Rashawn Crandell	OEM Coordinator
City of Hoboken	RJ Theofield	Capital Planning Manager
Hudson County Department of Emergency Management	Rosa Abrantes	OEM Monitoring & Evaluation
Hudson County Communications Department	Sean O'Connor	Hudson County Communications
Hudson County Planning Board	Tom Malavasi	County Engineer
Hudson County	Vincent Viera	GIS Specialist

*Until May 2025

Steering Committee members were charged with the following:

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



2.2.2 Planning Activities

Table 2-3 summarizes meetings and other planning activities conducted during the development of the plan. It also identifies which 44 CFR 201 requirements each activity satisfies. Documentation of meetings (agendas, sign-in sheets, minutes, etc.) is provided in Appendix C (Public and Stakeholder Outreach).

Table 2-3. Summary of Mitigation Planning Activities

Date	44 CFR 201 Requirement	Description of Activity	Participants
January 18, 2024	2	Project Start Up Meeting: Discuss proposed planning process and scope of work including documenting participation, schedule, and public and stakeholder outreach and involvement.	Hudson County Office of Emergency Management, Tetra Tech
January 24, 2024	2	All municipalities were invited to participate in the planning process.	-
March 7, 2024	1b, 2, 3a, 3b, 3c, 4a, 5c	SC Kickoff Meeting: Review project schedule; review municipal participation, discuss municipal Kickoff meeting and local data collection; review and discuss sources and availability of County and regional data; discuss public and stakeholder outreach efforts.	See Appendix D
March 7, 2024	1b, 2, 3a, 3b, 3c, 4a	Planning Partnership Kickoff Meeting: Complete overview of planning process, plan participant expectations, review of hazards and hazards of concern identification, discussion of data needs and data collection process explaining all provided worksheets, discussion of public and stakeholder outreach efforts	See Appendix D
April 9, 2024	2, 3c	GIS data collection meeting	Hudson County Office of Emergency Management, Hudson County GIS, Tetra Tech
May 13, 2024	2	Public project website developed: https://www.hudsoncountynjhmp.com/	Hudson County Office of Emergency Management, Tetra Tech
August 13, 2024	1b	Letters to neighboring municipalities, counties, and stakeholders were developed to publicize the planning process, identify opportunities for involvement and engagement, and provide links to the HMP website and surveys.	Hudson County Office of Emergency Management, Tetra Tech
August 13, 2024	2	Online Public Hazard Preparedness and Mitigation survey developed and deployed	Hudson County Office of Emergency Management, Tetra Tech
August 13, 2024	2	Online Stakeholder Hazard Mitigation surveys developed and deployed	Hudson County Office of Emergency Management, Tetra Tech
August 13, 2024	2	Online Neighboring County Mitigation survey developed and deployed	Hudson County Office of Emergency Management, Tetra Tech
August 30, 2024	1b	Meeting with Hudson County Department of Planning and Business Opportunity to discuss communication strategy	Hudson County Office of Emergency Management, Hudson County Communications Department, Tetra Tech
September 26, 2024	-	Quarterly meeting with Hudson County OEM Coordinators to provide worksheet assistance and notify participants of upcoming meetings and engagement opportunities.	Hudson County Office of Emergency Management, Tetra Tech



Date	44 CFR 201 Requirement	Description of Activity	Participants
December 10, 2024	3	Risk Assessment Meeting	See Appendix D
January 28, 2025	4	Mitigation Strategy Workshop: Jurisdictions reviewed their previous mitigation actions, completed outstanding worksheets with assistance from Tetra Tech planners, and identified 2025 mitigation actions.	See Appendix D
March 13, 2025	-	Mitigation development technical assistance meeting with City of Jersey City.	Jersey City OEM
April 2, 2025	-	Hudson County HMP annex review meeting.	Hudson County OEM
April 10, 2025	-	Technical assistance meeting to review worksheets with Borough of East Newark.	Borough of East Newark OEM
April 16, 2025	-	Technical assistance meeting to review worksheets with Town of Secaucus.	Town of Secaucus Fire Official/OEM
May 13, 2025	-	Technical assistance meeting to review worksheets with Town of West New York and Township of Weehawken.	Town of West New York OEM Township of Weehawken Business Administrator/Deputy OEM
May 22, 2025	-	Mitigation actions overview with Hudson County.	Hudson County OEM
June 26, 2025	-	Technical assistance meeting to review worksheets with City of Bayonne.	City of Bayonne City Planner and OEM
TBD	2	Draft Plan Review Presentation: Overview of entire plan and sections; confirmed plan maintenance schedule	TBD
TBD	1b, 2	Draft HMP posted to public project website; all plan participants were notified and asked to assist with the public outreach including social media. Neighboring communities and stakeholders were notified of the posting as well.	Public and Stakeholders
TBD	2	HMP submitted to NJOEM	NJOEM
TBD	2	HMP submitted to FEMA Region II	FEMA Region II
Upon plan approval by FEMA	1a	Plan adoption by resolution by the governing bodies of all participating jurisdictions	All Plan Participants

Note: TBD = to be determined.

Under the 44 CFR 201 Requirement column, numbers identify specific federal requirements, as follows:

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



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

Table 2-3 identifies only formal meetings and milestone events in the plan update process. In addition to these meetings, there was a great deal of communication between Planning Partnership members and the consultant through individual local meetings, phone, and email.

2.3 Stakeholder Outreach and Involvement

The Hudson County HMP update was written using the best available information obtained from a wide variety of sources. Throughout the HMP update process, a concerted effort was made to gather information from municipal and regional agencies and staff as well as stakeholders, federal and state agencies, and the residents of the County. A Steering Committee solicited information from local agencies and individuals with specific knowledge of certain natural hazards and past historical events. In addition, the Steering Committee and Planning Partnership took into consideration planning and zoning codes, ordinances, and recent land use planning decisions.

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

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

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

2.3.1 Federal and State Agencies

The federal and state agencies listed in Table 2-4 were contacted during the planning process. The table describes how each participated.

*Table 2-4. Participation of Federal and State Agencies*

Agency	Participation
FEMA Region 2	Provided updated planning guidance; provided NFIP data for planning area; presented preliminary regulatory flood products to municipalities and the public; attended meetings; participated in a Mitigation Strategy Workshop; conducted plan review.
• National Centers for Environmental Information • National Hurricane Center • National Oceanic and Atmospheric Administration • National Weather Service • Storm Prediction Center • U.S. Army Corps of Engineers • U.S. Census Bureau • U.S. Geological Survey	Information regarding hazard identification and the risk assessment for this HMP update was requested and received or incorporated by reference
New Jersey Office of Emergency Management	Administered planning grant and facilitated FEMA review; provided planning guidance; attended meetings; participated in the Steering Committee Kickoff Meeting, provided review of draft and final HMP.
New Jersey American Water	Participated in the Steering Committee Kickoff Meeting and provided information in the planning process.
New Jersey Office of Climate Resilience	Participated in the Planning Partnership Kickoff meeting

2.3.2 County and Regional Agencies

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

Table 2-5. County and Regional Agencies

Agency	Participation
• Rutgers – Bloustein • New Jersey Office of Emergency Management • Hudson County Regional Health Commission • Hudson County GIS • Kearny Fire Department Deputy OEM Coordinator • Hudson County Planning and Business Opportunities	Served on steering committee, attended meetings, provided input in completing exercises and reviewed draft plan.
• Hudson County Administrators Office • New Jersey State Police	Provided input and reviewed draft plan.
• North Hudson Sewerage Authority • North Bergen Municipal Utilities Authority • Secaucus Municipal Utilities Authority • Keany Municipal Utilities Authority • Jersey City Municipal Utilities Authority	Invited to take the stakeholder survey and review the draft plan.



2.3.3 Stakeholders by Community Lifeline Category

FEMA defines community lifelines as fundamental services in a community that, when stabilized, enable all other aspects of society. Following a disaster event, intervention is required to stabilize community lifelines. All participating jurisdictions were asked to invite their internal agencies associated with community lifeline categories to complete a stakeholder survey. Many jurisdictions also directly involved representatives of these agencies in the planning process, as identified in Table 2-1. This section describes outreach to and participation by other stakeholders in the planning process associated with FEMA's eight designated community lifeline categories. More detailed information about community lifelines in the planning area is provided in Chapter 3: County Profile.

SAFETY AND SECURITY

Law Enforcement

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

- East Newark Police Department
- Little Ferry Police Department
- Kearny Police Department
- Lyndhurst Police Department
- Weehawken Police Department

Fire Districts and Fire Departments

Many jurisdictions directly involved fire district/department, hazmat teams, and rescue team representatives in the planning process. Jurisdictions were asked to invite their fire departments to complete a stakeholder survey. The following fire districts or departments, hazardous materials response teams, and rescue teams were invited to complete a stakeholder survey and review the draft plan:

- NJ State Fire
- Town of Harrison Fire Chief
- Town of Kearny Fire Department
- Town of Secaucus Fire Official

Dams

In order to address High Hazard Potential Dams, outreach was conducted with the following dam owners and/or the dam safety agency.

- Township of Weehawken

The following information was requested:



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

HEALTH AND MEDICAL

Hospitals and Health-Care Facilities

The Hudson County Regional Health Commission was invited to complete a stakeholder survey and review the draft plan.

TRANSPORTATION

The New Jersey Transportation Planning Authority was invited to complete a stakeholder survey and review the draft plan:

WATER SYSTEMS AND UTILITIES

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

- North Hudson Sewerage Authority
- Jersey City Municipal Utilities Authority
- Keany Municipal Utilities Authority
- Secaucus Municipal Utilities Authority

2.3.4 Additional Stakeholder Groups

Additional stakeholder outreach was made to academia and organizations that support socially vulnerable populations and underserved populations, as listed in the sections below.

GROUPS SUPPORTING SOCIALLY VULNERABLE POPULATIONS AND UNDERSERVED COMMUNITIES

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

- City of Bayonne Planning
- City of Hoboken Public Safety
- City of Hoboken Department of Climate Action and Innovation
- Hudson County Planning



- Hudson County Improvement Authority
- Hudson County Communications

2.3.5 Adjacent Jurisdictions

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

- Bergen County
 - Borough of Bogota
 - Borough of Little Ferry
 - Borough of North Arlington
 - City of Hackensack
 - Township of Lyndhurst
 - Township of Ridgefield
 - Township of Teaneck
 - Village of Ridgefield Park
- Union County
 - Borough of East Rutherford
 - Borough of Rutherford
 - City of Elizabeth
 - City of Newark
 - Village of Carlstadt

2.3.6 Stakeholder and Neighboring Community Survey Summaries

This section summarizes the results and feedback received by those who completed the stakeholder and neighboring community surveys. Feedback was reviewed by the Steering Committee and integrated where appropriate in the plan.

STAKEHOLDER SURVEY

The stakeholder survey was designed to identify general needs for hazard mitigation and resiliency within Hudson County from the perspective of stakeholders, as well as to identify specific projects that may be included in the mitigation plan. It was distributed to identified stakeholders, including county and municipal departments and agencies.

As of April 21, 2025, 12 stakeholders completed the survey, with respondents coming from the emergency management sector, economic development sector, health and social services sector, infrastructure sector, and the land use and development sector. The majority of respondents represented groups that served Hudson County as a whole (58.33 percent).

When asked if the organization maintains or manages anything within their designated service area, 66.67 percent said no they do not manage any facilities. For those that did answer, they indicated the following facilities: buildings, stormwater infrastructure, roads, or water/sewer plants.

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



- Education
- Support for individuals with disabilities
- Support for refugees, the economically disadvantaged, developmentally disabled, and those diagnosed with HIV/AIDS
- Housing and services to the homeless population
- Emergency aid
- Food distribution

Hazard and Damage Identification

More than half of respondents (58.33 percent) indicated that buildings, facilities, or structures their organization is involved with have been impacted by a natural hazard. Of these, respondents noted issues with flooding, wind damage, pandemic, and building damages.

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

- Flooding causing water damage and blocking roads
- School facilities are vulnerable to natural, and human caused hazards
- Damage to overhead electric lines from high winds and ice
- Transportation and access to services
- Power outages causing a halt in internet services

The majority of respondents (58.33 percent) stated that they have facilities that have been impacted by a hazard event, mostly being related to flooding and severe storms. Of these respondents, 58.33 percent of people stated that their agency owns their facilities as opposed to leasing them. Respondents stated that they were most concerned about school facilities and flooding in relation to the pumping stations. Respondents also stated that proximity to water bodies and the density of population were the biggest challenge and barriers in reducing vulnerability in the County.

Community Preparedness

Sixty percent of respondents noted they are aware of the location and number of socially vulnerable populations in their community/operating area. Organizations within Hudson County support socially vulnerable populations through education, emergency aid, providing services and programs to seniors, and serving those that are economically disadvantaged. Respondents reported participation in preparedness activities as follows:

- Part of an Emergency Operations Plan—72.73 percent of total respondents
- Part of a Continuity of Operations/Government Plan—45.45 percent of total respondents
- Part of a Business Continuity Plan—36.36 percent of total respondents



Other capabilities that respondents indicated that they have to help address hazards include operational coordination, cybersecurity, and emergency power. Respondents also listed that there is a Disaster Response Project which provides legal representation and other legal services to individuals and families that may be impacted by a disaster.

Project Identification

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

- Free and easily accessible training for hazard events.
- Harden Infrastructure to be more hazard resistant
- Collaborate with other organizations and local agencies
- Inflow and Infiltration research and planning
- Flood hazard assessments

NEIGHBORING COMMUNITY SURVEY

The neighboring community survey was sent to the county and municipal governments that border Hudson County due to their proximity to the county and because the effects of hazard events that impact Hudson County would be similar to that of their neighbors. As of Monday, April 21, 2025, no neighboring communities submitted the survey.

2.3.7 Public Outreach

In order to facilitate better coordination and communication between the Planning Partnership and all community members and to involve the public in the planning process, draft documents were made available to the public through a variety of venues, including printed and online format. The Steering and Planning Partnership made the following efforts toward public participation in the development and review of the Plan:

- The public was informed of the hazard mitigation planning effort commencement at the kickoff meeting and through press releases, news articles, and public service announcements released throughout the planning process. Copies of these announcements may be found in Appendix C.
- Media Release were drafted for the County to send to local news sources or to publish through the County.
- A public website is being maintained as another way to facilitate communication between the Steering Committee, planning partnership, public and stakeholders (<https://hudsoncountynjhmp.com/>). The public website contains a project overview, County and local contact information, access to the citizens survey and various stakeholder surveys, and sections of the HMP for public review and comment.
- All participating jurisdictions have been encouraged to distribute press releases on the project, including links to the project webpage and citizen and stakeholder surveys.
- In order to facilitate coordination and communication between the Planning Partnership and citizens and involve the public in the planning process, the Plan Update will be available to the public through a variety of venues. A printed version of the Plan will be maintained at the Hudson County Office of Emergency Management, and Hudson County Division of Planning.



- An online natural hazards preparedness citizen survey was developed to gauge household preparedness that may impact Hudson County and to assess the level of knowledge of tools and techniques to assist in reducing risk and loss of those hazards. The questionnaire asks quantifiable questions about citizen perception of risk, knowledge of mitigation, and support of community programs.
- The questionnaire was posted on the County website and was available through April 21 for public input. All participating jurisdictions have been requested to advertise the availability of the survey via local homepage links, and other available public announcement methods (e.g., Facebook, Twitter, email blasts, etc.). Roughly 19 responses have been collected. A summary of survey results is provided later in this Section with full results provided in Appendix C of this plan.
- Directed response surveys were distributed to Academia, Fire Departments, EMS, Hospitals and Healthcare Organizations, Business and Commercial interests, Utilities and Law Enforcement stakeholders as detailed in the Stakeholder outreach subsection of this chapter. A summary of survey results is provided later in this Section with full results provided in Appendix C of this plan. In addition, an example of the directed stakeholder surveys is presented in Appendix C.
- The Draft Plan was posted to the public website as of **November 23, 2022**, for public review and comment. All public comments were directed to the Hudson County Office of Emergency Management for collection and review by the Steering Committee. All public comments received were forwarded to the appropriate jurisdiction and/or agency and incorporated into the final plan as appropriate.
- Once submitted to NJOEM/FEMA, the Final Plan will be available for public review and comment in the same manner and format as the Draft Plan, as well as in hard-copy format at the following as identified in the Plan Maintenance chapter.

Examples of virtual outreach via websites and social media completed by the Planning Partners are provided in Figure 2-1 and Figure 2-2.

PUBLIC SURVEY SUMMARY

The public survey was developed to assess the level of knowledge of tools and techniques to assist in reducing risk and loss associated with hazards. It asked quantifiable questions about citizen perception of risk, knowledge of mitigation, and support of community programs. The County advertised the survey on their website and social media accounts. As of April 21, 2025, the survey received 19 responses.

Demographically, survey respondents were from four municipalities within Hudson County, with 62.5 percent having lived in the County for 20 years or more.

The most common (50 percent) age of respondents was ages 31 to 40. The majority (73.68 percent) of residents receive information concerning natural hazards through the internet and through TV news. Over half (52.63 percent) receive information through social media or radio news (52.63 percent).

Most residents receive information concerning natural hazards through the internet (73.68%) or TV News (73.68%).



Figure 2-1. Hudson County HMP Webpage and Local Online Outreach





Figure 2-2. Hudson County HMP Webpage and Local Online Outreach



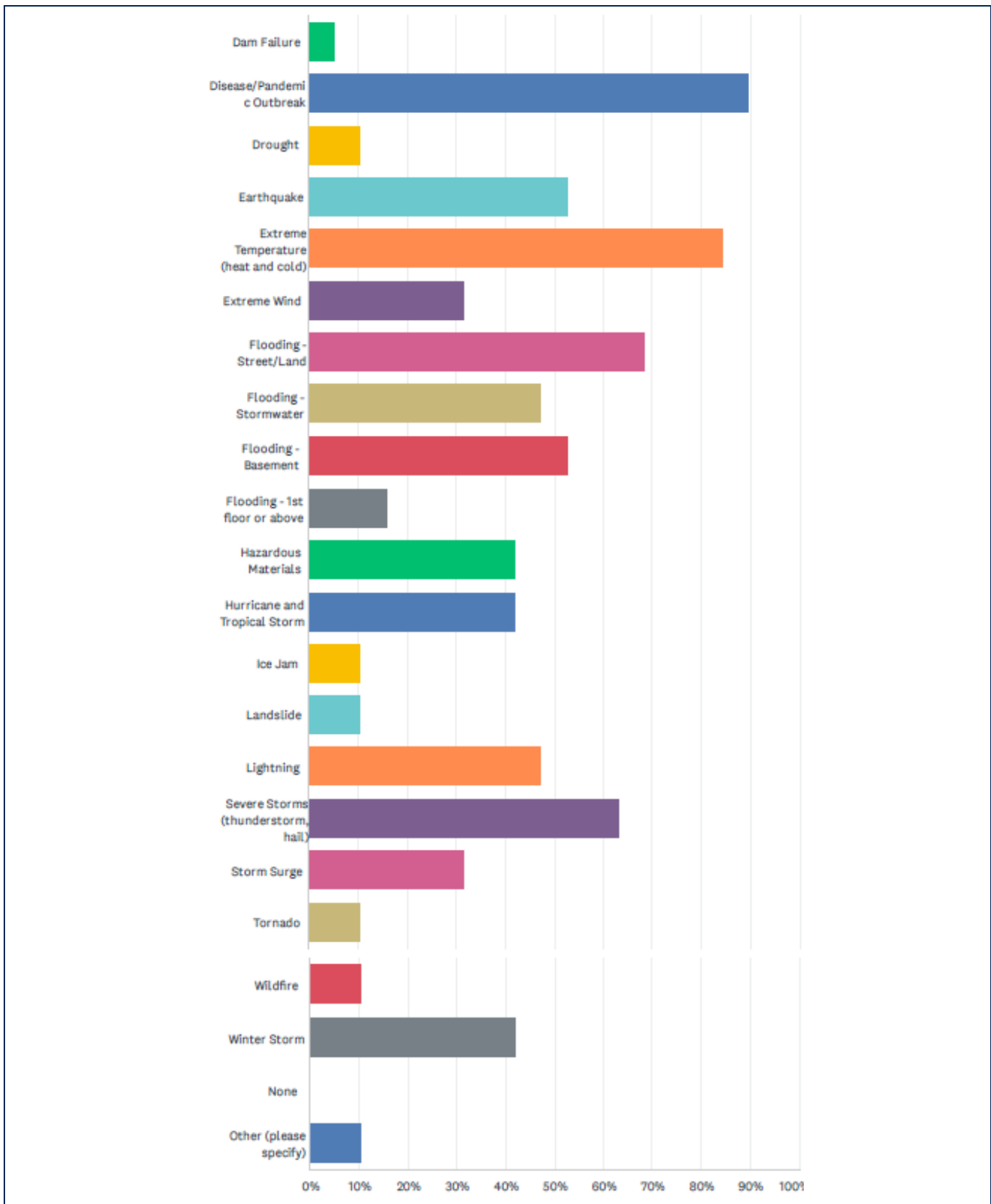
Survey respondents identified the following as the top 5 most frequently occurring natural hazard events within Hudson County in the past 10 years, as shown in Figure 2-3:

- Disease/Pandemic Outbreak (89.47 percent)
- Extreme temperature – heat and cold (84.21 percent)
- Flooding – street/land (68.42 percent)
- Severe Storm (63.16 percent)
- Earthquake (52.63 percent)

The highest hazards of concern (respondents reporting somewhat concerned, very concerned, or extremely concerned) include flooding, and hazardous materials.



Figure 2-3. Most Frequently Experienced Natural Hazard Events in Hudson County





Respondents identified the following as priorities to focus on to reduce the damage due to natural hazards:

- Protecting critical facilities and community lifelines (81.25 percent)
- Preventing development in hazard areas (56.25 percent)
- Protecting and reducing damages to utilities (87.5 percent)
- Strengthening emergency services (75 percent)
- Disclosing natural hazard risks during real estate transactions (93.75 percent)
- Promoting cooperation among public agencies, residents, non-profit organizations, and local businesses (93.75 percent)

Respondents were then given the opportunity to identify specific vulnerabilities in Hudson County or their applicable jurisdiction. Suggestions included reducing flooding along Jersey City roads, backup power for traffic signals, and air quality improvements.

Respondents were asked if their home has been damaged by a hazard event. Slightly less than half of the respondents (47.37 percent) stated that they had experienced property damage to their home from a hazard event including frozen pipes, basement flooding, and water damage to infrastructure. 41.67 percent of those that reported property damage to their home stated that they did report the damage to the local police, fire or emergency management agency. Respondents were also asked what kind of things they have implemented in their home in preparation for hazard events. Half of all respondents stated that they have talked with members in the home about what to do in case of a natural disaster or emergency, while 93.75 percent of respondents have installed smoke detectors throughout the home.

Respondents were also asked about their property's location within the floodplain, and if they have flood insurance. Of the 19 respondents who answered this question, only four (21.05 percent) indicated that their property is located in a designated floodplain. However, five residents (41.67 percent) indicated their home is covered by flood insurance.

The most self-selected jurisdictions respondents indicated that they live in, include the Town of Kearny, Jersey City, Town of Harrison, and the Town of West New York.

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

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

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

The asset inventory data used for the risk assessment is presented in Chapter 3. Details of the source of this data, along with technical information on how the data was used to develop the risk assessment, are presented in Chapter 4, as



well as throughout the hazard profiles in this HMP. The County and participating jurisdictions provided relevant jurisdiction-specific planning and regulatory documents, which were reviewed to identify:

- Existing jurisdictional capabilities
- Needs and opportunities to develop or enhance capabilities, which may be identified in the County or local mitigation strategies
- Mitigation-related goals or objectives, considered in the review and update of the overall Goals and Objectives in Chapter 16
- Proposed, in-progress, or potential mitigation actions to be incorporated into the updated County and local mitigation strategies

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

- Comprehensive/master plans
- Building codes
- Zoning and subdivision ordinances
- Flood insurance studies
- Flood insurance rate maps
- NFIP flood damage prevention ordinances
- Site plan requirements
- Local waterfront revitalization plans
- Stormwater management plans
- Emergency management and response plans
- Land use and open space plans
- Capital plans
- Climate smart community program
- Community rating system
- NJOEM State of New Jersey All-Hazard Mitigation Plan, 2024

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



2.5 Integration with Existing Planning Mechanisms and Programs

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

The capability assessment presented in Chapter 15 (Capability Assessment) provides a summary and description of the existing plans, programs, and regulatory mechanisms at all levels of government (federal, state, county and local) that support hazard mitigation in the County. In the jurisdictional annexes in Volume II, each participating jurisdiction identifies how it has already integrated hazard mitigation into its planning, regulatory and administrative framework (“integration capabilities”) and how it intends to promote this integration (“integration actions”).

A description of continued efforts toward a holistic approach to hazard mitigation is presented in Chapter 17 (Plan Maintenance).

2.6 Plan Adoption

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

All participating jurisdictions will proceed with formal adoption proceedings. Each jurisdiction must submit a copy of its formal adoption resolution or other legal instrument to the Hudson County HMP Coordinator in the Hudson County Office of Emergency Management. Hudson County will forward the executed resolutions to the New Jersey Office of Emergency Services (NJOEM), after which they will be forwarded to FEMA for the record. FEMA allows two options for submitting adoption resolutions:

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

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

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

- **Submittal of adoption resolutions with plan**—All participating jurisdictions provide documentation of plan adoption when the plan is initially submitted to the state for review. After receiving the draft plan from the state, FEMA conducts its review and will approve the plan if it meets all requirements.
- **Approvable pending adoption**—A draft HMP is submitted to the state and FEMA for approval prior to adoption by the jurisdictions. When FEMA determines that the plan as a whole and each participating jurisdiction have met all the requirements except adoption, FEMA will inform the state that the plan is “approvable pending adoption” (APA). After that, once FEMA receives documentation of adoption resolutions from at least one



jurisdiction, the status is changed from APA to approved for the entire plan and for that jurisdiction. Other jurisdictions that participated in the planning process then receive approval once they pass their own adoption resolutions. A jurisdiction with a plan in APA status does not meet the requirement for an approved mitigation plan to apply for and receive funding assistance.

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

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

2.7 Continued Public Involvement

The Planning Partners are committed to the continued involvement of the public in the hazard mitigation process. This Plan update will be posted online (currently at <https://www.hudsoncountynjhmp.com/>), and jurisdictions will be encouraged to maintain links to the plan website. Further, the County will make hard copies of the Plan available for review at public locations as identified on the public plan website.

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

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

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

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

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

Mr. James Woods of the Hudson County Office of Emergency Management has been identified as the ongoing County HMP Coordinator, and is responsible for receiving, tracking, and filing public comments regarding this Plan Update. Contact information is:



Mailing Address: Hudson County Department of Roads and Public Property
Office of Emergency Management
830 Bergen Avenue
Jersey City, NJ 07306

Contact Name: Mr. James Woods

Email Address: jwoods@hcnj.us

Telephone: (201) 369-5200

Further details regarding continued public involvement are provided in Chapter 17 (Plan Maintenance).



3. COUNTY PROFILE

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

3.1 Location

Hudson County is on a peninsula in northeast New Jersey, west of New York City and within the New York Metropolitan area. The County is bordered by Newark Bay and the Passaic and Hackensack Rivers to the west, the Hudson River and New York City to the east, the Kill Van Kull to the south and Bergen County to the north. The Hackensack River runs through the center of the County from north to south. Figure 3-1 shows Hudson County and its municipalities.

With an area of 46.6 square miles, Hudson County is the smallest, most urbanized county in New Jersey. It encompasses residential areas, business districts, commercial and industrial areas, transportation systems, natural features, waterfront areas, and educational facilities. The County's natural and developed features, proximity to water, and dense and growing population lay a foundation for its vulnerability to natural hazards and climate change.

3.2 History

Hudson County is named after Henry Hudson, an English navigator who explored upon arrival in 1609 (Kane and Aiken 2005). At that time, the region was inhabited by bands of the Lenape tribe, including the Hackensack, the Tappan, the Raritan, and the Manhattan. Within a few decades, Dutch and other European settlers had begun trading along the Hudson River, which thrived due to its proximity to New Amsterdam, the Dutch settlement of today's lower Manhattan. During the first century of European exploration and settlement in the region, numerous conflicts arose between the British, Dutch, and Lenape. By the end of the 17th century, the British forced the Dutch to cede control of the area, which it secured through a trade with the Lenape, and annexed it as part of the Province of New Jersey.

The region's proximity to Manhattan fueled its early growth. During the American Revolution and Civil War, the area that is now Hudson County served as a key base for military operations and the supply chain. The area was considered part of Bergen County, specifically the Township of Bergen, until the creation of Hudson County on February 22, 1840 (Snyder 2004). During the American Civil War, multiple Underground Railroad routes ran through present-day City of Jersey City, facilitating the movement of an estimated 60,000 formerly enslaved individuals to freedom (Zinsli 2005).

Hudson County's continued to expand through the 19th and 20th centuries as the region solidified its standing as a trading hub and became an immigration hub. Its proximity to New York City facilitated the early construction of ports and railroad terminals, as well as the establishment of a successful industrial, manufacturing, and shipping-based economy. Further, the County became an attractive destination for the influx of German and Irish immigrants arriving at Ellis Island seeking economic opportunities. As the region's population and economy swelled, development concentrated along the riverfront and transit infrastructure as it was constructed, including the North River Tunnels and Hoboken Terminal. Manufacturing and shipping continued to power the County's economy through the First and Second World Wars.



Figure 3-1. Hudson County Planning Area





After the Second World War, the region witnessed some population decline and turnover in businesses as many returning soldiers took advantage of the federal GI Bill to construct new homes in the nearby suburbs. As a result, housing and economic opportunities opened in Hudson County, making it a desirable location for many Latin American immigrants in the 1960s and 1970s, particularly Cubans fleeing the Cuban Revolution (García 1996). By the 2000s, approximately 40 percent of Hudson County residents were foreign-born (Roberts 2010).

Today, the County's population density is the highest in the state and the sixth highest in the nation. Its ethnically and culturally diverse population has contributed to its dynamic economy, which has grown since the 2000s through revitalization efforts and expansions of the technology, finance, and healthcare sectors (4Ward Planning 2016).

3.3 Jurisdictions Within the County

The 12 incorporated municipalities in Hudson County are as follows:

- City of Bayonne
- Borough of East Newark
- Town of Guttenberg
- Town of Harrison
- City of Hoboken
- City of Jersey City
- Town of Kearny
- Township of North Bergen
- Town of Secaucus
- City of Union City
- Township of Weehawken
- Town of West New York

The Cities of Hoboken and Jersey City make up the County's urbanized core. The northern area of the County is made up of five densely populated communities: the Towns of Guttenberg and West New York, Townships of North Bergen and Weehawken, and the City of Union City. The City of Bayonne makes up the County's southern peninsula. The western portion of Hudson County contains smaller, less densely populated areas and includes the Borough of East Newark and the Towns of Harrison and Kearny. The northwestern area of the County consists of the Town of Secaucus.

There are multiple special districts in the County that provide services to different parts of the region. The following entities participated in this planning process: Jersey City Municipal Utilities Authority, Kearny Municipal Utilities Authority, North Bergen Municipal Utilities Authority, North Hudson Sewage Authority, and Secaucus Municipal Utilities Authority.

3.4 Physical Setting

3.4.1 Surface Waters

Hudson County's primary surface waters are the Hudson River and its tributaries. The Hudson River is a tidal estuary and provides critical water resources to the region (NJDEP 2009). Smaller water bodies, such as the Hackensack and Passaic Rivers, cross through the region. Cumulatively, these resources provide water for drinking, irrigation, industrial and manufacturing uses, and ecological purposes. Wetlands and marshes along these waterways serve as wildlife habitats and provide ecosystem services such as water filtration and flood or wave attenuation (Schwarz 2006).

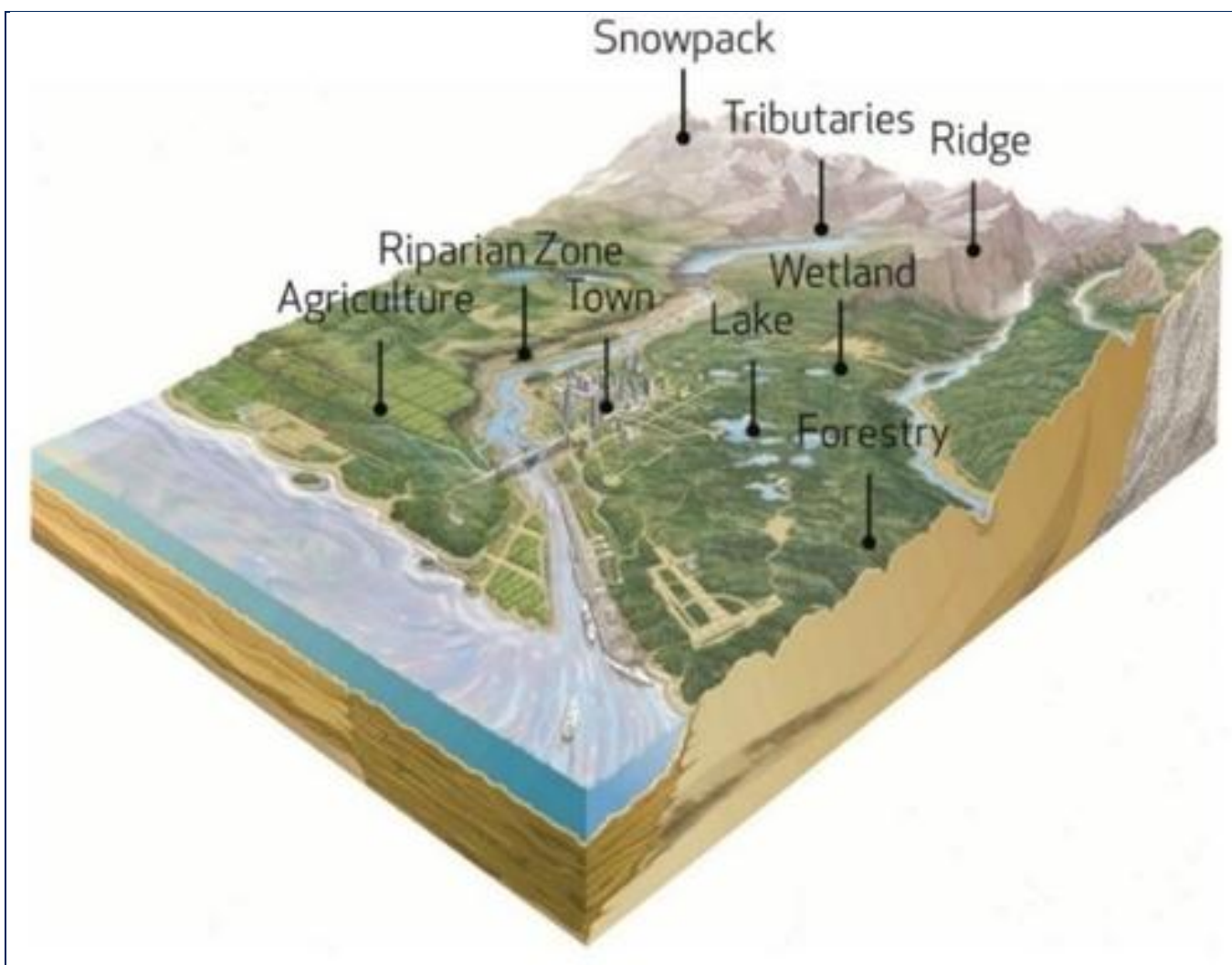


Urbanization can have a great effect on local water resources. Historically, Hudson County's waterways have been polluted by development and industrial activities initiated before water protection legislation was enacted. As natural waterways or marshes are filled, the rate of stormwater runoff can increase. Less stormwater is able to soak into the ground when sidewalks, roads, parking lots, and rooftops block this infiltration. This means a greater volume of water can reach the waterway more quickly and less of that water is able to infiltrate to groundwater. This can lead to more flooding after storms, with the potential of a reduced flow in streams and rivers during dry periods.

3.4.2 Watersheds

As shown in Figure 3-2, 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 acts as a drain to the waterway. Drainage basins generally refer to large watersheds that encompass the watersheds of many smaller rivers and streams.

Figure 3-2. Watershed Hydrological System

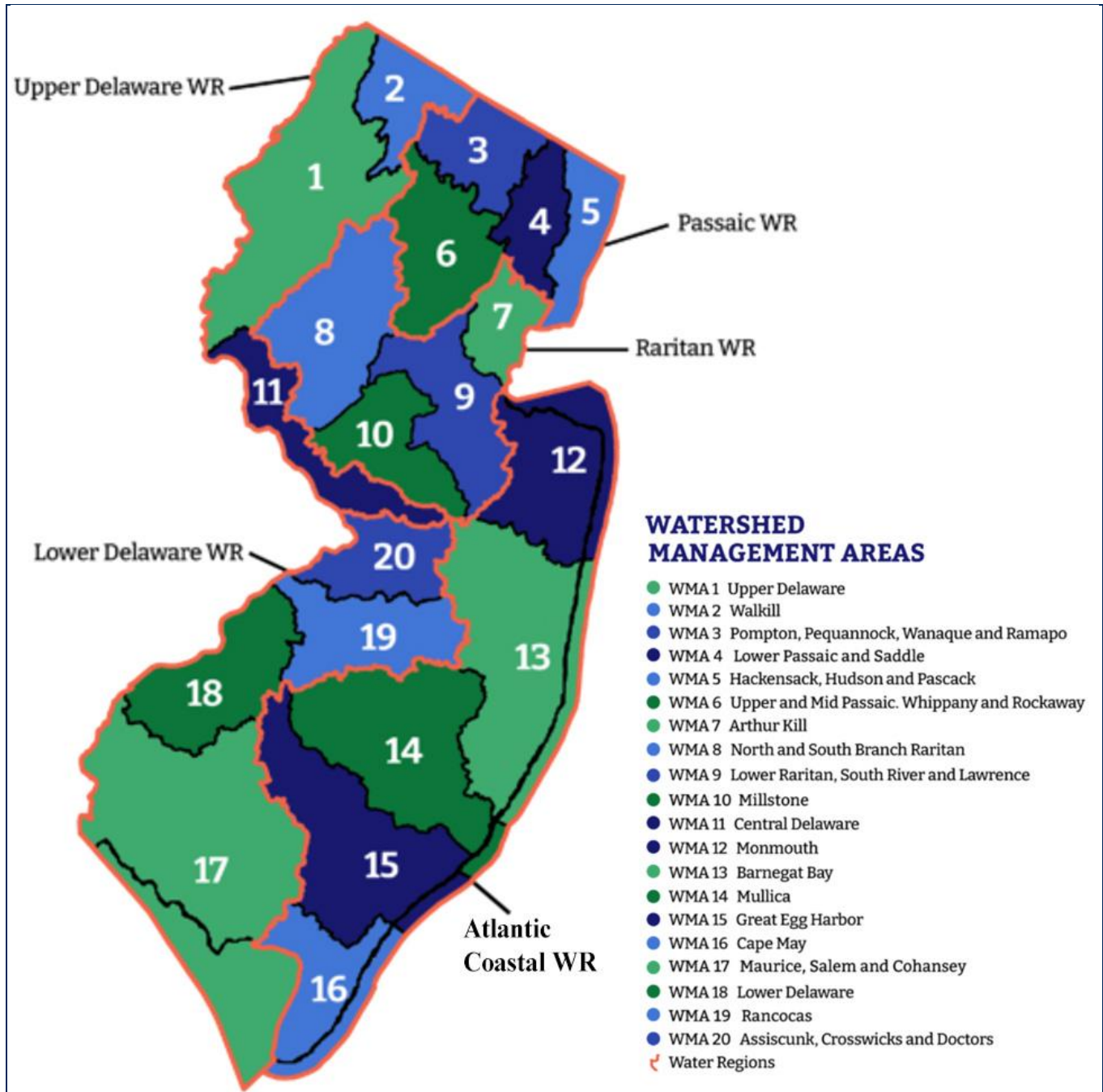


Source: State of New Jersey All-Hazard Mitigation Plan 2024



New Jersey is divided into 20 Watershed Management Areas (WMA), which are made up of smaller watersheds, as shown in Figure 3-3. Hudson County intersects with two WMAs: Lower Passaic Saddle River (WMA 4) and the Hackensack-Hudson-Pascack (WMA 5).

Figure 3-3. Watershed Management Areas in New Jersey



Source: (Cucinotta 2023)



WATERSHED MANAGEMENT AREA 4: LOWER PASSAIC 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 comprise WMA 4: the Lower Passaic River Watershed and Saddle River Watershed. Land in this watershed is extensively developed and contains many older cities and industrial centers including Newark, Paterson, Clifton, and East Orange (NJOEM 2024).

WATERSHED MANAGEMENT AREA 5: HACKENSACK-HUDSON-PASCACK

WMA 5 has a drainage area of approximately 165 square miles, which includes parts of Hudson and Bergen Counties. WMA 5 is comprised of three watersheds: Hackensack River Watershed, Hudson River Watershed and Pascack Brook Watershed. Although WMA 5 is the most populated of all the WMAs, approximately 50 percent of the land is still undeveloped; more than 30 percent is residential development. The remaining developed land is commercial/industrial use. Much of the lower Hackensack River Watershed is tidal marsh known as the Hackensack Meadowlands District (NJOEM 2024).

3.4.3 Topography and Geology

The topography of Hudson County varies from gentle rolling hills to flat lowland areas. Vegetation consists of planted lawns, trees, and shrubbery and is typical of residential, commercial areas (FEMA 2013). Hudson County is located within the Piedmont Province, one of the four major physiographic regions of New Jersey. This province has an area of approximately 1,600 square miles and makes up about one-fifth of the state. The Piedmont Province is mainly underlain by slightly folded and faulted sedimentary rocks of the Triassic and Jurassic age and igneous rocks of the Jurassic age. In Hudson County, there are small bands of highly metamorphosed rocks ranging in age from Middle Proterozoic to Cambrian (NJGS 2003).

According to the New Jersey Geological Survey (NJGS), the Piedmont Province is a low rolling plain divided by a series of higher ridges. The width varies from approximately 16 miles near the New York border to over 30 miles at the Delaware River. The most prominent feature of the eastern portion of the province is the Palisades, which has a maximum elevation of 547 feet near Closter and provides views of the Hudson River and New York City. Near Newark Bay, toward its boundary with the Coastal Plain Province, the elevation is at sea level (NJGS 2003).

3.4.4 Climate

CURRENT CLIMATE

Hudson County is in New Jersey's Central climate zone, which extends northeast to southwest from New York Harbor and the Lower Hudson River to the bend of the Delaware River near Trenton. This region has many urban locations with large amounts of air pollutants produced by the high volume of automobile traffic and industrial processes. Hudson County is particularly vulnerable to heat island effect because of its densely urbanized landscape (Shope, et al. 2023). The concentration of buildings and paved surfaces serve to retain more heat than surrounding suburban and rural areas, resulting in much higher localized temperatures in urban areas that elevate the risk for heat-related illnesses (EPA 2024).



The climate of Hudson County is characteristic of the Mid-Atlantic and is variable with cold, dry winters and warm, humid summers. Over the past 30 years, Hudson County has received an average of 47.3 inches of precipitation each year, and the average annual temperature is 54.9 degrees Fahrenheit (°F) (ONJSC 2024). Seasonally, Hudson County experiences the highest maximum temperature during July, averaging 86.3°F, and the lowest minimum temperature in January, averaging below freezing at 25.5°F.

PAST AND PROJECTED CLIMATE CHANGE

Temperature

Due to the increase in greenhouse gas concentrations, New Jersey has experienced a 3.5 °F increase in average temperature since the end of the 1890s, which is faster than the rest of the Northeast region (2 °F) and the world (1.5 °F) (NJDEP 2023). This warming trend is expected to continue. By 2050, temperatures in New Jersey are expected to increase by 4.1 °F to 5.7 °F. Thus, New Jersey can expect to experience an average annual temperature that is warmer than any to date (low emissions scenario), and future temperatures could be as much as 10 °F warmer (high emissions scenario). The state can also expect that by the middle of the 21st century, 70 percent of summers will be hotter than the warmest summer experienced to date.

The increase in temperatures is expected to be felt more during the winter (December, January, and February), resulting in less intense cold waves, fewer sub-freezing days, and less snow accumulation. Changes in winter temperatures could result in a change in the frequency of ice jam events (NJDEP 2020).

Precipitation

As temperatures increase, the atmosphere can hold more water vapor, which leads to a greater potential for precipitation. Currently, New Jersey receives an average of 46 inches of precipitation each year. Since the end of the 20th century, the state has experienced slight increases in the amount of precipitation it receives each year, and over the last 10 years there has been a 7.9 percent increase. By 2050, annual precipitation in the state could increase by 4 percent to an 11 percent overall increase.

A warmer atmosphere means storms have the potential to be more intense and occur more often. In New Jersey, extreme storms typically include nor'easters, snowstorms, spring and summer thunderstorms, tropical storms, and occasional hurricanes. Over the last 50 years, storms that resulted in extreme rain increased by 71 percent in New Jersey, which is a faster rate than anywhere else in the United States (NJDEP 2020).

By the end of this century, heavy precipitation events are projected to occur 2 to 5 times more often and with more intensity than in the last century. Also, small decreases in the amount of precipitation may occur in the summer months, resulting in greater potential for more frequent and prolonged droughts. New Jersey could also experience an increase in the number of flood events (NJDEP 2020). Most of the additional precipitation is expected to come during the winter (NOAA 2023).

3.4.5 Land Cover

Historically, the area containing Hudson County featured forests, wetlands, and natural meadows that supported diverse species of wildlife. Hudson County's land cover has transformed dramatically since the arrival of European



explorers in the early 17th century as the region rapidly urbanized and industrialized. In this process, many wetlands and marshes were filled, forests and open spaces were cleared, and agricultural lands were sold or repurposed for denser uses (NJFS 2009).

As demonstrated by Table 3-1, nearly three-quarters of Hudson County is urban area, which includes residential, industrial, transportation, and recreational land. Under 5 percent of land is barren or forested, and there is no agricultural cover in the County. As a peninsula, Hudson County and its development patterns are affected by the presence of wetlands, which occupy 4 percent of the area. The area identified as wetland has decreased consistently since 2007, from 1,433 acres to 1,297 acres. The distribution of land cover is shown in Figure 3-4.

Table 3-1. Land Cover in Hudson County

Land Cover Category	2007 Data		2012 Data		2020 Data	
	Acreage	Percent	Acreage	Percent	Acreage	Percent
Agriculture	0	0%	0	0%	0	0%
Barren	1,258.8	2.8%	1,493.9	2.9%	1,468	4.5%
Forest	1,868.8	4.2%	1,759.0	3.4%	1,564	4.7%
Urban Area	25,052.0	56.7%	24,518.2	47.5%	23,852	72.4%
Wetlands	1,433.6	3.2%	1,397.3	2.7%	1,297	3.9%

Source: NJDEP 2020

Note: Urban land includes residential, industrial, transportation, and recreational land.

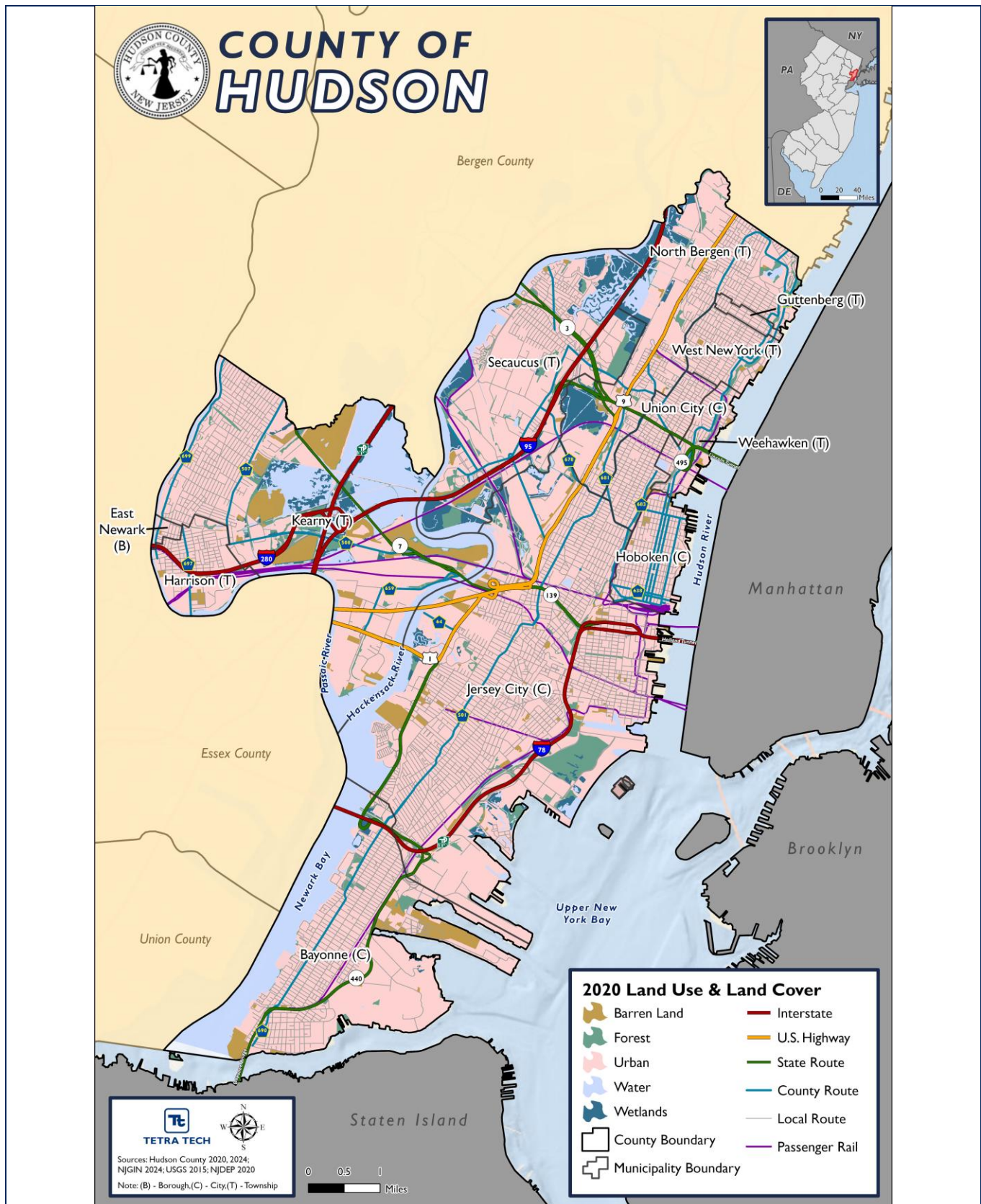
Hackensack Meadowlands District

-Four communities in Hudson County are in the Hackensack Meadowlands District (Meadowlands), a large ecosystem of wetlands in northeastern New Jersey: Jersey City, Kearny, North Bergen, and Secaucus. The Meadowlands stretch along the Hackensack and Passaic Rivers as they flow into Newark Bay. Tributaries of the Hackensack River (Sawmill Creek, Berrys Creek, and Overpeck Creek) also make up the Meadowlands. This area in New Jersey consists of 30.3 square miles of open, undeveloped space, in addition to developed areas. The Meadowlands are home to more than 700 plant and animal species including several rare and threatened species.

The Hackensack Meadowlands Development Commission was created in 1969 to focus on environmental protection, economic development, and solid waste management (NJOEM 2024). In February 2015, the Hackensack Meadowlands Agency Consolidation Act merged the Commission into the North Jersey Sports Exposition Authority (NJSEA). The merger did not change the mandates for the Meadowlands (New Jersey Sports & Exposition Authority 2019).



Figure 3-4. Land Cover in Hudson County





3.5 Land Use

3.5.1 Current Land Use

The County's most recent update to its master plan, the 2017 Hudson County Master Plan Re-examination Report, documented the County's land use data and trends, covering topics such as housing, circulation, and land use. Hudson County's land area includes residential, commercial, industrial, public and semi-public, parks and open space, vacant land, streets and rights-of-way, and water. As shown in Table 3-2, most (86 percent) of the County's properties are designated as residential, but all residential land occupies just 40 percent of land area, which demonstrates Hudson County's urban density. About a fifth of the County's area is designated as agricultural, but that accounts for less than 1 percent of all properties. Commercial and industrial uses collectively occupy 7 percent of land area (5.2 percent commercial and 1.8 percent industrial) and contain 5 percent of all properties (4.6 percent commercial and 0.3 percent industrial).

Table 3-2. Hudson County 2020 Land Use Classification

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

Source: Hudson County Department of Planning and Business Opportunity Division of Planning 2020

3.5.2 Land Use Trends

In New Jersey, land use regulatory authority is vested in municipalities through home rule. However, many development and preservation issues transcend local political boundaries. Federal guidance for hazard mitigation planning (44 CFR 201) requires that communities consider land use trends, which can impact the need for, and priority of, mitigation options over time. Land use trends can also significantly affect vulnerability to various hazards and the potential impacts from hazard events. For example, significant development in a hazard area increases the building stock and population exposed to that hazard.



RESIDENTIAL AND COMMERCIAL

The majority of homes in Hudson County (56 percent) were built prior to 1970, including 30 percent of the county's homes constructed before 1940 (US Census Bureau 2022). The median year for all structures built is 1964, during the housing construction boom of the 1950s and 1960s. During that time, approximately 30,000 new housing units were added each decade. After the 1960s, housing construction declined, but this trend reversed in the 2000s with more than 35,000 housing units being built, especially in the Cities of Hoboken and Jersey City (Hudson County Planning Board 2017). As of 2022, 16 percent of households had moved into their current home between 2000 and 2009 (US Census Bureau 2022).

The Hudson County Master Plan Re-examination Report emphasizes mixed-use development and re-development, which is more conducive to economic growth and increasing access to employment, educational facilities, commercial facilities, entertainment, and recreation facilities. Other objectives include retrofitting to accommodate access and functional needs and refurbishment of older structures to rejuvenate neighborhoods and attract new residents. Another goal is the integration of land use planning with transportation planning with a specific focus on pedestrian and bicycle accessibility and infrastructure. This goal is to increase use of public transportation options and reduce the congestion on roadways (Hudson County Planning Board 2017).

The Hudson County Master Plan Re-examination notes the importance of increasing household resiliency and reducing the impacts of natural hazards on buildings and people. Fifteen percent of the County's population was exposed to storm surges during Hurricane Sandy, and the New Jersey Department of Community Affairs' Action Plan identified 4,407 housing units with major or severe damage because of the event. Of the buildings identified in the Action Plan, 84 percent (3,702) were in the Cities of Bayonne, Hoboken, and Jersey City. Over 60 percent of housing units damaged in Sandy were owner-occupied. The total estimated damage to households in Hudson County from Hurricane Sandy exceeded \$25 million. Further compounding the impacts were the number of socially vulnerable individuals such as those aged 65 and older and individuals with low-income. Directing new residential construction out of the floodplain can reduce the impacts of flooding. Identifying locations for interim housing may be important to house County residents should their primary dwelling be uninhabitable from damage sustained during flood or storm events (Hudson County Planning Board 2017).

INDUSTRIAL

Most industrial areas in Hudson County are located along the southern waterfront of the Cities of Jersey City and Bayonne, between Routes 1 and 9 and the New Jersey Turnpike, the Township of North Bergen and City of Jersey City, the southern end of the City of Harrison, the southern end of the City of Secaucus, and south of Belleville Turnpike and east of Schuyler Avenue in the City of Kearny. Smaller industrial areas are also found throughout Hudson County. Industries in the County include manufacturing, wholesale trade, transportation/warehousing and private sector (Hudson County Planning Board 2017).

The industrial land use category also includes ports. Development at the ports continues to grow, driven by growth in global trade. Major port infrastructure projects include deepening at the Global Marine Terminal; improved efficiency at Global Container Terminals in Bayonne; redevelopment of Greenville Yards; Bayonne Bridge Navigational Clearance Project and the Roadway Capital Plan from Port Authority of New York and New Jersey for an improved road network into Port Jersey (Hudson County Planning Board 2017).



Hudson County has been affected by national downturns in manufacturing, wholesale trade, and transportation/warehousing establishments. Although large industrial development has occurred in Hudson County, there has been a slight decrease in industrial uses (Hudson County Planning Board 2017). The region may experience industrial growth in the future. In 2024, the Federal Transit Administration committed to providing \$600 million annually to support the \$16-billion Gateway project to build an additional rail tunnel between Hudson County and New York City (McGeehan 2024).

PARKS AND OPEN SPACE

Open space helps balance the urban and the natural environments, provide recreational opportunities for residents, improve air and water quality, and enhance social cohesion. There are nine parks in the County Park System: Columbus Park, James J. Braddock Park, Laurel Hill Park, Lincoln Park, Mercer Park, Stephen G. Gregg Bayonne Park, Washington Park, West Hudson Park, and the 14th Street Viaduct (Hudson County Planning Board 2017). The County is also home to the state-owned Liberty State Park, which offers a view of the Manhattan skyline, the Statue of Liberty, and Ellis Island as well as a promenade and nature center (NJDEP n.d.).

Greenways, or linear open space systems connecting parks and neighborhoods through trails, scenic roads and bikeways are an important and vital component to the County's open space. The Hudson County Open Space Trust Fund assists in creating, enhancing, and maintaining parks throughout the County.

AGRICULTURE

There is limited agricultural land use in Hudson County. The County is under the jurisdiction of the Passaic-Hudson-Essex Soil Conservation District.

3.6 Population and Demographics

3.6.1 Current Population

This plan references two U.S. Census Bureau datasets to characterize Hudson County's population and demographic characteristics: the 2022 American Community Survey (ACS) 5-Year Estimate and the 2020 Decennial Census. Unless otherwise noted, the figures in the following section refer to the Decennial Census data products.

Based on the 2010 and 2020 Decennial Censuses, Hudson County witnessed a 14 percent increase in population, from 634,000 to 725,000 residents. Based on ACS data, Hudson County has grown 4.7 percent since the last plan update (US Census Bureau 2022, US Census Bureau 2017). Hudson County is the most densely populated county in New Jersey, with an overall population density of 16,740 persons per square mile. The density varies throughout the county, in part due to the region's industrial and commercial development patterns, as depicted in Figure 3-5.

The most populous municipality in the County is Jersey City, with 292,500 residents or more than 40 percent of all County residents. Jersey City is also the largest of all municipalities, occupying 14.6 square miles. The least populated municipality is also the smallest one: the Borough of East Newark, home to just under 2,600 people and occupying just 0.1 square miles. Table 3-3 shows population by municipality based on the 2020 Decennial Census.



Figure 3-5. Population Density in Hudson County

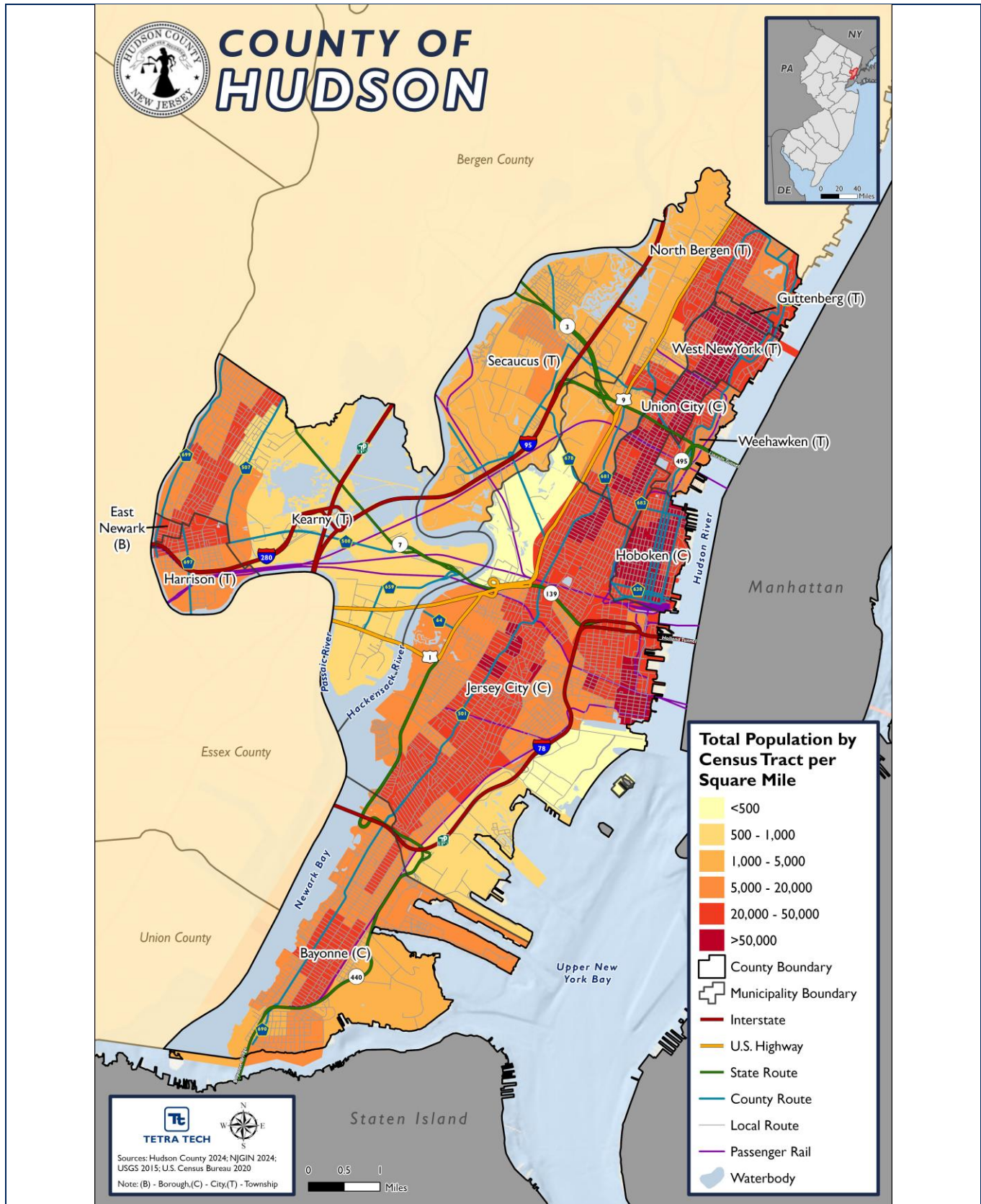


**Table 3-3. Hudson County Population by Municipality**

Jurisdiction	Population	% of County total
Bayonne (C)	71,686	9.9%
East Newark (B)	2,594	0.4%
Guttenberg (T)	12,017	1.7%
Harrison (T)	19,450	2.7%
Hoboken (C)	60,419	8.3%
Jersey City (C)	292,449	40.3%
Kearny (T)	41,999	5.8%
North Bergen (T)	63,361	8.7%
Secaucus (T)	22,181	3.1%
Union City (C)	68,589	9.5%
Weehawken (T)	17,197	2.4%
West New York (T)	52,912	7.3%
Hudson County (Total)	724,854	100.0%

Source: U.S. Census Bureau 2020

Note: (B) = Borough; (C) = City; (T) = Township

3.6.2 Population Trends

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

Hudson County experienced an overall population decline in the latter half of the 20th century, but this trend has reversed over the past several decades in part due to strong housing construction and significant immigration (HCOEM 2020). As shown in Table 3-4, Hudson County has grown steadily since 2000, peaking with the 2020 Decennial Census. Based on the 2022 ACS estimates, Hudson County may have experienced some population loss, but this discrepancy may be attributable to the collection and analysis methods used by the ACS versus the Decennial Census, and the 2020 Decennial data are believed to be sufficient and appropriate to support the risk assessment and mitigation planning efforts of this project.

3.6.3 Role of Immigration

The physical, economic, and social structure of Hudson County has been largely influenced by the number of immigrants who have settled in the area over the past 150 years. Hudson County has historically been home to immigrants entering the U.S. due to the availability of jobs, affordable housing, and freedom. Throughout the 19th century, immigrants made up most of Hudson County's population and labor force. During World War II, the need for factory workers increased, which brought in new immigrants to the area to fill these positions.

**Table 3-4. Hudson County Population Change 2000 to Present**

Jurisdiction	2000	2010	2020	2022
Bayonne (C)	61,842	63,024	71,686	70,497
East Newark (B)	2,377	2,406	2,594	2,718
Guttenberg (T)	10,807	11,176	12,017	11,765
Harrison (T)	14,424	13,620	19,450	19,217
Hoboken (C)	38,577	50,005	60,419	58,754
Jersey City (C)	240,055	247,597	292,449	287,899
Kearny (T)	40,513	40,684	41,999	41,157
North Bergen (T)	58,092	60,773	63,361	62,066
Secaucus (T)	15,931	16,264	22,181	21,470
Union City (C)	67,088	66,455	68,589	67,258
Weehawken (T)	13,501	12,554	17,197	16,790
West New York (T)	45,768	49,708	52,912	52,438
Hudson County (Total)	608,975	634,266	724,854	712,029

Source: (US Census Bureau 2022, US Census Bureau 2010, US Census Bureau 2000, US Census Bureau 2020)

Note: (B) = Borough; (C) = City; (T) = Township

When Congress changed the immigration law in 1965, more immigrants arrived at the Hudson County and changed the ethnic and racial composition of the area. Immigrants have been behind the different industries and the development pattern in Hudson County over the years and continue to drive economic and population growth.

Today, 43 percent of County residents are foreign born (US Census Bureau 2022). In the Borough of East Newark, nearly two-thirds (65 percent) of residents were born outside of the country, the largest share of any of the County's municipalities. Jersey City has the largest number of foreign-born residents (118,527). As shown Table 3-5, nearly 15 percent of Hudson County residents are foreign-born and entered the country in 2010 or later. The Towns of Harrison and West New York have the highest shares of population that are foreign-born and entered the country since 2010 (21 percent and 20 percent, respectively).

3.6.4 Socially Vulnerable Populations

Social vulnerability is the susceptibility of an individual or social group to the negative impacts of natural hazards and disasters due to characteristics that influence one's ability to prepare, respond, cope, or recover from a disaster. These factors include, but are not limited to, financial circumstances, health, age, functional status, the ability to communicate effectively, presence of chronic or terminal illness, or an access and functional need (FEMA 2019). Historical discriminatory policies such as redlining have also placed communities of color and low-income communities at more risk for experiencing impacts from disasters.

**Table 3-5. Foreign-Born Population in Hudson County**

Jurisdiction	Foreign Born Population		Foreign Born Entered U.S. 2010 or Later	
	Population	% of Total Population	Population	% of Total Population
Bayonne (C)	21,193	30.1%	5,819	8.3%
East Newark (B)	1,773	65.2%	502	18.5%
Guttenberg (T)	6,474	55.0%	2,222	18.9%
Harrison (T)	10,335	53.8%	4,034	21.0%
Hoboken (C)	11,567	19.7%	4,454	7.6%
Jersey City (C)	118,527	41.2%	48,695	16.9%
Kearny (T)	18,881	45.9%	4,069	9.9%
North Bergen (T)	31,592	50.9%	8,041	13.0%
Secaucus (T)	9,566	44.6%	3,702	17.2%
Union City (C)	36,729	54.6%	10,822	16.1%
Weehawken (T)	6,536	38.9%	2,295	13.7%
West New York (T)	30,983	59.1%	10,409	19.9%
Hudson County (Total)	304,156	42.7%	105,064	14.8%

Source: (US Census Bureau 2022)

Note: (B) = Borough; (C) = City; (T) = Township

Populations who may be disproportionately impacted by disaster include the following groups:

- Members of the LGBTQ+ community
- Renters
- People of color
- Service workers and migrant laborers
- Tribal and first nation communities
- Women
- Populations over the age of 65 or under the age of 5
- Underserved communities with a low socioeconomic status
- Populations with limited cognitive or physical abilities
- Individuals experiencing homelessness or displacement
- Institutionalized populations, such as those in prisons and nursing homes, or individuals going through reentry

Table 3-6 presents population statistics for five key socially vulnerable populations for each municipality in the County, based on 2022 ACS 5-Year Estimates. The distributions of the general population density (persons per square mile) for these five metrics of social vulnerability are shown in Figure 3-6.

**Table 3-6. Hudson County Population and Demographic Statistics 2020 Census, American Community Survey 5-Year Estimates**

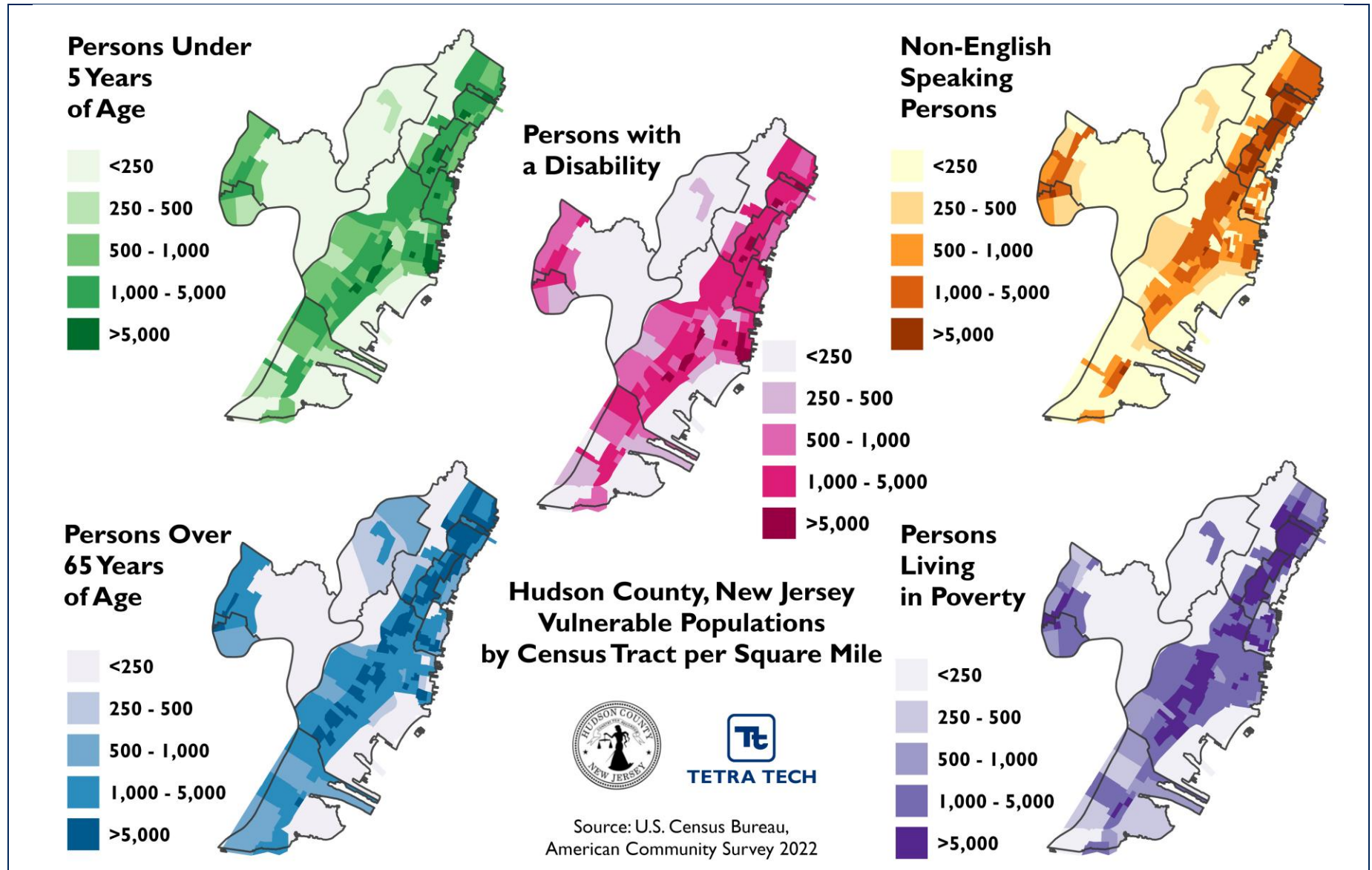
	Total	65 and Older		5 and Younger		Non-English-Speaking		Disability		Below Poverty Level	
	Population	Population	% of Total	Population	% of Total	Households	% of Total	Population	% of Total	Population	% of Total
Bayonne (C)	71,686	9,962	13.9%	5,109	7.1%	5,659	7.9%	6,861	9.6%	8,417	11.7%
East Newark (B)	2,594	308	11.9%	106	4.1%	474	18.3%	209	8.1%	638	24.6%
Guttenberg (T)	12,017	1,618	13.5%	811	6.7%	2,017	16.8%	1,337	11.1%	1,876	15.6%
Harrison (T)	19,450	2,064	10.6%	1,183	6.1%	4,097	21.1%	1,445	7.4%	2,718	14.0%
Hoboken (C)	60,419	3,859	6.4%	4,100	6.8%	2,612	4.3%	3,075	5.1%	4,511	7.5%
Jersey City (C)	292,449	32,671	11.2%	20,476	7.0%	29,070	9.9%	22,396	7.7%	43,134	14.7%
Kearny (T)	41,999	5,469	13.0%	2,698	6.4%	5,625	13.4%	3,196	7.6%	4,264	10.2%
North Bergen (T)	63,361	10,501	16.6%	3,839	6.1%	10,952	17.3%	6,128	9.7%	7,347	11.6%
Seacaucus (T)	22,181	3,354	15.1%	1,056	4.8%	2,151	9.7%	1,951	8.8%	1,122	5.1%
Union City (C)	68,589	8,157	11.9%	4,094	6.0%	16,626	24.2%	7,690	11.2%	13,530	19.7%
Weehawken (T)	17,197	2,046	11.9%	999	5.8%	1,264	7.3%	1,064	6.2%	1,252	7.3%
West New York (T)	52,912	6,655	12.6%	2,376	4.5%	12,947	24.5%	5,822	11.0%	10,737	20.3%
Hudson County (Total)	724,854	86,664	12.0%	86,664	12.0%	93,494	12.9%	61,174	8.4%	99,546	13.7%

Source: U.S. Census Bureau 2022 ACS Vulnerable Population Totals; U.S. Census Bureau 2020

Note: (B) = Borough; (C) = City; (T) = Township



Figure 3-6. Vulnerable Populations by Census Tract per Square Mile





AGE

Children are considered vulnerable to hazard events because they are dependent on others to safely access resources during emergencies and may experience increased health risks from hazard exposure. People older than 65 are more likely to experience health or medical conditions that contribute to a lack the physical and economic resources necessary for response to hazard events, making them more likely to suffer adverse impacts that impede recovery. Those living on their own may have more difficulty evacuating their homes. These individuals are also more likely to live in senior care and living facilities where emergency preparedness occurs at the discretion of facility operators. According to the 2022 ACS 5-Year Estimates, 46,847 (6.5 percent) of the County's population is under the age of 5 and 86,664 people (12 percent) of the County's total population were age 65 and older.

LANGUAGE PROFICIENCY

Individuals who are not fluent or working proficiency in English are vulnerable because they may have difficulty with understanding information being conveyed to them. Cultural differences can also add complexity to how information is being conveyed to populations with limited proficiency of English (Centers for Disease Control and Prevention 2025). According to 2022 ACS 5-Year Estimates, 93,494 (12.9 percent) of the County's population over the age of 5 primarily speak a language other than English at home and are reported to speak English "less than very well."

INCOME BELOW THE POVERTY LEVEL

Individuals living below the federal poverty line are inherently more at risk of experiencing debilitating impacts from the natural and human-caused hazards and threats identified in this plan because they may not have the financial means to adequately prepare, respond and recover. For example, FEMA recommends that families and individuals keep a small cash reserve in case of disaster. For those that struggle to put food on the table, this can be a difficult, or even impossible, feat. Insurance – such as home insurance or flood insurance - is another positive indicator of faster recovery from disasters. However, many living in poverty may not have the resources to prioritize insurance. The 2022 ACS 5-Year Estimates identified 99,546 individuals (13.7 percent of the total county population) living below the poverty level.

While the poverty threshold is typically used as a standard for identifying low-income populations, some households above the poverty threshold still struggle financially, making them socially vulnerable to hazard events. Therefore, this HMP also considers data available from United for ALICE (ALICE stands for Asset Limited, Income Constrained, Employed). This dataset identifies households with income above the federal poverty threshold but below the basic cost of living. It represents the growing number of families who are unable to afford the basics of housing, childcare, food, transportation, health care, and technology (United For ALICE 2024). Costs associated with hazard events could exceed the financial capacity of these households, making them highly vulnerable to hazard events. According to 2022 Point-in-Time-Data from ALICE, 21 percent of the 304,526 households in Hudson County are ALICE households (compared to the state average of 26 percent). See Table 3-7 for ALICE data by jurisdiction.

**Table 3-7. Hudson County ALICE Data**

Name	# of Households Below ALICE	% Below ALICE Threshold
Bayonne (C)	27,198	38%
East Newark (B)	846	48%
Guttenberg (T)	4,973	41%
Harrison (T)	8,531	36%
Hoboken (C)	27,879	20%
Jersey City (C)	119,278	35%
Kearny (T)	14,703	33%
North Bergen (T)	23,959	40%
Secaucus (T)	8,607	23%
Union City (C)	25,610	49%
Weehawken (T)	7,862	24%
West New York (T)	20,608	43%
Hudson County (Total)	63,893	21%

Source: United For ALICE 2024

DISABILITIES

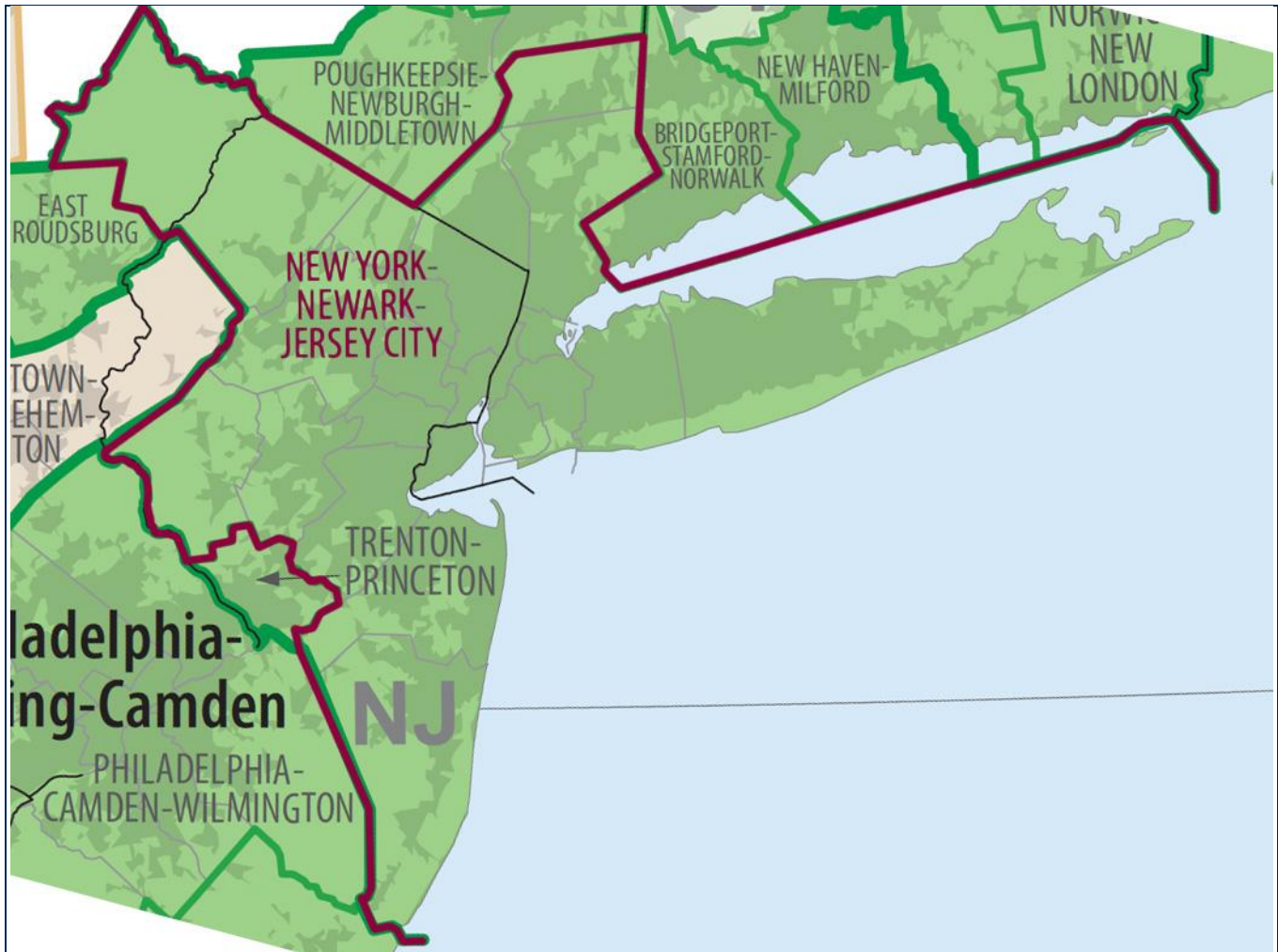
A disability is any impairment of the body or mind that makes it more difficult for the person with the condition to do certain activities and interact with the world around them (CDC 2024). Cognitive impairments can increase the level of difficulty that individuals might face during an emergency and reduce an individual's capacity to receive, process, and respond to emergency information or warnings. Individuals with physical or sensory disabilities can face issues of mobility, sight, hearing, or reliance on specialized medical equipment. Additional accommodations may be necessary for individuals with disabilities and access and functional needs during the response and recovery phases of a disaster. According to the 2022 ACS 5-Year Estimates, 61,174 (8.4 percent) percent residents of Hudson County are living with a disability.

3.7 Economy

A healthy economy promotes job growth, high employment rates, and more income, all which give residents the ability to prepare for and quickly recover from disasters when they occur. Hudson County is in the New York-Newark-Jersey City Metropolitan Statistical Area (MSA), as shown in Figure 3-7. An MSA is an area defined by the U.S. Office of Management and Budget (OMB) that is linked by significant social and economic interactions and has at least one urbanized area with a minimum population of 50,000 people (U.S. Census 2008). The New York-Newark-Jersey City MSA is the largest in the nation, home to nearly 20 million people (U.S. Bureau of Economic Analysis 2024).



Figure 3-7. New York-Newark-Jersey City MSA



Source: (U.S. Census Bureau 2020)

Gross domestic product (GDP) is an estimate of the value of the goods and services produced in an area and can be used to compare the size and growth of a region's economy. In 2023, the New York-Newark-Jersey City MSA recorded a GDP of nearly \$2.3 billion, the most of any MSA in the country and a small increase (1.6 percent) over the past year (U.S. Bureau of Economic Analysis 2024).

Between 2013 and 2023, the New York-Newark-Jersey City MSA experienced growth but at a slower rate than other metropolitan areas: the compound annual growth rate of GDP for the New York-Newark-Jersey City MSA was 1.8 percent, whereas nationally, metropolitan areas recorded 2.5 percent growth (U.S. Bureau of Economic Analysis 2024).

3.7.1 Major Institutions

Hudson County is home to major universities, healthcare providers, retail and service businesses, and recreational and tourist attractions that bring workers and visitors from all over the region and world. Seven major hospitals in the



County collectively employ thousands of workers and treat many more patients: CarePoint Health – Bayonne Medical Center, CarePoint Health – Christ Hospital, CarePoint Health – Hoboken University Medical Center, Hudson County Meadowview Hospital, Robert Wood Johnson-Barnabas Health – Jersey City Medical Center, Hudson Regional Hospital, and Hackensack Meridian Health Palisades Medical Center. Higher education institutions in the County include Stevens Institute of Technology in the City of Hoboken and New Jersey City University, St. Peter’s University, and Hudson County Community College in the City of Jersey City.

3.7.2 Employment

In 2023, the finance and insurance sector represented the largest employers in the County, employing nearly 39,000 individuals, followed by the health care and social assistance sector, which employed roughly 31,600 (Bureau of Labor Statistics 2023). Between June 2023 and June 2024, the average unemployment rate was 4.6 percent (Bureau of Labor Statistics 2024).

The largest employer in the County is the Insurance Services Office, Inc., located in the City of Jersey City, which is an insurance company that administers the Community Rating System program for FEMA’s National Flood Insurance Program (Hudson County Economic Development Corporation 2022). Financial services employment has grown rapidly since 2015, despite sharp declines due to the onset on the COVID-19 pandemic; employment in this sector rebounded after the pandemic to reach new highs (Federal Reserve Bank of New York 2024).

3.7.3 Income

In 2023, the household median income in Hudson County was \$89,272—lower than state median (\$99,781) but higher than the national median (\$77,719) (U.S. Census Bureau 2024). Adjusted for inflation, the median household income in Hudson County fell since 2019, when the median income was \$94,071 in 2023 dollars (\$78,808 in 2019 dollars).

3.7.4 Economic Trends

Hudson County’s economy is a relatively diverse economy focused on finance, insurance, high-technology industry, education, health care, and a growing small and mid-sized business sector. Between 2018 and 2023, the number of jobs grew by 3.1 percent in the larger Bergen-Hudson-Passaic region, slightly lower than a statewide increase of 4.1 percent in the same period (Federal Reserve Bank of New York 2024).

The North Jersey Transportation Planning Authority (NJTPA), the metropolitan planning organization that includes Hudson County, projects continued growth in the region that outpaces the rest of the region. NJTPA projections anticipate Hudson County will experience an average 0.8 percent increase in employment every year through 2050, compared to a regionwide average of 0.4 percent (NJTPA 2021).



3.8 General Building Stock

3.8.1 Existing Development

For this plan, 93,031 structures were identified from available tax data and spatial data. These structures account for a replacement cost value of \$92.5 billion. Estimated content value was calculated by using 50 percent of the residential replacement cost value, and 100 percent of the non-residential replacement values. Using this methodology, approximately \$43.5 billion in contents exists within these properties. The City of Jersey has the most buildings and therefore the highest replacement cost value for structure, contents and total replacement cost value. Table 3-8 and Table 3-9 present building stock statistics by occupancy class for Hudson County.

According to 2023 Census data, 295,552 households are in Hudson County. A household includes all the people who occupy a housing unit as their usual residence. The Census data identified 325,364 housing units in the county. A housing unit is a house, apartment, mobile home or trailer, a group of rooms, or a single room occupied as separate living quarters (or if vacant, intended for occupancy as separate living quarters) (United States Census Bureau 2020-2024).

Figure 3-8 through Figure 3-10 show the distribution and value density of residential, commercial, and industrial buildings in Hudson County based on the New Jersey Property Tax System. Value density is the dollar value of structures per unit area, including building content value. The densities are shown in units of \$1,000 per square mile. Such value distribution maps help to visualize areas of high loss potential.

Table 3-8. Building Stock Count and Replacement Cost Value (RCV)

	Count	Replacement Cost Value (Structure Only)	Replacement Cost Value (Contents Only)	Total Replacement Cost Value (Structure + Contents)
Bayonne (C)	9,264	\$5,996,478,080	\$5,282,486,879	\$11,278,964,959
East Newark (B)	434	\$156,602,585	\$144,109,718	\$300,712,303
Guttenberg (T)	2,574	\$655,847,708	\$406,924,797	\$1,062,772,505
Harrison (T)	2,646	\$1,484,886,801	\$1,327,383,121	\$2,812,269,922
Hoboken (C)	14,289	\$4,144,605,889	\$2,778,243,763	\$6,922,849,652
Jersey City (C)	38,336	\$16,204,981,747	\$13,624,295,034	\$29,829,276,781
Kearny (T)	7,207	\$4,687,718,063	\$4,942,908,504	\$9,630,626,567
North Bergen (T)	6,002	\$5,042,868,886	\$4,863,837,443	\$9,906,706,329
Secaucus (T)	3,844	\$5,529,671,274	\$6,545,417,275	\$12,075,088,549
Union City (C)	1,729	\$2,316,026,228	\$1,693,686,201	\$4,009,712,429
Weehawken (T)	2,112	\$960,178,502	\$677,933,603	\$1,638,112,105
West New York (T)	4,594	\$1,774,007,550	\$1,302,848,793	\$3,076,856,343
Hudson County (Total)	93,031	\$48,953,873,313	\$43,590,075,131	\$92,543,948,444

Source: NJ Office of Information Technology, Office of GIS 2024; Microsoft BING 2019; RS Means 2024

Note: (B) = Borough; (C) = City; (T) = Township



Table 3-9. Replacement Cost Value by Occupancy Class

Jurisdiction	Residential		Commercial		Industrial		Government, Religion, Agricultural, and Education	
	Building Count	Total Replacement Cost Value	Building Count	Total Replacement Cost Value	Building Count	Total Replacement Cost Value	Building Count	Total Replacement Cost Value
Bayonne (C)	7,633	\$4,407,011,146	384	\$1,843,123,702	968	\$3,662,703,826	279	\$1,366,126,285
East Newark (B)	383	\$121,106,805	23	\$17,456,513	19	\$139,380,338	9	\$22,768,647
Guttenberg (T)	2,337	\$793,353,007	144	\$103,910,347	56	\$75,728,646	37	\$89,780,505
Harrison (T)	2,184	\$1,051,265,623	265	\$266,269,945	69	\$974,926,702	128	\$519,807,652
Hoboken (C)	13,241	\$4,487,700,853	745	\$1,012,290,529	27	\$416,825,260	276	\$1,006,033,010
Jersey City (C)	32,722	\$11,977,538,315	3,484	\$4,801,765,059	677	\$6,321,382,614	1,453	\$6,728,590,793
Kearny (T)	6,241	\$2,472,746,317	328	\$728,193,752	382	\$5,284,939,189	256	\$1,144,747,309
North Bergen (T)	5,124	\$3,069,269,949	416	\$2,092,260,645	208	\$4,019,492,243	254	\$725,683,492
Secaucus (T)	3,280	\$1,768,213,596	238	\$2,016,337,449	174	\$7,636,304,705	152	\$654,232,799
Union City (C)	1,252	\$2,024,166,983	286	\$1,028,522,228	23	\$234,330,330	168	\$722,692,888
Weehawken (T)	1,926	\$942,526,673	102	\$369,162,322	20	\$169,847,693	64	\$156,575,417
West New York (T)	3,583	\$1,585,530,203	759	\$692,877,645	123	\$248,752,884	129	\$549,695,611
Hudson County (Total)	79,906	\$34,700,429,470	7,174	\$14,972,170,136	2,746	\$29,184,614,430	3,205	\$13,686,734,408

Source: NJ Office of Information Technology, Office of GIS 2024; Microsoft BING 2019; RS Means 2024

Note: (B) = Borough; (C) = City; (T) = Township



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

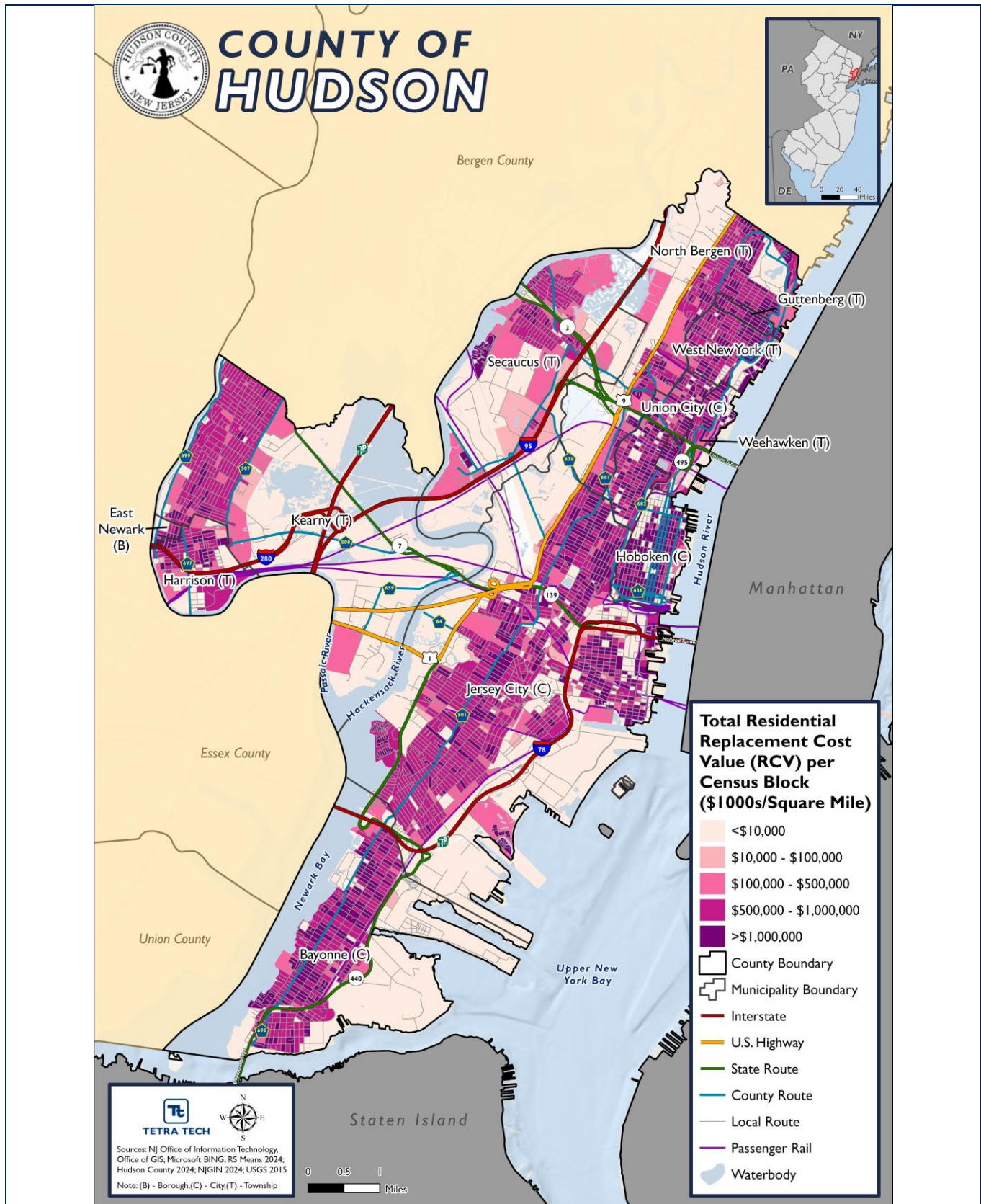




Figure 3-9. Distribution of Commercial Building Stock and Value Density in Hudson County

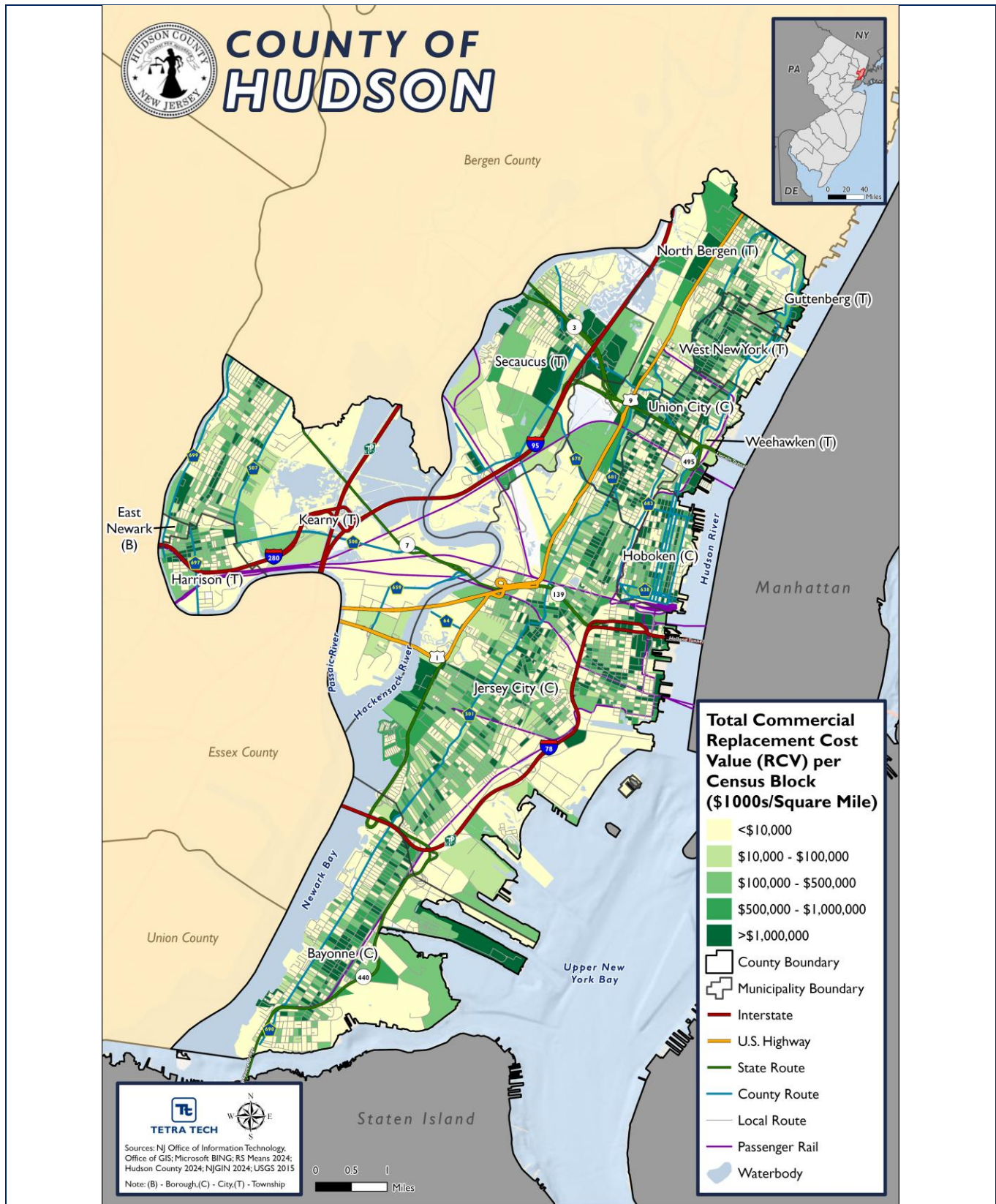
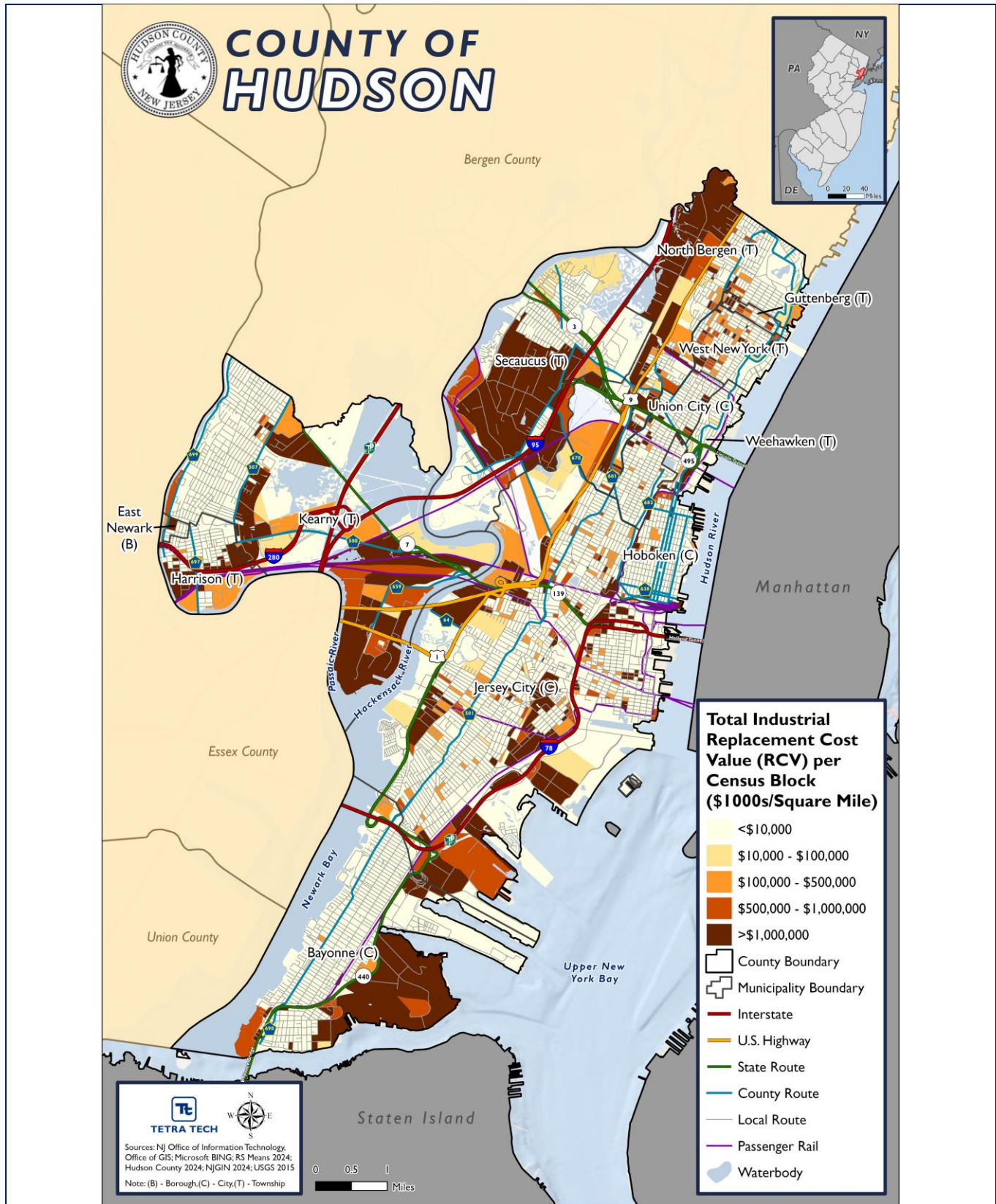




Figure 3-10. Distribution of Industrial Building Stock and Value Density in Hudson County





3.8.2 New Development

Local zoning and planning authority are provided under the New Jersey Municipal Land Use Law, which gives municipalities zoning and planning authority. The NJSEA holds zoning jurisdiction over the portions of each municipality within its borders. The Consolidation Act allows municipalities to administer most of the zoning requirements of the NJSEA, upon adoption of an “opt-out” resolution agreeing to follow the land use provisions of the Meadowlands zoning regulations. To date, the Towns of Secaucus and Kearny have become “opt-out” municipalities (NJSEA 2020).

Hudson County Master Plan Re-examination Report Goal 10:

To minimize the negative effects of development and redevelopment on the natural built environments and to discourage development on environmentally sensitive areas.

In recent years, Hudson County has identified the need for land use resiliency through zoning regulations. Large portions of Hudson County are located in flood-prone areas, with approximately 80 percent of this land being developed. Severe weather and normal rainfall events can disrupt the daily lives of citizens. Most of the developable land in Hudson County has been built out, and redevelopment is commonly occurring throughout many municipalities. As part of this redevelopment process, the 2016 Land Development Regulations Update provides guidelines for implementation of Green Stormwater Infrastructure methods when development is adjacent to a County-owned roadway or facility. The City of Hoboken has developed a Green Infrastructure Strategic Plan that recommends incentive zoning for incorporating on-site green infrastructure to reduce the expansion of impervious surface. The 2014 Jersey City Sandy Recovery Strategic Planning Report identified that Jersey City was working toward the development and codification of zoning and flood damage prevention ordinances for building rehabilitation and new construction (Hudson County Division of Planning 2014). Jersey City has incorporated updated FEMA flood zones into its zoning code to protect the development potential of any lot (Resiliency Master Plan 2017). The city intends to update its Flood Damage Prevention Ordinance to reflect the model code coordinated ordinance, and the update is an identified action in its jurisdictional annex.

An understanding of land use trends and types of development occurring 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.

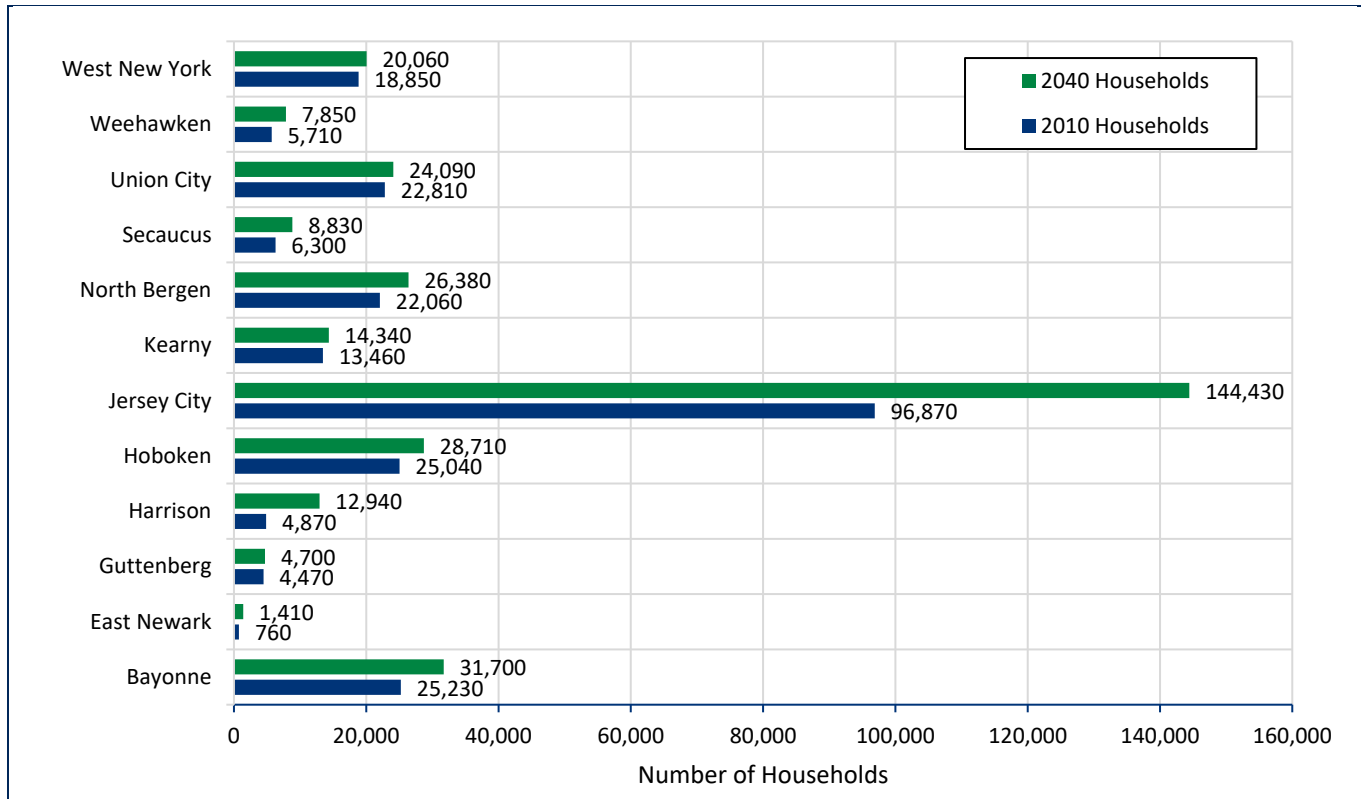
Hudson County has limited land use powers. While site plan review and approval is within the County’s powers for traffic and drainage projects abutting a County road, the County has no zoning authority. However, the County promotes a variety of land use options that support economic activity and recreational and education opportunities and that protect human health and the natural environment. In addition, the County makes recommendations to support responsible land use decision-making by municipalities (Hudson County Planning Board 2017).

According to the Hudson County Master Plan Re-examination Report, between 2013 and 2015, the Hudson County Planning Board approved various site plans that impacted steep slopes, freshwater wetlands, or floodplains. All approved applications involved sites that were already developed. Under County jurisdiction, no new developments have occurred in environmentally constrained areas (Hudson County Planning Board 2017).



The North Jersey Transportation Authority forecasts a 32 percent increase in households over the next 30 years in Hudson County (NJTPA 2021) In addition, NJTPA forecasts that Jersey City will experience the greatest growth compared to the rest of the County; refer to Figure 3-11.

Figure 3-11. Hudson County Projected Household Growth (2010 – 2040)



Source: (Hudson County Planning Board 2017)

County and community capabilities to manage development to minimize increased natural hazard risk are discussed in the capability assessment subsection of Chapter 15, as well as within each jurisdictional annex in Volume II. Also identified within each annex are actions the jurisdiction has taken or will take to further integrate the findings and recommendations of this plan into other planning mechanisms and programs, many of which support land use and development so as to minimize the increase of natural hazard risk.

Each jurisdiction was asked to provide known new major development that has occurred since 2020 and anticipated major development within their jurisdiction over the next five years. A spatial analysis was then conducted to determine the presence of natural hazards that may impact the future investment. These results were communicated to each plan participant to discuss potential mitigation measures to reduce future impacts to these areas.

3.9 Community Lifelines

Facilities that are essential to the health and welfare of the population and that maintain essential and emergency functions are designated as critical facilities. These typically include police and fire stations, schools, emergency



operations centers, and infrastructure such as roads, bridges and utilities that provide water, electricity, and communications. Facilities that use or store hazardous materials are designated as critical facilities as well. All of these facilities are especially important after any hazard event (FEMA 1997).

FEMA defines some types of critical facilities, as well as public services or activities, as “community lifelines.” Community lifelines provide the fundamental services in a community that, when stabilized, enable all other aspects of society. Following a disaster event, intervention is required to stabilize lifelines. FEMA defines eight categories of community lifelines as summarized in Table 3-10.

Table 3-10. FEMA-Defined Categories of Community Lifelines

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

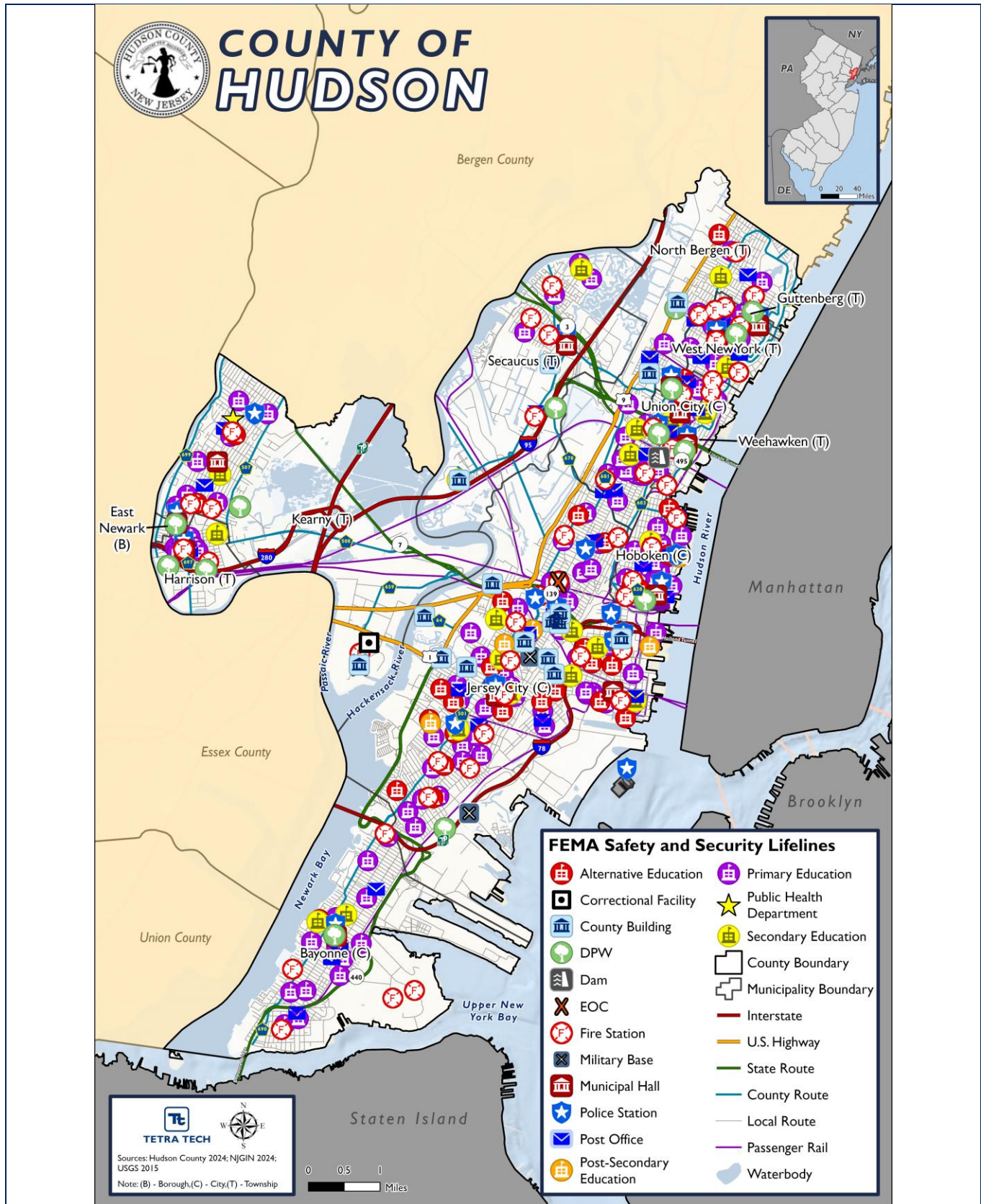
A comprehensive inventory of community lifelines in Hudson County was developed from various sources, including input from the Steering Committee and Planning Partnership. The following sections describe the inventory of community lifelines that was used for the risk assessment in this HMP. Although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

3.9.1 Safety and Security

Figure 3-12 shows the location of safety and security facilities. The sections below describe the assets in this category.



Figure 3-12. Safety and Security Facilities in Hudson County





EMERGENCY FACILITIES

The County Sheriff's Department is responsible for policing Hudson County Parks and County roads, providing security in all court rooms, serving warrants and transporting prisoners. Each municipality has at least one police department and fire department servicing its residents. The larger municipalities, such as Jersey City, have multiple departments to ensure safety in times of need. Municipal police departments, fire departments, first aid and public works departments provide emergency services to the municipalities they are located in. North Hudson Regional Fire & Rescue responds to emergencies in Guttenberg, North Bergen, Union City, Weehawken and West New York (Hudson County Planning Board 2017).

There are 25 police stations, 51 fire stations, seven EMS/public safety squads and two EOCs.

DAMS AND LEVEES

According to the NJDEP Bureau of Dam Safety and the U.S. Army Corps of Engineers National Inventory of Dams, there is one dam located in Hudson County, which is classified as a high-hazard dam.

MILITARY INSTALLATIONS

Two military installations are located in Hudson County: an armory and a National Guard facility in Jersey City.

3.9.2 Food, Hydration, Shelter

Figure 3-13 shows the location of food, hydration, and shelter facilities. The sections below describe these assets.

SHELTERS

There are 95 shelter locations in the County and multiple agencies can assist with the coordination of shelter availability as necessitated by the execution of local municipal emergency operation plans. County-wide sheltering policies and procedures are documented in the following plans, which are maintained by the Hudson County OEM:

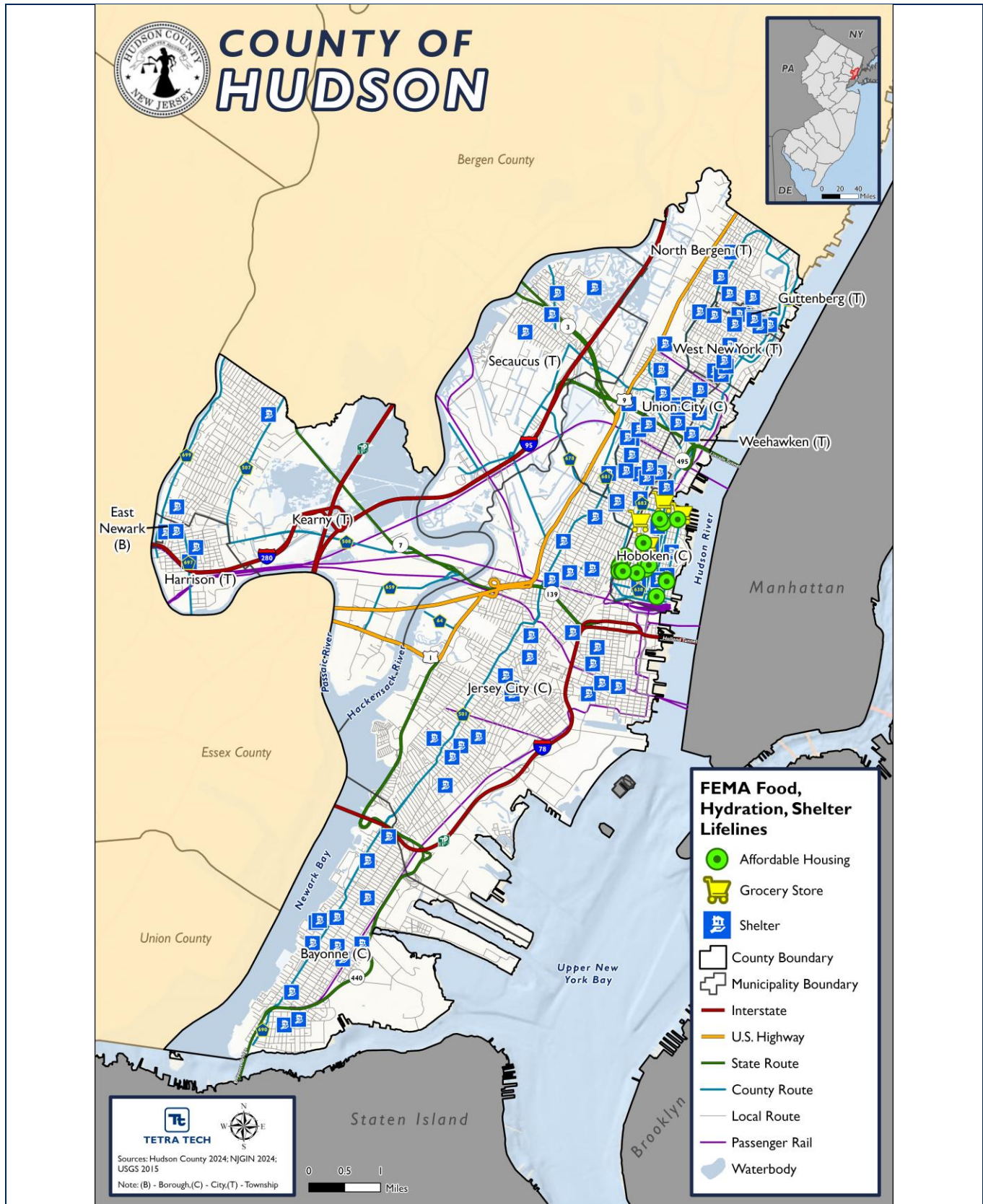
- Hudson County Comprehensive Emergency Management Plan, including the Mass Sheltering Plan Annex
- Hudson County Radiological Emergency Preparedness Plan

SCHOOLS

There are 187 public and private primary and secondary education facilities (elementary, middle, and high schools), including 37 alternative schools (charter schools, adult education), and 5 post-secondary facilities (colleges and universities) located in Hudson County. In times of need, schools can function as shelters and are an important resource to the community as noted in the Safety and Security lifeline. For the Food, Hydration and Shelter lifeline, 49 schools are covered under this lifeline as designated shelters or temporary shelters for Hudson County and its jurisdictions.



Figure 3-13. Food, Hydration, and Shelter Facilities in Hudson County





3.9.3 Health and Medical

Figure 3-14 shows the location of health and medical facilities. The sections below describe the assets in this category.

HOSPITALS AND MEDICAL FACILITIES

The County has eight hospitals and two medical centers ranging in size and primary function. For non-emergency health care needs, seven “urgent care centers” are located throughout the County. Some of these clinics are open 24 hours per day, and most have evening and weekend hours.

SENIOR CARE AND LIVING FACILITIES

The County has an extensive system of programs and services for the senior population, including 35 senior care facilities. These facilities are highly vulnerable to potential impacts from disasters and knowing the location and numbers of these types of facilities will be effective in managing a response plan pre- and post-disaster. By understanding the distribution and quantity of these facilities, it would enable better management of an emergency response plan after a disaster.

3.9.4 Energy

PSE&G is the primary provider for electric and gas utilities in Hudson County. There is an oil refinery located in the City of Bayonne, and a Transco gas pipeline that runs through the Towns of Guttenberg, North Bergen, and Kearny. There are nine electric power facilities and 51 electric substations in the County evaluated in the risk assessment. Figure 3-15 illustrates the inventory of these facilities in Hudson County.

3.9.5 Communications

Figure 3-16 shows the location of communications facilities. The sections below describe the assets in this category.

EMERGENCY WARNINGS AND RESPONDER COMMUNICATIONS

Telephone and wireless communication services are available through multiple providers in the County. The emergency communication systems are provided by five critical broadcast facilities in Hudson County, according to local resources and HAZUS-MH. There are seven communication facilities in the County evaluated in the risk assessment.

COMMUNICATIONS

Hudson County is served by a variety of communications systems, including traditional land line, fiber optic, and cellular service provided by multiple companies. Each carrier has individual plans for emergency situations during hazard events and post-disaster recovery efforts. In addition to land line, fiber optic and cellular communications systems, Hudson County has an extensive radio communications network that is utilized by emergency services agencies, hospitals, law enforcement, public works, transportation, and other supporting organizations. There are six TV transmitter facilities and one radio tower in the County.



Figure 3-14. Health and Medical Facilities in Hudson County

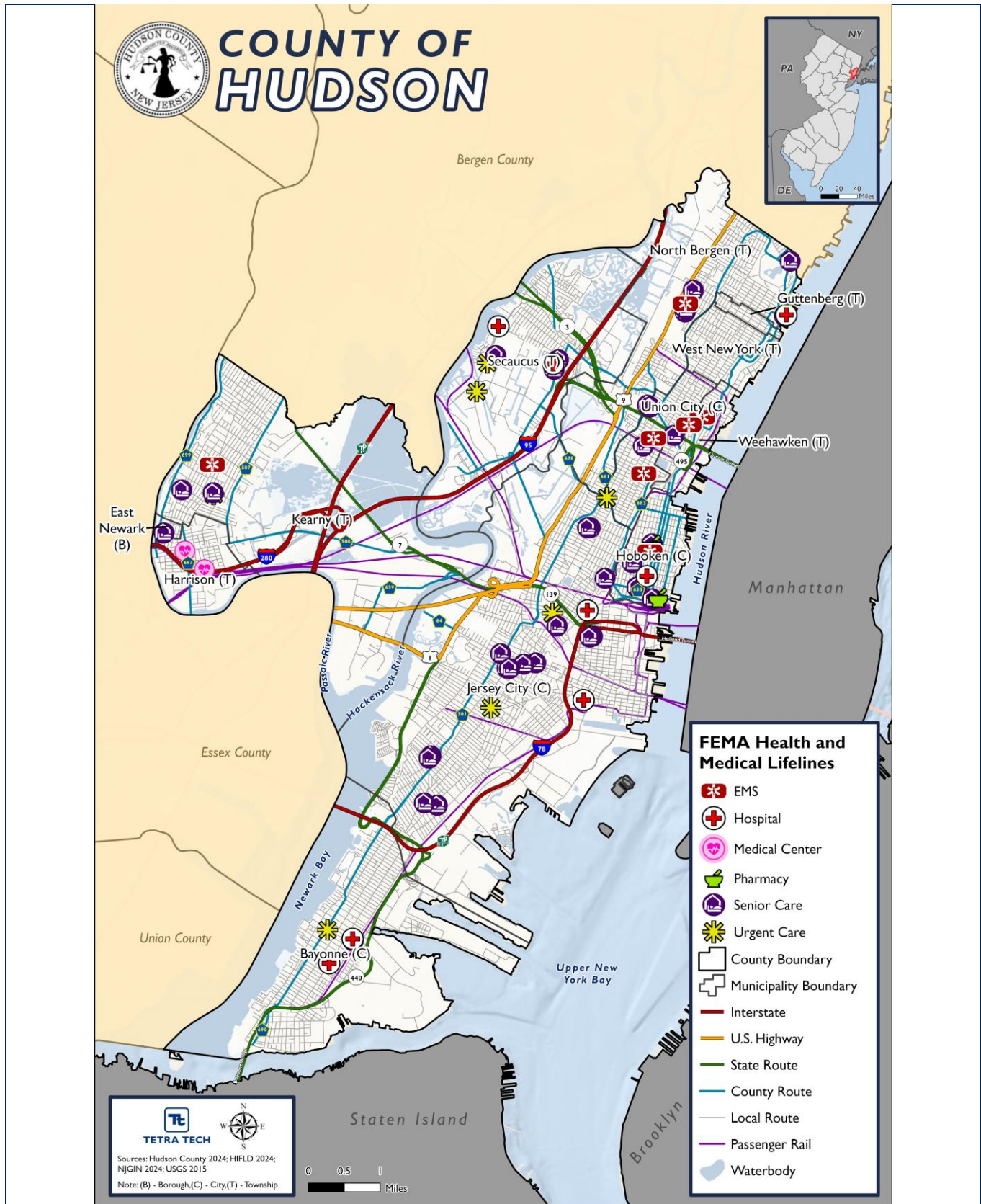


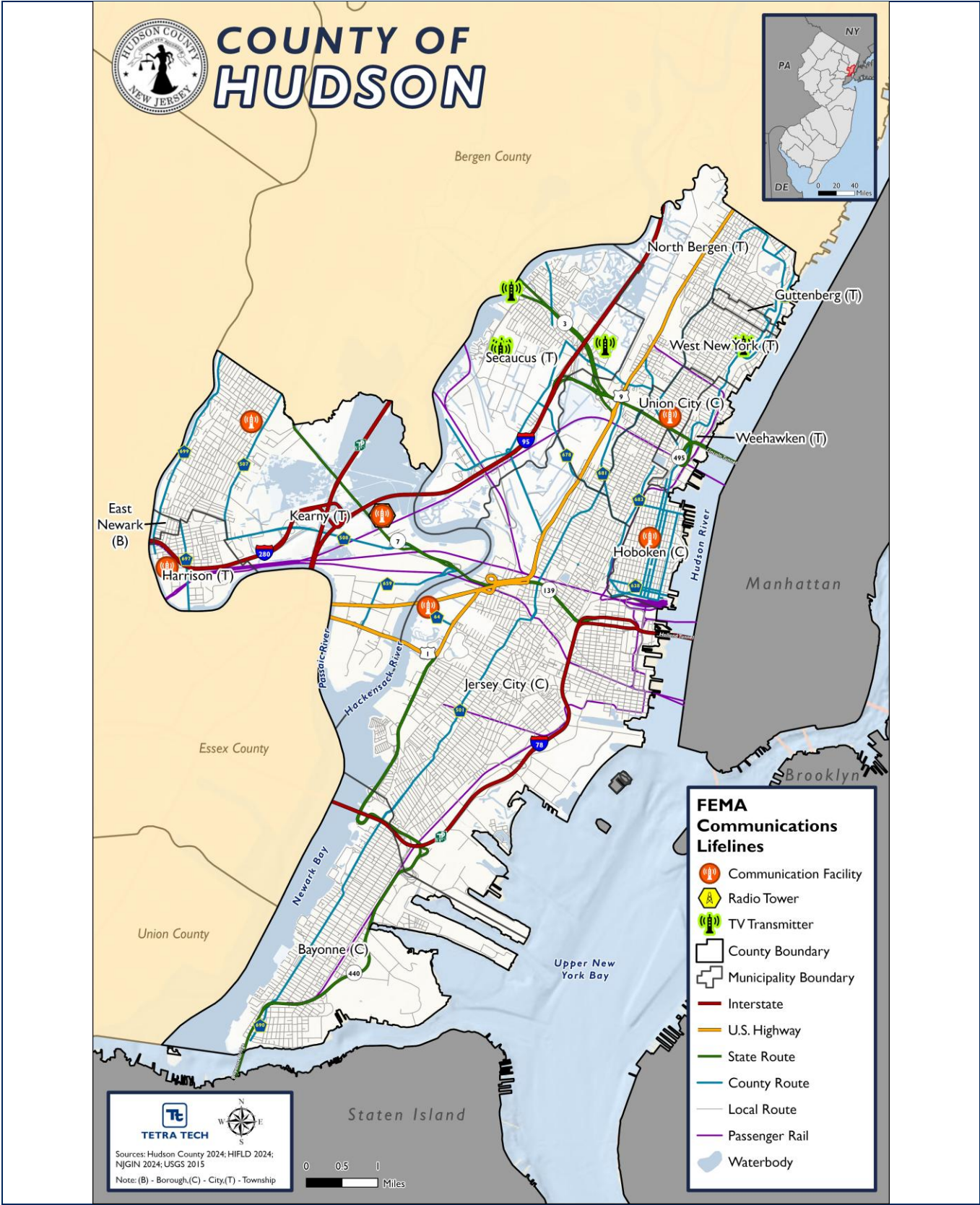


Figure 3-15. Energy Facilities in Hudson County





Figure 3-16. Communications Facilities in Hudson County





3.9.6 Transportation

Figure 3-17 shows the location of transportation facilities in Hudson County. The sections below generally describe the assets in this category.

Hudson County has a highly developed and well-established transportation network that serves as a major transportation hub for the Northeast, providing access to national highways, state freeways and toll roads, and water crossings. The Hudson County transportation system consists of passenger rails; New Jersey Transit commuter rail lines, the Port Authority Trans-Hudson (PATH) rapid transit system; New Jersey Transit; trans-Hudson tunnels; private, regional, and local bus services; the cross-Hudson ferry/water taxi system; and streets and highways (Hudson County Planning Board 2017). This complex network is relied upon by residents and commuters to maintain County operations. Hudson County's population relies on public transportation services; and 32.4 percent of households have no automobiles (US Census 2014, 5-year estimates).

It is essential that the transportation network in Hudson County remain accessible and operational before, during and after natural hazard events to ensure safe evacuation, continuity of essential services and maintain economic activity in the County. Hurricane Sandy is one recent example of the immediate and long-term significant impacts on mobility in Hudson County.

BUS AND OTHER TRANSIT FACILITIES

Hudson County bus service is provided by a variety of private and public operators. There are 17 bus facilities in the County. The largest of these providers is New Jersey Transit. According to NJ Transit, there are 59 bus routes in the County that transport passengers locally, around New Jersey and outside of New Jersey. The major bus routes have a north/south orientation to serve the heavily populated areas in eastern Hudson County.

Both public and private companies operate commuter bus services for different travel purposes throughout the County. These bus services are designed for longer commutes to bring people from residential areas to places of employment during peak commuting periods. The major destinations for these commuter buses in Hudson County include Journal Square, Exchange Place, and Hoboken. The 30th/31st Street Corridor in Union City functions as a service corridor for I-495 into Manhattan (Hudson County Public Transit 2008).

FREIGHT TRANSPORT

Truck access to large intermodal facilities is vital to the state and regional economy. Due to the large regional market, geographic proximity to several Hudson River crossings into New York City, and the availability of the port, rail and distribution infrastructure, freight is a major user of the transportation network in the County (Hudson County Planning Board 2017).

EVACUATION ROUTES

The County has identified evacuation zones for severe weather, and the County can assist with the coordination and communication of evacuation routing as necessitated by the execution of local municipal emergency operation plans. Figure 3-18 depicts the evacuation routes identified as the Hudson County.



HUDSON COUNTY
NEW JERSEY

COUNTY OF HUDSON

Bergen County

North Bergen (T)
Guttenberg (T)
West New York (T)
Union City (C)
Weehawken (T)
Hoboken (C)
Jersey City (C)
Bayonne (C)
East Newark (B)
Kearny (T)
Harrison (T)

Essex County
Union County
Staten Island

Manhattan
Brooklyn

Upper New York Bay
Newark Bay
Passaic River
Hockensack River
Hudson River

FEMA Transportation Lifelines

- Bridge
- Bus Facility
- Ferry
- Heliport
- Marina
- Rail Station
- Subway Station
- County Boundary
- Municipality Boundary
- Interstate
- U.S. Highway
- State Route
- County Route
- Local Route
- Passenger Rail
- Waterbody

TETRA TECH

Sources: Hudson County 2024; HIFLD 2024; NJGIN 2024; USGS 2015

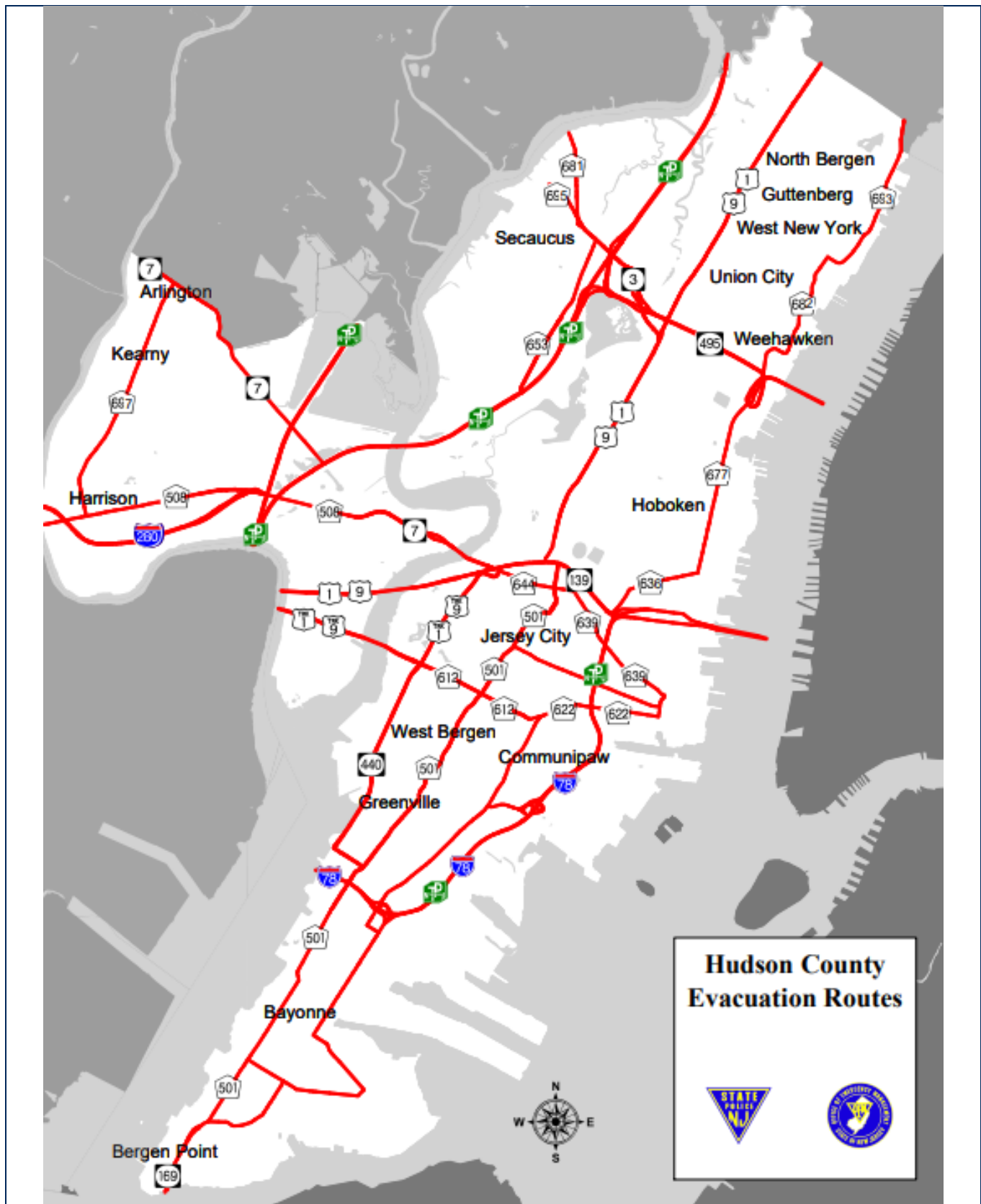
Note: (B) - Borough, (C) - City, (T) - Township

0 0.5 1 Miles





Figure 3-18. Evacuation Routes Identified in Hudson County





RAILROAD FACILITIES

Rail transportation in Hudson County is used for freight and public transportation. There are 35 railroad stations that have been identified within the County.

Approximately 41 million tons of domestic freight is shipped or received annually at Hudson County, and an additional 15 million e-commerce packages are delivered (NJTPA 2020). Of this, approximately 4 percent of freight traveling to, from, or within Hudson County runs via rail. There are major rail yards at Croxton, South Kearny, North Bergen, Port Jersey ExpressRail, and Greenville.

The existing passenger rail system within Hudson County is directed to New York City, with limited service to different counties. It primarily serves commuters from northern and central New Jersey traveling to and from New York City. The New Jersey Transit rail system consists of two rail stations in Hudson County: Secaucus Junction in Secaucus, and Hoboken Terminal in Hoboken. Secaucus Junction is the primary transfer station between lines servicing New York Penn Station and Hoboken, as well as other New Jersey Transit lines entering the County. The Hoboken Terminal is served directly by the Boonton Line, the Main Line, the Bergen County Line, the Pascack Valley Line, and the Morris and Essex Lines. This terminal is also served by the North Jersey Coast Line, the Raritan Valley Line, and the Northeast Corridor Line (Hudson County Public Transit 2008).

The PATH transit system is the primary link between New York City and urban communities in New Jersey. With approximately 16 percent of Hudson commuters using rail transit into Manhattan, this is the most frequently used method of transportation by Hudson County residents and other commuters to travel to and from New York City (NJTPA 2020). The PATH system consists of four lines through Hudson County, which include the Newark-World Trade Center Line, the Journal Square-33rd Street Line, the Hoboken-World Trade Center Line, and the Hoboken-33rd Street Line (Heyer, Gruel, & Associates, PA, 2002). At night and on weekends, these lines are altered to service two lines; Newark-World Trade Center Line and 33rd Street to Journal Square via Hoboken (Hudson County Public Transit 2008).

The Hudson Bergen Light Rail is Hudson County's regional passenger rail service. It is made up of three service configurations: Bayonne to Hoboken, Tonnelle Avenue to Hoboken, and Tonnelle Avenue to West Side Avenue;. These lines service Bayonne, Jersey City, Hoboken, Union City, Weehawken and North Bergen. This line is primarily designed to service the employment, retail and residential developments of downtown Jersey City and Hoboken, while connecting them to the other municipalities it serves (Hudson County Public Transit 2008).

AIRPORTS

Air travel to and from and within Hudson County is limited to helicopter traffic. Major airports in the vicinity of Hudson County are Newark Liberty International Airport in Newark, John F. Kennedy International Airport in Jamaica, New York, and LaGuardia Airport in Flushing, New York. There are 10 heliports in the County.

FERRY SERVICE AND PORTS

Water transportation is a major component of the transportation system in Hudson County. Waterfront structures include ports and harbor transportation systems, cranes/cargo handling equipment, warehouses and fuel facilities. In addition to the ports, the County has an extensive ferry system between New York City and other New Jersey counties, and multiple marinas. There are 12 ferry facilities and 5 marina facilities in the County.



3.9.7 Hazardous Materials

Figure 3-19 shows the location of hazardous materials facilities in Hudson County. The U.S. Environmental Protection Agency (EPA) Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS) (Superfund) Public Access Database reports that there are currently five Superfund sites in Hudson County (U.S. EPA 2021). Superfund sites are polluted locations requiring a long-term response to clean up hazardous material contaminations. Of these sites, three are located in the Town of Kearny (the Diamond Head Oil Refinery, Syncon Resins, and Standard Chlorine Chemical Company), and one is in Jersey City (PJP Landfill). The final site is the lower Hackensack River, which runs through Bergen and Hudson Counties. A site that was removed from the National Priorities List in 2007, located in the City of Hoboken (Grand Street Mercury), is not included in this summary.

In addition to these sites, there are numerous facilities in Hudson County that produce or work with materials that are hazardous to human health. There are 46 hazardous materials facilities in the County.

3.9.8 Water Systems

Figure 3-20 shows the location of water system facilities in Hudson County. The sections below generally describe the assets in this category.

POTABLE WATER

Hudson County receives all of its water supply from sources outside the County, managed by several water service companies including the Passaic Valley Water Commission, United Water Company, and North Jersey District Water Supply Commission.

WASTEWATER FACILITIES

The County is primarily serviced by public sewers. These sewers are divided into two jurisdictions: the Passaic Valley Sewerage Commission (PVSC) and Hudson County. Hudson County is divided into the Jersey City Municipal Utility Authority (MUA), Kearny MUA, Secaucus MUA, North Bergen MUA and North Hudson MUA. Seven wastewater treatment plants and 68 wastewater pump stations were identified in the County.

Typically, stormwater and sewer infrastructure function separately; however, in several Hudson County municipalities, stormwater and sewage are combined into what are called combined sewer systems. During wet-weather events such as heavy rainfall or snowmelt, the additional high volume of rainwater overwhelms the capacity of the pipes in these systems, and the stormwater/sewage mixture gets discharged directly into local waterways without treatment. A total of 11 of the 12 Hudson municipalities share 85 combined sewer outfalls. In 2015, a new permit system requires Long Term Control Combined Discharge Reduction Plans and enhanced public outreach for combined sewer overflows (Hudson County Planning Board 2017). These plans identify strategies to mitigate and are included in the jurisdictional annexes.

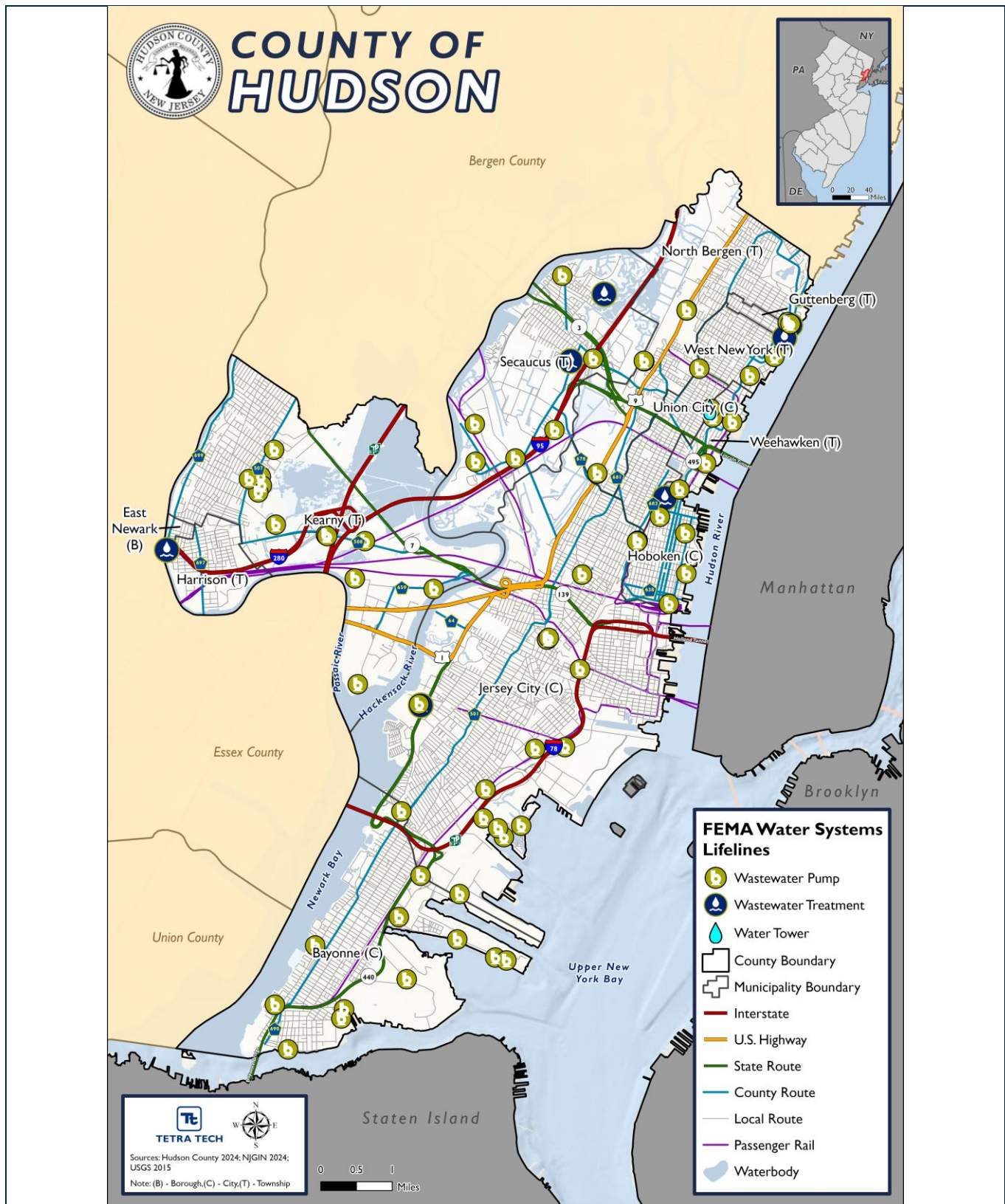


Figure 3-19. Hazardous Materials Facilities in Hudson County





Figure 3-20. Water System Facilities in Hudson County





3.10 Other Critical Facilities

Figure 3-21 shows the location of other identified critical facilities in Hudson County such as daycares and libraries located throughout the County.

3.11 Natural, Historic and Cultural Resources

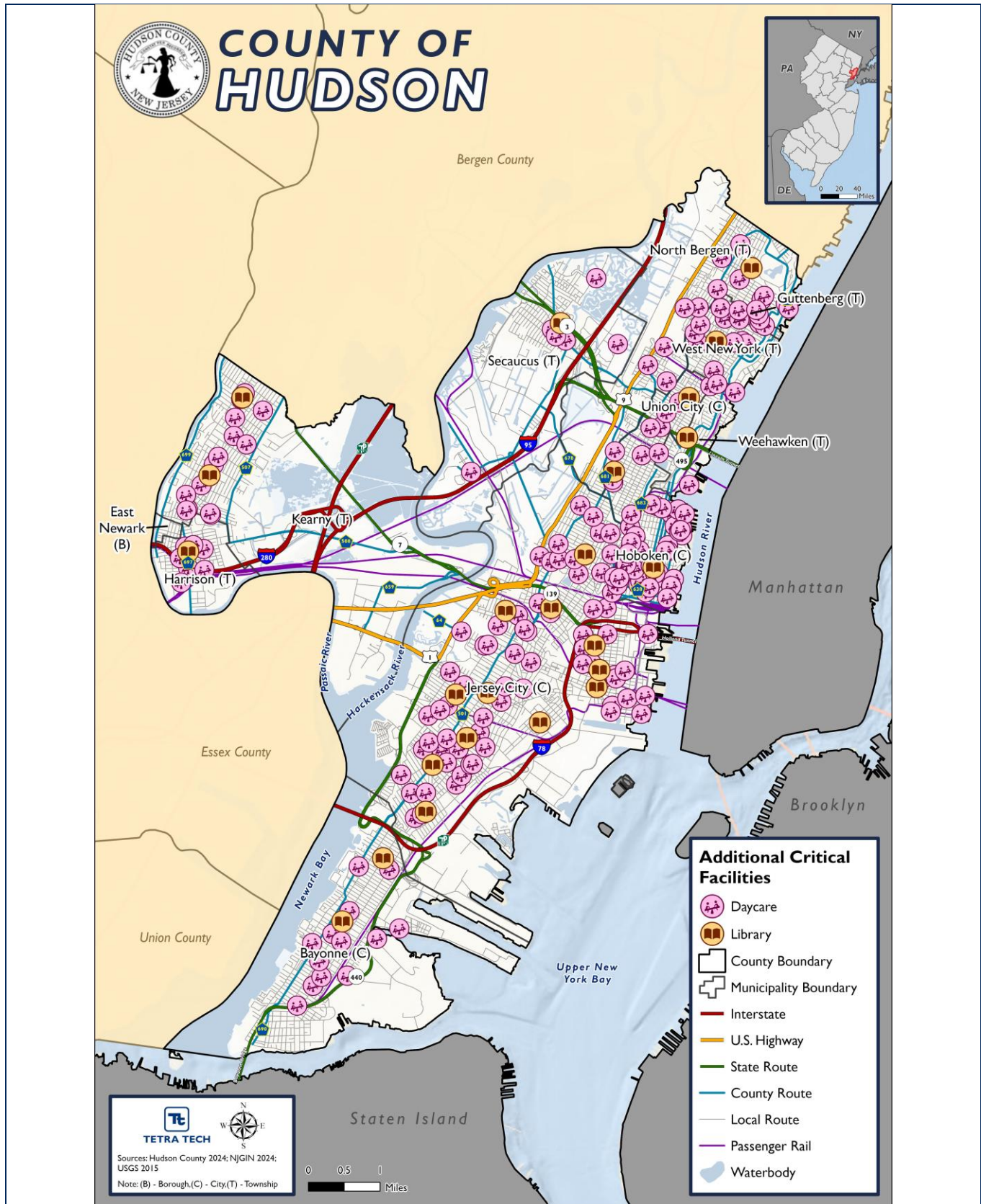
Hudson County is a highly urbanized region with a rich cultural history. Its natural resources are critical due to existing development pressures, and the County has placed significant resources into making sure residents can access open space.

There are 64 properties in Hudson County that are designated as historic sites by inclusion on the National Register of Historic Places and the New Jersey Register of Historic Places. Several of these sites are considered community lifelines and critical facilities, which are included in the risk assessment. These include multiple fire stations, rail terminals, municipal buildings, and schools. The County contains 10 historic districts on both the National and New Jersey Registers of Historic Places:

- Clark Thread Company Historic District
- Hamilton Park Historic District
- Hamilton Park Historic District Extension (Boundary Increase)
- Harsimus Cove Historic District
- Lembeck and Betz Eagle Brewing Company District
- Paulus Hook Historic District
- Paulus Hook Historic District (Boundary Increase)
- Van Vorst Park Historic District
- Van Vorst Park Historic District (Boundary Increase)
- West Bergen-East Lincoln Park Historic District



Figure 3-21. Additional Critical Facilities in Hudson County





4. RISK ASSESSMENT METHODOLOGY AND TOOLS

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

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

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

- An updated building stock inventory was generated using MOD-IV parcel tax assessor information provided by Hudson County GIS & Mapping Services, as well as 2024 RSMeans for cost adjustment values.
- The 2020 Decennial statistics from the U.S. Census Bureau were used for total population while the 2018-2022 American Community Survey 5-Year Population Estimates were used for vulnerable populations.
- Critical facilities were provided by Hudson County, HIFLD (Homeland Infrastructure Foundation-Level Data) and NJGIN (New Jersey Geographic Information Network). The facilities were updated based on review by officials from each participating jurisdiction.
- Lifelines were identified in the critical facility inventory to align with FEMA's lifeline definition.
- Hazus (v6.1) was used to estimate potential impacts to the earthquake, flood, and wind hazards.
- Best-available hazard data were used, as described in this section.



4.1 Asset Inventories

Hudson County assets were identified to assess potential vulnerability and impacts associated with the hazards of concern. For the HMP update, Hudson County assessed vulnerability and potential hazard impacts for the following types of assets: population, buildings, critical facilities, community lifelines, and the environment. Each asset type is described below. To protect individual privacy and the security of critical facilities, information on properties assessed is presented in aggregate, without details about specific individual personal or public properties.

4.1.1 Population

Statistics from the 2020 Decennial Census and 2018-2022 American Community Survey (ACS) 5-year estimate were used to estimate the vulnerability of and potential impacts on the County's population. Population counts at the jurisdictional level were averaged among the residential structures in the county to estimate the population at the structure level. This estimate provides a more precise distribution of population across the county compared to only using census block or census tract boundaries. The results provide a general estimate suitable for planning purposes.

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

FEMA's Hazus program to estimate sheltering and injuries as part of the hazard analysis contains 2020 Decennial U.S. Census data.

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

4.1.2 Buildings

A custom-building stock inventory was developed for Hudson County. The general building stock that was developed for the 2020 Hudson County HMP was updated with 2024 MOD-IV parcel tax assessor information provided by Hudson County. If a building footprint was not located due to limited spatial data, parcels that had assessor's information supporting the presence of a building were given a centroid to represent the location of a structure. Attributes provided in the associated files were used to further define each structure, such as year built, number of stories, occupancy class, and square footage. The centroid of each building footprint was used to estimate the building location.

Structural and content replacement cost values (RCV) were calculated for each building using the available assessor data, the building footprint, and RSMeans 2024 values. RCV is the cost of returning a destroyed asset to its pre-damaged condition using present-day cost of labor and materials. Total RCV consists of both the structural cost to replace a building and the estimated value of contents of a building. The cost analysis used the following location factors based on zip code:

- Zip codes beginning in 070
 - Residential location factor = 1.15
 - Non-Residential location factor = 1.14



- Zip codes beginning in 073
 - Residential location factor = 1.12
 - Non-Residential location factor = 1.11

The occupancy classes available in Hazus were condensed into the categories of residential, commercial, industrial, and other (agricultural, religious, governmental, and educational) to facilitate analysis and presentation of results. Residential loss estimates addressed both multi-family and single-family dwellings.

4.1.3 Critical Facilities and Community Lifelines

The 2020 HMP critical facility inventory, which includes essential facilities, utilities, transportation features and user-defined facilities was updated by Hudson County for the 2025 HMP. Additionally, new facilities were added to the inventory from sources such as HIFLD and NJGIN.

4.1.4 Environment and Land Use

The New Jersey Department of Environmental Protection (NJDEP) Division of Information Technology and the Bureau of Geographic Information Systems updated their 2015 land-use/land cover data in 2020. This update was created by comparing the 2015 LU/LC layer from NJDEP's Geographic Information Systems (GIS) database to 2020 color infrared imagery and delineating any coding areas of change.

4.1.5 New Development

New development in the planning area was defined as development that occurred over the last 5 years and development that is expected to occur over the next 5 years. Each jurisdiction was asked to provide a list by address of major development that has taken place within these timeframes. The location of new development projects was submitted via ArcGIS Survey123. Identifying these changes and integrating new development into the risk assessment provides communities with information to consider when developing the mitigation strategy to reduce these vulnerabilities in the future.

The new development is listed in Chapter 3 and presented as a table in each annex in Volume II. A GIS analysis for new development was not conducted for this update.

4.2 Methodology

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

- **Qualitative Analysis**—This analysis includes an examination of historical impacts to understand potential impacts of future events of similar size. Potential impacts and losses are discussed qualitatively using best-available data and professional judgment.



- **Vulnerability Analysis**—This analysis involves overlaying available spatial hazard layers, for hazards with defined extent and locations, on asset mapping in GIS to determine which assets are located in the hazard area.
- **Loss Estimation**—The FEMA Hazus modeling software was used to estimate potential losses for the following hazards: flood, earthquake, and hurricane.

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

Table 4-1. Summary of Risk Assessment Analyses

Hazard	Population	General Building Stock	Critical Facilities	New Development
Dam and Levee Failure	Q	Q	Q	Q
Drought	Q	Q	Q	Q
Extreme Temperatures	Q	Q	Q	Q
Flood	V, H	V, H	V, H	Q
Geological Hazards	V, H	V, H	V, H	Q
Severe Weather	V, H	V, H	V, H	Q
Severe Winter Weather	Q	V	Q	Q
Wildfire	V	V	V	Q

Notes: V = Vulnerability analysis; H = Hazus analysis; Q = Qualitative analysis

4.2.1 Hazus

Hazus is a GIS-based software tool developed by FEMA that applies engineering and scientific risk calculations, which have been developed by hazard and information technology experts, to provide defensible damage and loss estimates. These methodologies are accepted by FEMA and provide a consistent framework for assessing risk across a variety of hazards. The GIS framework also supports the evaluation of hazards and assessment of inventory and loss estimates for these hazards.

Hazus uses GIS technology to produce detailed maps and analytical reports that estimate a community's direct physical damage to building stock, critical facilities, transportation systems and utility systems. To generate this information, Hazus uses default data for inventory, vulnerability, and hazards; this default data can be supplemented with local data to provide a more refined analysis. The following levels of analysis can be conducted using the Hazus software:

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

Damage reports can include induced damage (inundation, fire, threats posed by hazardous materials and debris) and direct economic and social losses (casualties, shelter requirements, and economic impact) depending on the hazard and available local data. Losses were estimated in the program using depth grids for the flood analysis, For hurricane



wind and seismic hazards, probabilistic analyses were performed to develop expected or estimated distribution of losses. The probabilistic model estimates damage for specified mean return periods (e.g., 100- and 500-year).

Hazus' open data architecture can be used to manage community GIS data in a central location. The use of this software also promotes consistency of data output now and in the future and standardization of data collection and storage.

4.2.2 Hazard-Specific Methodologies

DAM AND LEVEE FAILURE

A qualitative analysis was conducted for the dam and levee failure. For security reasons, these asset locations and downstream inundation due to a failure are not displayed on maps or discussed in this plan.

DROUGHT

To assess the vulnerability of Hudson County to drought and its associated impacts, a qualitative assessment was conducted. Resources from NJDEP and the Centers for Disease Control and Prevention were used to assess the potential impacts on the population from a drought event.

EXTREME TEMPERATURE

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

FLOOD

Riverine Flooding

The 1- and 0.2-percent chance flood events were examined to evaluate Hudson County's risk and vulnerability to the riverine flood hazard. The following data were used to evaluate exposure and determine potential future losses for this plan update:

- The Hudson County FEMA Preliminary Digital Flood Insurance Rate Map (DFIRM) dated January 30, 2015 and the Bergen County FEMA DFIRM dated July 02, 2018.
- A depth grid was generated using the preliminary DFIRMs and 1-meter resolution Digital Elevation Model (DEM) provided by the Hudson County Division of Planning and integrated into the Hazus v6.1 riverine flood model used to estimate potential losses for the 1-percent annual chance flood event.

To estimate exposure to the 1-percent- and 0.2-percent annual chance flood events, the DFIRM flood boundaries, updated assets (population, building stock, critical facilities, and new development) with their centroid in the hazard areas were totaled to estimate the numbers and values vulnerable to a flooding event.

The NFIP policies, claims, and repetitive and severe repetitive loss properties were also examined.

A Level 2 Hazus riverine flood analysis was performed; buildings located within the floodplain were imported as user-defined facilities to estimate potential losses to the building stock at the structural level. Both the critical facility and



building inventories were formatted to be compatible with Hazus and its Comprehensive Data Management System. The Hazus riverine flood model was run to estimate potential losses in Hudson County for the 1-percent annual chance flood event. Hazus calculated the estimated potential losses to the population (default 2020 U.S. Census data) and potential damage to the general building stock and critical facility inventories based on the depth grid generated and the default damage functions in the Hazus flood model.

Coastal Erosion

A USGS report for the National Assessment of Shoreline Change entitled Historical Shoreline Change along the New England and Mid-Atlantic Coasts was released in 2011. The New England and Mid-Atlantic shores were subdivided into a total of 10 analysis regions for the purpose of reporting regional trends in shoreline change rates. The average rate of long-term shoreline change for the New England and Mid-Atlantic coasts was -0.5 meters per year.

There are no NJDEP-identified shoreline types in Hudson County characterized as vulnerable to erosion. However, to estimate exposure to long-term coastal erosion for purposes of this risk assessment, the entire shoreline was analyzed. To generate the extent of the estimated coastal erosion hazard area (CEHA), an erosion rate of 0.5 meters per year was multiplied by 60 to include all structure types and developed/undeveloped areas (annual erosion rate of 0.5 meters x 60 years = 30 meters or approximately 98 feet). Therefore, population, buildings, and infrastructure within 98 feet of the shoreline are identified as vulnerable to long-term coastal erosion. This methodology assumes that once lost to erosion, an area of land is not subsequently restored.

Sea Level Rise

Projected sea-level rise data (in 1-foot increments) available from the NOAA Office of Coastal Management (NOAA 2025) was considered and used for this analysis. These levels do not include additional storm surge due to a hurricane or nor'easter. The current FIRMs also do not include the effects of sea-level rise. A Rutgers University report details several projected sea level rise scenarios for New Jersey between 2030 and 2100 (Kopp, et al. 2016). The 1-foot and 3-foot sea level rise inundation areas from that report were used in the 2019 New Jersey State Hazard Mitigation Plan. To be consistent with the State HMP, these spatial datasets were used for the 2025 Hudson County HMP update.

Asset data (population, building stock, critical facilities) were used to support an evaluation of assets exposed and potential impacts and losses associated with this hazard. To determine what assets are exposed to sea-level rise, the County's assets were overlaid with the hazard area. Assets with their centroid located in the hazard area were totaled to estimate the totals and values exposed to sea-level rise.

GEOLOGICAL HAZARDS

Earthquake

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



An exposure analysis was also conducted for the County's assets (population, building stock, critical facilities) using the NEHRP soil data and liquefaction susceptibility data. NEHRP Soil Classes Type D and Type E and liquefaction susceptibility Class 4 were used to determine what assets are exposed to the soils most susceptible to seismic activity. Assets with their centroid in the hazard areas were totaled to estimate the numbers and values vulnerable to these soil types.

A Level 2 probabilistic assessment in Hazus v6.1 was conducted for Hudson County for the 500 and 2,500-year MRPs to provide earthquake loss estimates. The probabilistic method uses information from locations and magnitudes of historic earthquakes and inferred faults and computes the probable ground shaking levels that could be experienced during a recurrence period by Census tract.

The default assumption is a magnitude 7.0 earthquake for all return periods. Damage and loss due to liquefaction, landslide, or surface fault rupture were not included in this analysis. Although damages are estimated at the Census tract level, results were presented at the municipal level. Damage estimates are calculated for losses to buildings (structural and non-structural) and contents; structural losses include load carrying components of the structure, and non-structural losses include those to architectural, mechanical, and electrical components of the structure, such as nonbearing walls, veneer and finishes, HVAC systems, boilers, etc. For Census tracts encompassing multiple municipalities, the default general building stock inventory was used to calculate the percent of the total Census tract replacement cost value in each municipality. This percentage was applied to the Census tract losses to estimate the municipal level losses. For example, the Census blocks from Municipalities A and B are located within one Census tract, with the total replacement cost value of Municipality A as 60% of the total Census tract replacement cost value and Municipality B as 40% of the total value. Therefore, 60% of the losses for the Census tract will be applied to Municipality A and 40% will be applied to Municipality B.

Landslide

The New Jersey Geologic and Water Survey delineated a landslide susceptibility layer that differentiates areas based on the ground surface and slope. The categories are defined as follows:

- Class A
 - AI—Strongly cemented rock; slope angle of 15-20 degrees
 - AII—Strongly cemented rock; slope angle of 20-20 degrees
 - AIV—Strongly cemented rock; slope angle of 30-40 degrees
 - AVI—Strongly cemented rock; slope angle of greater than 40 degrees
- Class B
 - BIII—Weakly cemented rock and sandy soil; slope angle of 10-15 degrees
 - BIV—Weakly cemented rock and sandy soil; slope angle of 15-20 degrees
 - BV—Weakly cemented rock and sandy soil; slope angle 20-30 degrees
- Class C
 - CVI—Shales and clayey soil; slope angle of 10-15 degrees
 - CVII—Shales and clayey soil; slope angle of 15-20 degrees
 - CIX—Shales and clayey soil; slope angle of 20-40 degrees if dry or 10-15 degrees if groundwater at surface



- CX—Shales and clayey soil, groundwater at surface; slope angle greater than 15 degrees

To determine what assets are exposed to landslide, the County's assets were overlaid with the Class A hazard area; the area of Class B and Class C landslide susceptibility is negligible in Hudson County. Assets with their centroid located in the Class A hazard area were totaled to estimate the number (or count) and replacement cost values exposed to a hazard event.

SEVERE WEATHER

All of Hudson County is exposed to severe weather events. A qualitative assessment was conducted for the severe weather hazard. Information from Hudson County and the Planning Committee were used to assess the potential impacts to the county's assets.

A HAZUS-MH v6.1 probabilistic analysis was performed to analyze the wind hazard losses for Hudson County. The probabilistic hurricane hazard activates a database of thousands of potential storms that have tracks and intensities reflecting the full spectrum of Atlantic hurricanes observed since 1886 and identifies those with tracks associated with Hudson County. HAZUS-MH contains data on historic hurricane events and wind speeds. It also includes surface roughness and vegetation (tree coverage) maps for the area. Surface roughness and vegetation data support the modeling of wind force across various types of land surfaces. Annualized losses and the 100- and 500-year Mean Return Periods (MRPs) were examined for the wind/severe storm hazard. Default demographic and updated building and critical facility inventories in HAZUS-MH v6.1 were used for the analysis.

There is currently a FEMA-acknowledged issue with importing user-defined facilities in HAZUS-MH v6.1. To estimate potential losses to user-defined facilities identified by Hudson County, they were appended to the Emergency Operation Centers input in HAZUS-MH Comprehensive Data Management System (CDMS) and uploaded to the program.

In addition to estimating potential losses due to wind, an exposure analysis was conducted using SLOSH Model (Sea Lake Overland Surge from Hurricanes), which represents potential flooding from worst-case combinations of hurricane direction, forward speed, landfall point, and high astronomical tide were used to estimate exposure. These inundation zones do not include riverine flooding caused by hurricane surge or inland freshwater flooding. The model, developed by the NOAA National Hurricane Center (2022) to forecast surges that occur from wind and pressure forces of hurricanes, considers only storm surge height and does not consider the effects of waves. The SLOSH spatial data includes boundaries for Category 1 through Category 4 hurricane events.

Asset data (population, building stock, critical facilities) were used to support an evaluation of assets exposed and potential impacts and losses associated with this hazard. To determine what assets are exposed to storm surge, the County's assets were overlaid with the SLOSH hazard area. Assets with their centroid located in the hazard area were totaled to estimate the totals and values exposed to the hazard.

SEVERE WINTER WEATHER

The entire general building stock inventory in Hudson County is exposed and vulnerable to the severe winter weather hazard. In general, structural impacts include damage to roofs and building frames, rather than building content. Current modeling tools are not available to estimate specific losses for this hazard. A percentage of the custom-building



stock structural replacement cost value was utilized to estimate damage that could result from severe winter weather. Given professional knowledge and the currently available information, the potential losses for this hazard are considered to be overestimated; hence, providing a conservative estimate for losses associated with severe winter weather.

WILDFIRE

The New Jersey Forest Fire Service uses Wildfire Fuel Hazard data to assign wildfire fuel hazard rankings across the State. This data, developed in 2009, is based upon NJDEP's 2002 Land Use/Land Cover datasets and NJDEP's 2002 10-meter Digital Elevation Grid datasets. For the wildfire hazard, the Wildfire Fuel Hazard "extreme," "very high," and "high" areas are identified as the wildfire hazard area. The defined hazard area was overlaid upon the asset data (population, building stock, critical facilities and potential new development) to estimate the exposure to each hazard.

Asset data (population, building stock, critical facilities) were used to support an evaluation of assets exposed and potential impacts and losses associated with this hazard. To determine what assets are exposed to wildfire, the County's assets were overlaid with the hazard area. Assets with their centroid located in the hazard area were totaled to estimate the totals and values exposed to a wildfire event.

4.3 Rating Probability of Occurrence

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

- **Unlikely**—A hazard event is not likely to occur or is unlikely to occur with less than a 1 percent annual chance probability.
- **Rare**—Between 1 and 10 percent annual probability of a hazard event occurring.
- **Occasional**—Between 10 and 100 percent annual probability of a hazard event occurring.
- **Frequent**—100 percent annual probability; a hazard event may occur multiple times per year.

4.4 Data Source Summary

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



Table 4-2. Risk Assessment Data Documentation

Data	Source	Date	Format
Population	U.S. Census, American Community Survey 5-Year Estimates	2020; 2018-2022	CSV Format
Building Inventory	NJ Office of Information Technology, Office of GIS; Microsoft BING	2024; 2019	Digital GIS Format
Critical Facilities	Hudson County; HIFLD; NJGIN	2024	Digital GIS Format
Land Use	NJ Department of Environmental Protection	2020	Digital GIS Format
Digitized Preliminary FIRM Data (Hudson County)	Federal Emergency Management Agency	2015	Digital GIS Format
Digitized Preliminary FIRM Data (Bergen County)	Federal Emergency Management Agency	2018	Digital GIS Format
1- Meter DEM	Hudson County Division of Planning	2020	Digital GIS Format
Flood Depth Grid	Tetra Tech	2020	Digital GIS Format
Sea Level Rise (1-foot & 3-foot)	NOAA	2022	Digital GIS Format
Coastal Erosion	NJ Department of Environmental Protection	2015	Digital GIS Format
SLOSH	NOAA	2022	Digital GIS Format
NEHRP	New Jersey Geologic and Water Survey	2016	Digital GIS Format
Landslide Susceptibility	New Jersey Geologic and Water Survey	2016	Digital GIS Format
Liquefaction	New Jersey Geologic and Water Survey	2016	Digital GIS Format
Wildfire	New Jersey Forest Fire Service	2012	Digital GIS Format

Notes: FIRM = Flood Insurance Rate Map; HIFLD = Homeland Infrastructure Foundation-Level Data; NJGIN = New Jersey Geographic Information Network; NOAA = National Oceanic and Atmospheric Administration; NEHRP = National Earthquake Hazard Reductions Program; SLOSH = Sea, Lake, and Overland Surges from Hurricanes

4.5 Limitations

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

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

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



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

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

4.6 Considerations for Mitigation and Next Steps

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

- All Hazards
 - Create an updated user-defined general building stock dataset using up-to-date parcels, footprints, and RS Means values.
 - Utilize updated and current demographic data.
- Dam and Levee Failure
 - Leverage current dam failure inundation data to perform a quantitative assessment.
- Flood
 - The general building stock inventory can be updated to include attributes regarding first floor elevation and foundation type (basement, slab on grade, etc.) to enhance loss estimates.
 - Conduct a Hazus loss analysis for more frequent flood events (e.g., 10- and 50-year flood events).
 - Conduct a repetitive loss area analysis.
 - Continue to expand and update urban flood areas to further inform mitigation.
 - As more current FEMA floodplain data become available (i.e., DFIRMs), update the vulnerability analysis and generate a more detailed flood depth grid that can be integrated into the current Hazus version.
- Geologic Hazards
 - A pilot study conducted in Schenectady County, NY (Landslide Susceptibility—A Pilot Study of Schenectady County, NY) provided a detailed methodology for delineating high-risk landslide areas. This study looked at a variety of environmental characteristics including slope and soil conditions to determine areas at risk from landslide. To coincide with the methodology of that study, the generated slopes were categorized into five classes: 0 to 2 percent; 3 to 7 percent; 8 to 15 percent; 16 to 25 percent; Greater than 25 percent. Should the county determine the need for a more detailed assessment of risk, it could determine steep slope by other percentage categorizations. Additional environmental and soil characteristics used in the Schenectady County plan can be collected and used to follow the methodology used to further delineate the county's most at-risk areas.
 - Identify unreinforced masonry in critical facilities and privately-owned buildings (i.e., residences) by accessing local knowledge, tax assessor information, and/or pictometry/orthophotos. These buildings may



not withstand earthquakes of certain magnitudes and plans to provide emergency response or recovery efforts at these properties can be developed.

- Extreme Temperatures
 - Track extreme temperature data for injuries, deaths, shelter needs, pipe freezing, agricultural losses, and other impacts to determine distributions of most at-risk areas.
- Severe Storm
 - The general building stock inventory can be updated to include attributes regarding protection against strong winds, such as hurricane straps, to enhance loss estimates.
 - Integrate evacuation route data that is currently being developed.
- Wildfire
 - General building stock inventory can be updated to include attributes such as roofing material, fire detection equipment, or distance to fuels as another measure of vulnerability.



5. IDENTIFICATION OF HAZARDS OF CONCERN

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

- Input from all Planning Partners
- Review of the State of New Jersey 2024 Hazard Mitigation Plan
- Review of the 2020 Hudson County HMP
- Research on the frequency, magnitude, and costs associated with hazards that have previously or could feasibly impact the region
- Qualitative information regarding natural (not human-caused) hazards and the perceived vulnerability of the study area's assets to them.

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

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

5.1 Hazard Review and Selection

Table 5-1 documents the process of identifying the hazards of concern for further profiling and evaluation, based on the hazards identified and included in the State HMP. Based on the review, eight of the potential hazards of concern were identified as significant hazards to be addressed in this plan (shown here in alphabetical order):

- Dam and levee failure
- Drought
- Extreme temperature
- Flood
- Geological hazards
- Severe weather
- Severe winter weather
- Wildfire

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

*Table 5-1. Identification of Hazards of Concern for Hudson County*

Hazard	May Occur in the County?	Significant Threat to the County?	Why was this determination made?	Sources
Animal Disease	Yes	No	The 2024 New Jersey State HMP identifies animal disease as a hazard of concern for New Jersey. The Steering Committee and Planning Partnership do not consider animal disease to be a hazard of concern for Hudson County.	New Jersey State HMP Planning Partnership Input
Civil Unrest	Yes	No	The 2024 New Jersey State HMP identifies civil unrest as a hazard of concern for New Jersey. The Steering Committee and Planning Partnership do not consider civil unrest to be a hazard of concern for this HMP as it is addressed in other preparedness plans.	New Jersey State HMP Planning Partnership Input
Coastal Erosion	Yes	Yes	The Steering Committee and Planning Partnership have added coastal erosion as part of flood, identified as a hazard of concern for Hudson County.	New Jersey State HMP Planning Partnership Input
Crop Failure	Yes	No	The 2024 New Jersey State HMP identifies crop failure as a hazard of concern for New Jersey. The Steering Committee and Planning Partnership do not consider crop failure to be a hazard of concern for Hudson County.	New Jersey State HMP Planning Partnership Input
Cyber Attack	Yes	No	The 2024 New Jersey State HMP identifies cyber-attack as a hazard of concern for New Jersey. The Steering Committee and Planning Partnership do not consider cyber-attack to be a hazard of concern for this HMP as it is addressed in other preparedness plans.	New Jersey State HMP Planning Partnership Input
Dam and Levee Failure	Yes	Yes	The 2024 New Jersey State HMP identifies dam failure as a hazard of concern for New Jersey. According the 2024 New Jersey State HMP, Hudson County has one high-hazard dam. The Planning Partnership identified dam and levee failure as a hazard of concern for Hudson County.	New Jersey State HMP Planning Partnership Input USACE National Inventory of Dams
Drought	Yes	Yes	The 2024 New Jersey State HMP identifies drought as a hazard of concern for New Jersey. New Jersey has entered periods of drought and Hudson County has experienced droughts classified in the abnormally dry and moderate categories. According the 2024 New Jersey State HMP, Hudson County has experienced one U.S. Department of Agriculture (USDA) drought related declarations from 2012 to 2023. The Planning Partnership identified drought as a hazard of concern for Hudson County.	New Jersey State HMP FEMA NOAA National Centers for Environmental Information (NCEI) USDA U.S. Drought Monitor NDMC Planning Partnership Input



Hazard	May Occur in the County?	Significant Threat to the County?	Why was this determination made?	Sources
Earthquake	Yes	Yes	The 2024 New Jersey State HMP identifies earthquakes as a hazard of concern for New Jersey. FEMA's National Risk Index indicates that Hudson has a relatively low risk ranking in relation to the earthquake hazard. The Steering Committee and Planning Partnership have included earthquake with geological hazards, which are identified as a hazard of concern for Hudson County.	New Jersey State HMP FEMA New Jersey Geological & Water Survey U.S. Geologic Survey Planning Partnership Input
Economic Collapse	Yes	No	The 2024 New Jersey State HMP identifies economic collapse as a hazard of concern for New Jersey. The Steering Committee and Planning Partnership do not consider economic collapse to be a hazard of concern for Hudson County.	New Jersey State HMP Planning Partnership Input
Extreme Temperature	Yes	Yes	The 2024 New Jersey State HMP identifies extreme temperature as a hazard of concern for New Jersey. FEMA's National Risk Index indicates that Hudson has a relatively high risk ranking in relation to extreme heat and no risk ranking in relation to extreme cold. The Planning Partnership identified extreme temperature as a hazard of concern for Hudson County.	New Jersey State HMP FEMA Planning Partnership Input
Fishing Failure	No	No	The 2024 New Jersey State HMP identifies fishing failure as a hazard of concern for New Jersey. The Steering Committee and Planning Partnership do not consider fishing failure to be a hazard of concern for Hudson County.	New Jersey State HMP Planning Partnership Input
Flood (riverine, lakeshore, ice jam, dam failure, urban flooding, and flash flooding)	Yes	Yes	The 2024 New Jersey State HMP identifies flood as a hazard of concern for New Jersey. Hudson County has been included in four flood-related FEMA declarations. Hudson County has been included in numerous flood and flash flood events listed in the NOAA database since 2010 and has numerous critical facilities located within the special flood hazard area. The Planning Partnership identified flood as a hazard of concern for Hudson County.	New Jersey State HMP FEMA NOAA NCEI Planning Partnership Input
Geological Hazards	Yes	Yes	The 2024 New Jersey State HMP identifies geological hazards as hazards of concern for New Jersey. FEMA's National Risk Index indicates that Hudson has a relatively moderate risk ranking in relation to the landslide hazard. Based on the 2024 New Jersey State HMP, Hudson County has experienced numerous rockslides and debris flows. The Planning Partnership identified geological hazards as a hazard of concern for Hudson County.	New Jersey State HMP FEMA U.S. Geologic Survey New Jersey Geological & Water Survey Planning Partnership Input
Harmful Algal Blooms	Yes	No	The 2024 New Jersey State HMP identifies harmful algal blooms as a hazard of concern for New Jersey. The Steering Committee and Planning Partnership do not consider harmful algal blooms to be a hazard of concern for Hudson County.	New Jersey State HMP Planning Partnership Input



Hazard	May Occur in the County?	Significant Threat to the County?	Why was this determination made?	Sources
Hazardous Substances	Yes	Yes	The 2024 New Jersey State HMP identifies hazardous substances as a hazard of concern for New Jersey. The Steering Committee and Planning Partnership do not consider hazardous substances to be a hazard of concern for this HMP as this hazard is addressed in other preparedness plans.	
Hurricane (tropical cyclones, including tropical storms and tropical depressions)	Yes	Yes	The Steering Committee and Planning Partnership have added hurricane as part of severe weather, identified as a hazard of concern for Hudson County.	New Jersey State HMP Planning Partnership Input
Nuclear Hazards	Yes	Yes	The 2024 New Jersey State HMP identifies nuclear hazards as a hazard of concern for New Jersey. The Steering Committee and Planning Partnership do not consider nuclear hazards to be a hazard of concern for this HMP as this hazard is addressed in other preparedness plans.	New Jersey State HMP Planning Partnership Input
Pandemic	Yes	Yes	The 2024 New Jersey State HMP identifies pandemic as a hazard of concern for New Jersey. Hudson County State has been identified in three FEMA pandemic-related declarations, including two for COVID-19 and one for West Nile Virus. The Steering Committee and Planning Partnership do not consider pandemic to be a hazard of concern for this HMP as it is addressed in other preparedness plans and programs.	New Jersey State HMP FEMA Planning Partnership Input
Severe Weather (windstorms, thunderstorms, hail, tornadoes, hurricanes)	Yes	Yes	The 2024 New Jersey State HMP identifies severe weather as a hazard of concern for New Jersey. Hudson County was included in 11 FEMA declarations between 1997-2024 related to severe storms. The Planning Partnership identified severe weather as a hazard of concern for Hudson County.	New Jersey State HMP FEMA NOAA NCEI Planning Partnership Input
Severe Winter Weather (heavy snow, blizzards, ice storms)	Yes	Yes	The 2024 New Jersey State HMP identifies severe winter weather as a hazard of concern for New Jersey. Hudson County was included in four FEMA disaster declarations for winter weather between 1993 and 2024. The Planning Partnership identified severe winter weather as a hazard of concern for Hudson County.	New Jersey State HMP FEMA NOAA NCEI Planning Partnership Input
Terrorism	Yes	No	The 2024 New Jersey State HMP identifies terrorism as a hazard of concern for New Jersey. The Steering Committee and Planning Partnership do not consider terrorism to be a hazard of concern for this HMP as it is addressed in other preparedness plans.	New Jersey State HMP Planning Partnership Input



Hazard	May Occur in the County?	Significant Threat to the County?	Why was this determination made?	Sources
Wildfire	Yes	Yes	The 2024 New Jersey State HMP identifies wildfire as a hazard of concern for New Jersey. Hudson County has critical facilities located within moderate to high-risk wildfire area. The Planning Partnership identified wildfire as a hazard of concern for Hudson County.	New Jersey State HMP FEMA New Jersey Forest Fire Service Planning Partnership Input





5.2 Hazard Descriptions

The selected hazards of concern for this HMP are generally defined as follows:

- A dam is a structure built across a river or stream to hold back water. Dam failures occur when the dam is damaged, destroyed or otherwise overtopped, releasing water or other liquid stored behind the dam.
- A drought is a period characterized by long durations of below normal precipitation. Drought is a temporary irregularity that can affect agriculture, water supply, aquatic ecology, wildlife, and plant life.
- The extreme temperature hazard includes both heat and cold events, which can have a significant impact on human health, commercial/agricultural businesses, and primary and secondary effects on infrastructure (e.g., burst pipes and power failure). What constitutes “extreme cold” or “extreme heat” can vary across different areas of the country based on what the population is accustomed to. This HMP considers the heat island effect that occurs within developed areas.
- The flood hazard includes riverine flooding, coastal flooding, flash flooding, storm surge, stormwater/urban, sea-level rise, and coastal erosion. Inclusion of the various forms of flooding under a general flood hazard is consistent with that used in FEMA’s Multi-Hazard Identification and Risk Assessment guidance.
- Geological hazards include earthquakes and landslides. An earthquake is the sudden movement of the earth’s surface caused by the release of stress accumulated within or along the edge of the earth’s tectonic plates, a volcanic eruption, or a human activity that cause geologic stresses. The landslide hazard includes rock falls, rock topples, rotational slump, transitional slide, earth flows, creep, block slides, debris avalanche, and debris flows.
- The severe weather hazard includes windstorms that often entail a variety of other influencing weather conditions, including thunderstorms, hail, lightning, and tornadoes. Tropical disturbances (hurricanes, tropical storms, and tropical depressions) are often identified as a type of severe weather. For this HMP update, severe weather includes thunderstorms and lightning, high winds, hailstorms, tornadoes, and hurricanes.
- The severe winter weather hazard includes heavy snow, blizzards, sleet, ice storms, and nor’easters.
- The wildfire hazard can be defined as any non-structural fire that occurs in the wildland. Three distinct types of wildland fires have been defined and include naturally occurring wildfire, human-caused wildfire, and prescribed fire. They may be highly destructive and become difficult to control. Wildfires result in the disturbance of forest and brush and destruction of real estate and personal property and have secondary impacts on other hazards, such as flooding, by removing vegetation and disturbing watersheds.



6. DAM AND LEVEE FAILURE

6.1 Hazard Profile

6.1.1 Hazard Description

A dam is an artificial barrier built to contain, control or divert water, wastewater, or any liquid-borne material. The purpose of a dam is to store water, wastewater, or liquid borne materials for several reasons, including flood control, human water supply, energy generation, recreation, or pollution control (ASDSO 2024). Many dams fulfill a combination of these functions. Dams require regular maintenance to retain their level of protection.

A levee is a raised embankment along the edge of a river, canal, or other waterway to prevent flow in the waterway from overflowing onto surrounding lands. A levee is usually earthen and runs parallel to the course of the waterway in its floodplain.

A dam failure is any malfunction or abnormality outside of the design that adversely affects the primary function of impoundment (FEMA 2018). When dams fail or overtop, they can lead to major flooding and cause catastrophic impacts especially in downstream areas (ASDSO 2024). Dam failures cause serious downstream flooding either because of partial or complete dam collapse. 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 occur when the dam is damaged or destroyed, releasing water or other liquid stored behind the dam. Throughout history, hundreds of dams failed in the United States, causing property and environmental damage, injuries, and fatalities. Dam failures can occur suddenly, without warning, and may occur during normal operating conditions. This is referred to as a “sunny day” failure. Dam failures may also occur during a large storm event. Significant rainfall can quickly inundate an area and cause floodwaters to overwhelm a reservoir. If the spillway of the dam cannot safely pass the resulting flows, water will begin flowing in areas not designed for such flows, and a failure may occur. Dam failures are most likely due to one or a combination of the following events (ASDSO 2024):

- Overtopping caused by water spilling over the top of a dam
- Foundation defects, including settlement and slope instability
- Cracking caused by movement
- Inadequate maintenance and upkeep
- Seepage filtration that enables the formation of sinkholes in the dam

A levee failure or breach causes flooding in landward areas adjacent to the structure. The failure of a levee 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.



REGULATORY OVERSIGHT OF DAMS

National Dam Safety Program

The potential for catastrophic flooding caused by dam failures led to enactment of the National Dam Safety Act (Public Law 92-367), which for 30 years has protected Americans from dam failures. The National Dam Safety Program is a partnership among states, federal agencies, and other stakeholders that encourages individual and community responsibility for dam safety. Under the program, state assistance funds have allowed all participating states to improve their programs through increased inspections, emergency action planning, and purchases of needed equipment. FEMA has also expanded existing and initiated new training programs. Grant assistance from FEMA provides support for improvement of dam safety programs that regulate most dams in the United States (FEMA 2024).

New Jersey Department of Environmental Protection Dam Safety Section

The New Jersey Department of Environmental Protection (NJDEP) Dam Safety Section has responsibility for overseeing dam safety in the state. The primary goal of the oversight program is to ensure the safety and integrity of dams in New Jersey and thereby protect people and property from the consequences of dam failures. The Dam Safety Section reviews plans and specifications for the construction of new dams or for the alteration, repair, or removal of existing dams and must grant approval before the owner can proceed with construction. New Jersey's Safe Dam Act requires dams to meet state dam safety standards. NJDEP has enforcement capabilities to achieve compliance with the standards. This includes issuing orders for compliance to dam owners and pursuing legal action if the owner does not comply (with possible fines levied on a per-day basis for violations) (NJDEP 2024).

NJDEP assigns one of four hazard ratings to state-regulated dams in New Jersey (State of New Jersey 2017):

- Class I (High-Hazard Potential)—Failure of the dam may result in probable loss of life and/or extensive property damage.
- Class II (Significant-Hazard Potential)—Failure of the dam may result in significant property damage; however, loss of life is not envisioned.
- Class III (Low-Hazard Potential)—Failure of the dam is not expected to result in loss of life or significant property damage.
- Class IV (Zero-Hazard Potential)—Failure of the dam is not expected to result in loss of life or significant property damage.

Hazard potential is based on the consequences of dam failure and not the dam condition or the probability of failure occurring.

Existing dams are periodically inspected to ensure that they are adequately maintained, and owners are directed to correct any deficiencies found. The owners or operators of all dams that raise the waters of any stream more than 70 feet above its usual mean low-water height or that impound more than 10,000 acre-feet of water must have a regular inspection performed annually and formal inspections performed every three years by a state-licensed professional engineer. These inspections must be attended by a professional engineer assigned from the NJDEP (State of New Jersey 2024). Inspection guidelines are summarized Table 6-1.

**Table 6-1. Dam Inspection Requirements**

Dam Size/Type	Regular Inspection	Formal Inspection
Class I (High Hazard) Large Dam	Annually	Once every 3 years
Class I (High Hazard) Dam	Once every 2 years	Once every 6 years
Class II (Significant Hazard) Dam	Once every 2 years	Once every 10 years
Class III (Low Hazard) Dam	Once every 4 years	Only as required
Class IV (Zero Hazard) Dam	Once every 4 years	Only as required

Source: State of New Jersey 2017

Based on the inspection, owners are required to note the extent of deterioration as a basis for long term planning, periodic maintenance, or immediate repair; to evaluate conformity with current design and construction practices; and to determine the appropriateness of the existing hazard classification. NJDEP has guidelines to meet the requirements of the National Inventory of Dams condition assessment of existing dams. Table 6-2 summarizes the definitions for each potential deficiency rating.

Table 6-2. Dam Deficiency Ratings

Rating	Definition
Satisfactory	No existing or potential dam safety deficiencies are recognized. Acceptable performance is expected under all applicable loading conditions (static, hydrologic, seismic) in accordance with the applicable regulatory criteria. Minor maintenance items may be required.
Fair	Acceptable performance is expected under all required loading conditions (static, hydrologic, seismic) in accordance with the applicable dam safety regulatory criteria. Minor deficiencies may exist that require remedial action and/or secondary studies or investigations.
Poor	A dam safety deficiency is recognized for any required loading condition (static, hydrologic, seismic) in accordance with the applicable dam safety regulatory criteria. Remedial action is necessary. Poor also applies when further critical studies or investigations are needed to identify any potential dam safety deficiencies.
Unsatisfactory	Considered unsafe. A dam safety deficiency is recognized that requires immediate or emergency remedial action for problem resolution. Reservoir restrictions may be necessary.

Source: NJDEP 2017

The Dam Safety Section also coordinates with the Division of State Police and local and county emergency management officials in the preparations and approval of emergency action plans (EAPs). The state requires all high hazard and significant hazard dams to have NJDEP-approved EAPs in place. It is the responsibility of the dam owner to review and update the EAP on an annual basis.

U.S. Army Corps of Engineers Dam Safety Program

The U.S. Army Corps of Engineers (USACE) is responsible for safety inspections of some federal and non-federal dams in the United States that meet the size and storage limitations specified in the National Dam Safety Act. USACE has inventoried dams and has surveyed each states and federal agency's capabilities, practices, and regulations regarding design, construction, operation, and maintenance of the dams. USACE has also developed guidelines for inspection and evaluation of dam safety (USACE 2014).



Table 6-3 lists USACE-developed ratings of hazard potentials of dams, based on potential consequences of a dam failure. According to New Jersey's State HMP, the level of impact that a failure would have can be predicted based upon the USACE hazard rating.

Table 6-3. USACE Dam Hazard Ratings

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

Source: USACE 2014

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

Federal Energy Regulatory Commission Dam Safety Program

The Federal Energy Regulatory Commission (FERC) has the largest dam safety program in the United States. FERC cooperates with several federal and state agencies to ensure and promote dam safety and, more recently, homeland security. A total of 3,036 dams are part of regulated hydroelectric projects and are included in the FERC program; two-thirds of these dams are more than 50 years old (FERC 2020). Concern about their safety and integrity grows as dams age, rendering oversight and regular inspection especially important. FERC staff inspect hydroelectric projects on an unscheduled basis to investigate the following issues (FERC 2020):

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

Every five years, an independent consulting engineer, approved by FERC, must inspect and evaluate projects with dams higher than 32.8 feet (10 meters) or with total storage capacity of more than 2,000 acre-feet (FERC 2020). FERC staff visit dams and licensed projects during and after floods, assess extents of damage, and direct any studies or remedial measures the licensee must undertake.



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

REGULATORY OVERSIGHT OF LEVEES

New Jersey

Currently in the State of New Jersey, no single agency oversees the operation and maintenance of levees or levee systems nor has specific regulatory authority or responsibility over the safety of existing or proposed levees or levee systems. Oversight is accomplished through coordination of federal, state and local authorities (State of NJ HMP 2019).

USACE and FEMA

USACE and FEMA have differing roles and responsibilities related to levees. USACE addresses a range of operation and maintenance, risk communication, risk management, and risk-reduction issues as part of its responsibilities under the Levee Safety Program. FEMA addresses mapping and floodplain management issues related to levees, and it accredits levees as meeting requirements set forth by the National Flood Insurance Program.

Depending on the levee system, USACE and FEMA may be involved with the levee sponsor and community independently or—when a levee system overlaps both agency programs—jointly. Under both scenarios, the long-term goals are similar: to reduce risk and lessen the devastating consequences of flooding. Some USACE and FEMA partnering activities related to levees include:

- Joint meetings with levee sponsors and other stakeholders
- Integration of levee information into the National Levee Database
- State Silver Jackets teams
- Sharing of levee information
- Targeted task forces to improve program alignment

The Silver Jackets is a program that provides an opportunity to consistently bring together multiple state, federal, tribal, and local agencies to learn from each other and apply their knowledge to reduce risk. The Program's primary goals include the following:

- Create or supplement a mechanism to collaboratively identify, prioritize, and address risk management issues and implement solutions
- Increase and improve risk communication through a unified interagency effort
- Leverage information and resources and provide access to such national programs as FEMA's Risk Mapping, Assessment, and Planning (MAP) and USACE's Levee Inventory and Assessment Initiative
- Provide focused, coordinated hazard mitigation assistance in implementing high-priority actions such as those identified by state hazard mitigation plans



- Identify gaps among agency programs and/or barriers to implementation, such as conflicting agency policies or authorities, and provide recommendations for addressing these issues

Coordination between USACE and FEMA with regard to levees is now standard within many of each agency's policies and practices. Over the past several years, both agencies coordinated policies where appropriate; jointly participated in meetings with stakeholders; and participated in many multiagency efforts, such as the National Committee on Levee Safety, the Federal Interagency Floodplain Management Task Force, and the Silver Jackets Program.

National Committee on Levee Safety

Congress created the National Committee on Levee Safety to "develop recommendations for a national levee safety program, including a strategic plan for implementation of the program." The Committee is made up of representatives from state, regional, and local agencies; the private sector; USACE; and FEMA (USACE n.d.).

6.1.2 Location

NJDEP has identified and classified one dam in Hudson County: the Hackensack Reservoir Dam along the Passaic River. The reservoir is surrounded on all four sides by embankments comprised of soil, with a clay layer, covered by stone block. The dam is an earthen dam with conduits for overflow and water distribution and was constructed around 1900.

According to the National Levee Database, Hudson County has no active levee systems (USACE n.d.). However, the City of Hoboken is undertaking a significant infrastructure project, known as the Rebuild By Design - Hudson River project, to mitigate the impacts of severe coastal flooding. This initiative involves the construction of a hybrid levee and flood wall system strategically positioned at the northern and southern ends of the city (City of Hoboken n.d.).

Hudson County considers the locations of dams and levees to be sensitive information. A map is not included, and municipal-level statistics are not listed in this HMP due to these sensitivities.

6.1.3 Extent

The extent or magnitude of a dam failure event can be measured in terms of the classification of the dam. Additionally, there are two factors that influence the potential severity of a full or partial dam failure: the amount of water impounded; and the density, type, and value of development and infrastructure located downstream (FEMA 2018).

Hudson County contains one dam: the Hackensack Reservoir Dam. This structure is rated as a high hazard potential dam, as shown in Table 6-4. The failure of this dam could cause probable loss of life or property damage. Hazard potential is based on the consequences of dam failure and not the dam condition or the probability of failure occurring. Last inspected in October 2023, the Hackensack Reservoir Dam is in fair condition and last updated its EAP in November 2023.



Table 6-4. Dams by Hazard Classification in Hudson County

Hazard Ranking	Number of Dams
High	1
Significant	0
Low	0
Total	1

Source: USACE n.d.

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 miles per hour (mph). Survival would be a matter of having the good fortune not to be in the flood path at the time of the break. Dam failures due to the overtopping of a dam normally give sufficient lead time for evacuation.

Levees require maintenance to continue to provide the level of protection they were designed and built to offer. Maintenance responsibility belongs to a variety of entities including local, state, and federal government and private landowners. Well-maintained levees may obtain certification through independent inspections paid for by their owners. Levees can also be accredited by FEMA if they meet certain design, data, and documentation standards that show it reduces the base flood hazard (i.e., one-percent annual chance flood event) (FEMA 2021).

6.1.4 Previous Occurrences

FEMA MAJOR DISASTER AND EMERGENCY DECLARATIONS

Between 1954 and 2023, Hudson County was not included in any major disaster (DR) or emergency (EM) declarations for dam or levee failure-related events (FEMA 2023).

USDA DECLARATIONS

The Secretary of Agriculture from the U.S. Department of Agriculture (USDA) is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in contiguous counties. Between 2019 and 2023, Hudson County was not included in any USDA dam or levee failure-related agricultural disaster declarations (USDA 2024).

PREVIOUS EVENTS

No known dam or levee failure events impacted Hudson County between August 2019 and December 2023 (NJDEP 2024, NOAA-NCEI 2024, FEMA 2024). As noted in previous HMPs, there have been no dam or levee failure events recorded in Hudson County prior to 2019.



6.1.5 Probability of Future Occurrences

PROBABILITY BASED ON PREVIOUS OCCURRENCES

Based on NJDEP, FEMA, and NOAA-NCEI records, no dam or levee failure events have occurred or affected Hudson County (NJDEP 2024, NOAA-NCEI 2024, FEMA 2024). Dam failure events are infrequent and usually coincide with events that cause them, such as earthquakes, landslides, and excessive rainfall and snowmelt. Combined with the lack of recorded events in the County, there is likely a low probability that a dam or levee failure will occur in the future. However, the construction of new dam and levee structures could increase failure risks, and failure risks increase as dams age or are not maintained properly.

There are many regulatory bodies and mitigation measures in place to protect communities from the impacts of dam or levee failures. Even with these safeguards, dams and levees experience “residual risk,” which refers to the risk of more severe events than those that the facility was designed to withstand. However, overall, the probability of any type of dam failure is low given New Jersey’s dam safety regulatory and oversight environment.

Based on historical records and input from the Steering Committee, the probability of occurrence for dam or levee failure in the County is considered “rare.”

EFFECT OF CLIMATE CHANGE ON FUTURE PROBABILITY

Climate change can impact stored water systems as increased rainfall accumulations can cause reservoirs to overtop or rivers to run higher. Dams are designed using a hydrograph to evaluate dam safety issues for situations where the reservoir inflow peak discharge is greater than the maximum spillway capacity, the reservoir has large surcharge storage, and/or the reservoir has dedicated flood control space. Increased precipitation due to climate change may result in overtopping, as the hydrographs are based off historical events (FEMA 2013). Similarly, levees are designed to contain high river flows determined by historical records. Increased rainfall due to climate change can lead to flows beyond those the levee was intended to contain, with the resulting potential for the levee to fail or be overtopped.

6.1.6 Cascading Impacts on Other Hazards

Dam and levee failure can cause severe downstream flooding, depending on the magnitude of the failure. Other potential secondary hazards of dam or levee failure are landslides around the reservoir perimeter, bank erosion on the rivers, and destruction of downstream habitat. Floods caused by dam and levee failures have caused loss of life and property damage (FEMA 2013).

6.2 Vulnerability and Impact Assessment

To assess Hudson County’s risk to dam and levee failure, a qualitative review was implemented and supplemented with information from Section 4.3.7 (Flood) from this HMP.



6.2.1 Life, Health, and Safety

The impact of dam and levee failure on life, health, and safety is dependent on several factors such as the class of dam/levee, the area that the dam/levee is protecting, the location of the dam/levee, and the proximity of structures, infrastructure, and critical facilities to the dam or levee structure.

OVERALL POPULATION

The entire population residing within a dam failure inundation zone is considered exposed and potentially vulnerable to a dam failure event. The potential for loss of life is affected by the warning time provided, and capacity and number of evacuation routes available to populations living within these areas. Those most at risk include the economically disadvantaged and the population over the age of 65 due to their limited capability to respond or mitigate against dam failures.

SOCIALLY VULNERABLE POPULATION

People living below the poverty level are more at risk during a dam failure event because they may be unable to evacuate based upon the net economic impact to their family. Elderly populations are more likely than the general population to need medical attention, and the availability of medical services may be limited due to isolation during a dam failure event. This population also faces difficulties in evacuating. There is often limited warning time for a dam failure event. Populations without adequate warning of the event are highly vulnerable.

Without a quantitative assessment of potential impacts of a dam failure on socially vulnerable populations, the Planning Partners can best assess mitigation options through an understanding of the general numbers and locations of such populations across Hudson County. Section 3.6.4 provides detailed data on socially vulnerable populations within the planning area. Table 6-5 summarizes highlights of this information. For planning purposes, it is reasonable to assume that percentages and distribution of socially vulnerable populations affected by a dam failure will be similar to the countywide numbers.

Table 6-5. Distribution of Socially Vulnerable Populations by Municipality

Category	Countywide Total		Municipality Highest in Category		Municipality Lowest in Category	
	Number	Percent	Number	Percent	Number	Percent
Population Over 65	86,664	12.0%	Jersey City 32,671	North Bergen 16.6%	East Newark 308	Hoboken 6.4%
Population Under 5	86,664	12.0%	Jersey City 20,476	Bayonne 7.1%	East Newark 106	East Newark 4.1%
Non-English-Speaking Population	93,494	12.9%	Jersey City 29,070	West New York 24.5%	East Newark 474	Hoboken 4.3%
Population With Disability	61,174	8.4%	Jersey City 22,396	Union City 11.2%	East Newark 209	Weehawken 6.2%
Population Below Poverty Level	99,546	13.7%	Jersey City 43,134	East Newark 24.6	East Newark 638	Seaucus 5.1%
Households Below ALICE Threshold	63,893	21%	Jersey City 119,278	Union City 49%	East Newark 846	Hoboken 20%



6.2.2 General Building Stock

All buildings and infrastructure located in the dam and levee failure inundation zone are considered exposed and potentially vulnerable. Widespread damage to buildings and infrastructure affected by an event would result in large costs to repair these locations. Property located closest to the dam inundation area has the greatest potential to experience the largest, most destructive surge of water.

Dam and levee failure can cause severe downstream flooding and may transport large volumes of sediment and debris, depending on the magnitude of the event. Widespread damage to buildings and infrastructure affected by an event would result in large costs to repair these locations. In addition to physical damage costs, businesses can be closed while flood waters retreat, and utilities are returned to a functioning state.

6.2.3 Community Lifelines and Other Critical Facilities

Dam and levee failures may also impact critical facilities and infrastructure located in the downstream inundation zone. Consequentially, dam failure can cut evacuation routes, limit emergency access, and/or create isolation issues. All transportation infrastructure in the dam failure inundation zone is vulnerable to damage, which can potentially cut off evacuation routes, limit emergency access, and create isolation issues. Utilities such as overhead power lines, cable, and phone lines are also at risk. The loss of these utilities could further exacerbate isolation issues for the inundation areas, making it difficult for residents to communicate and access essential services.

6.2.4 Economy

Flooding from a dam or levee failure can cause extensive structural damage to private property and public utilities, cutting off essential services. Loss of power and communications may occur, and drinking water and wastewater treatment facilities can be temporarily out of operation. Debris from damaged buildings can accumulate, adding to the costs of removal. Additionally, the closure of businesses due to such flooding can have a severe impact on the local economy. When businesses cannot operate, it affects not only the revenue of those businesses but also the livelihoods of employees and the overall economic stability of the community. The inability to access shopping centers or workplaces further amplifies the economic strain by halting business operations, reducing revenue, impacting employment, disrupting supply chains, and decreasing consumer spending, all of which hinder the local economy's stability and recovery.

6.2.5 Natural, Historic and Cultural Resources

NATURAL

The environmental impacts of a dam and levee failure can include significant water-quality and debris-disposal issues or severe erosion that can impact local ecosystems. Floodwaters can back up sanitary sewer systems and inundate wastewater treatment plants, causing raw sewage to contaminate residential and commercial buildings and the flooded waterway. The contents of unsecured containers of oil, fertilizers, pesticides, and other chemicals may get added to flood waters. Hazardous materials may be released and distributed widely across the floodplain. Water supply and wastewater treatment facilities could be offline for weeks. The destruction of local ecosystems is a significant concern



because they are essential for maintaining biodiversity, supporting wildlife, and providing critical services such as clean water, air, and soil health.

HISTORIC

Dam and levee failures may impact historic resources by the resulting flood waters. Historic buildings and structures, sites, monuments, districts, and historic documents are often irreplaceable, and may become damaged or destroyed in the flood waters following a dam or levee failure. The loss of these resources is all the more painful as residents rely on the presence of these resources to reinforce connections with neighbors and the larger community, and to seek comfort in the aftermath of a disaster.

CULTURAL

Cultural resources include “moveable heritage,” such as collections of artifacts, statuary, artwork, and important documents or repositories. These resources are housed in libraries, museums, archives, historical repositories, or historic properties. Flood waters following a dam and levee failure creates the largest risk to these resources. Similar to historic resources, residents may rely on the presence of cultural resources to reinforce connections with neighbors and the larger community, and to seek comfort in the aftermath of a disaster.

6.3 Future Changes That May Affect Risk

6.3.1 Potential or Planned Development

As discussed in Section 3 (County Profile), areas targeted for future growth and development have been identified across the County. Any areas of growth could be potentially impacted by a dam and levee failure event if the structures are located within the flood protection area and mitigation measures are not considered. Therefore, it is 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. Due to the sensitive nature of dam locations and downstream inundation zones, an assessment to determine the proximity of these new development sites to potential dam inundation cannot be performed at this time.

6.3.2 Projected Changes in Population

The New Jersey Department of Labor and Workforce Development produced populations projections by County from 2014 to 2019, 2024, 2029, and 2034. According to these projections, Hudson County is projected to have an increase in population in the upcoming years. These projection totals include a population of 747,400 by 2029, and 766,500 by 2034 (State of New Jersey 2017). An increase in population density can impact the number of persons exposed to the probable maximum flood inundation hazard areas. Higher density can not only create issues for local residents during evacuation of a dam or levee failure event but can also have an effect on commuters that travel into and out of the County for work. Refer to Chapter 3 (County Profile), which includes a more thorough discussion about population trends for the County.



6.3.3 Climate Change

Most studies indicate that the State of New Jersey will experience a rise in average annual precipitation, primarily in the form of heavy rainfalls, which could elevate the risk of dam failures. Increased precipitation may place additional stress on dam structures. Existing flood control systems might struggle to manage the higher water flow from more frequent, intense rainfall events. This could lead to more frequent overtopping of dams and flooding of county assets in adjacent inundation areas. However, the probable maximum flood used in dam design may still accommodate these climate changes.

Projections suggest that annual precipitation in the State of New Jersey could increase by 4 percent to 11 percent, potentially affecting the hydrographs of many dammed rivers. This rise in precipitation could reduce the designed margin of safety, known as freeboard, for dams. A decrease in freeboard may result in floodwaters overtopping the dam or creating unintended loads, potentially leading to dam failure (NJOEM 2024)

6.3.4 Other Identified Conditions

When assessing the risk of dam and levee failure in the future, several conditions should be considered. Aging infrastructure is a significant risk factor, as many dams may not meet current safety standards and are more susceptible to failure due to wear and tear. Historical design and construction flaws can also become critical over time, especially under changing environmental conditions. Inadequate maintenance and delayed repairs further increase the risk of dam failure (FEMA 2018).

Issues with upstream dams can impact downstream dams, potentially leading to cascading failures. Development in areas surrounding dams, known as hazard creep, can heighten the potential consequences of a dam failure. Additionally, cybersecurity attacks and other security threats can alter dam operations and pose significant risks (CRS Report 2023).



7. DROUGHT

7.1 Hazard Profile

7.1.1 Hazard Description

As defined by the National Weather Service (NWS), drought is a deficiency in precipitation over an extended period resulting in a water shortage causing adverse impacts on vegetation, animals, and/or people (NOAA 2018). It is a normal, recurrent feature of climate that occurs in virtually all climate zones, from very wet to very dry. Drought is a temporary aberration from normal climatic conditions and can vary significantly from one region to another. Human factors, such as water demand and water management, can exacerbate the impact that a drought has on a region. There are five different ways that drought can be defined or grouped (NDMC n.d.):

- *Meteorological drought* is a measure of departure of precipitation from normal. It is defined solely on the relative degree of dryness. Due to climatic differences, what might be considered a drought in one location of the country may not be a drought in another location.
- *Agricultural drought* links various characteristics of meteorological (or hydrological) drought to agricultural impacts, focusing on precipitation shortages, differences between actual and potential evapotranspiration, soil water deficits, reduced ground water or reservoir levels, and other parameters. It occurs when there is not enough water available for a particular crop to grow at a particular time. Agricultural drought is defined in terms of soil moisture deficiencies relative to water demands of plant life, primarily crops.
- *Hydrological drought* is associated with the effects of periods of precipitation shortfalls (including snowfall) on surface or subsurface water supply. It occurs when these water supplies are below normal. It is related to the effects of precipitation shortfalls on stream flows and reservoir, lake, and groundwater levels.
- *Socioeconomic drought* is associated with the supply and demand of an economic good with elements of meteorological, hydrological, and agricultural drought. This differs from the types of droughts because its occurrence depends on the time and space processes of supply and demand to identify or classify droughts. The supply of many economic goods depends on the weather (for example water, forage, food grains, fish, and hydroelectric power). Socioeconomic drought occurs when the demand for an economic good exceeds supply as a result of a weather-related shortfall in water supply.
- *Ecological drought* is a prolonged and widespread deficit in naturally available water supplies — including changes in natural and managed hydrology — that create multiple stresses across ecosystems.

Water in hydrologic storage systems (e.g., reservoirs, rivers) is often used for multiple and competing purposes (e.g., flood control, irrigation, recreation, navigation, hydropower, or wildlife habitat), further complicating the sequence and quantification of impacts. Competition for water in these storage systems escalates during drought and conflicts between water users increase significantly (NDMC n.d.).



7.1.2 Location

Climate divisions are regions within a state that are climatically homogenous. The National Oceanic and Atmospheric Administration (NOAA) has divided the U.S. into 359 climate divisions. The boundaries of these divisions typically coincide with the county boundaries, except in the western U.S., where they are based largely on drainage basins (NCEI 2023). According to NOAA, New Jersey is made up of three climate divisions: Northern, Southern, and Coastal (NCEI 2023). Hudson County is in the Northern Climate Division.

Drought regions allow the State of New Jersey to respond to changing conditions without imposing restrictions on areas not experiencing water supply shortages. These regions were developed based upon hydrogeologic conditions, watershed boundaries, municipal boundaries, and water supply characteristics. The drought regions align with municipal borders because the primary enforcement mechanism for water restrictions during a drought emergency is the local police department (NJDEP 2022). The State of New Jersey is divided into six drought regions that are based on regional similarities in water supply sources and rainfall patterns. Hudson County is in the Northeast Drought Region. According to the New Jersey Department of Environmental Protection (NJDEP), water supply sources available to this region include rivers and New Jersey reservoirs, both major supply sources, and unconfined groundwater (minor supply source) (NJDEP 2023). Figure 7-1 shows the drought regions of the State with Hudson County circled in red.

Surface waters in New Jersey provide much of the water used for drinking supplies, as well as for recreation, fishing, tourism, and commercial uses (NJDEP 2023). The State is divided into five water regions based upon watershed management area and hydrologic unit codes (HUC). Hudson County is located within the Passaic water region, with a small portion of the County falling within the Raritan region; refer to Figure 7-2. In terms of annual water withdrawal by sector in the Passaic water region, the majority is for potable water supply and power generation, with a small percent of surface water used for commercial, industrial or mining purposes. By comparison, in the Raritan region, nearly all withdrawals are for potable supplies. Water use trends, like withdrawal trends, vary from month to month with water use typically peaking during summer months when outdoor and irrigation demands are high (NJDEP 2024).

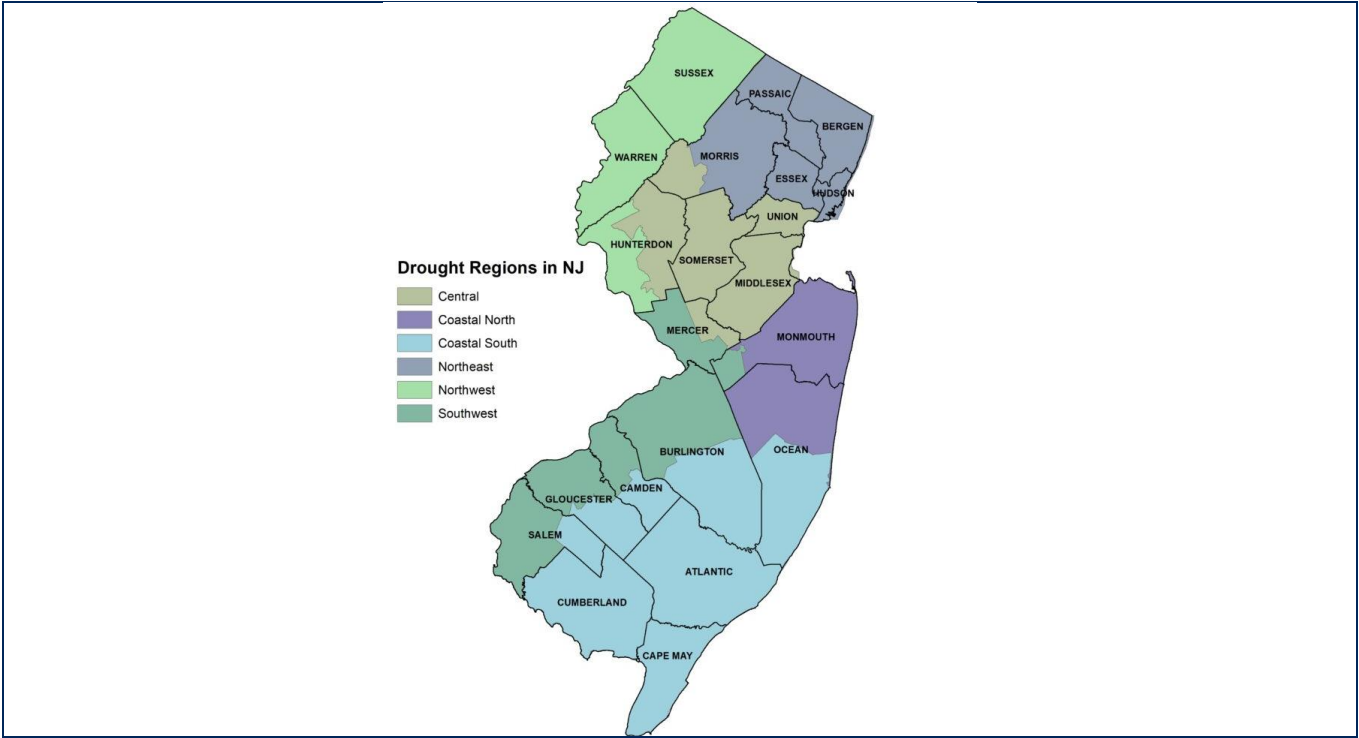
Over 1.2 billion gallons of potable water are used in New Jersey each day, with 88 percent of the State's population receiving its drinking water from public community water systems. A public water system is defined as a water system that pipes water for human consumption that has at least 15 service connections or regularly serves at least 25 individuals 60 days or more a year. About half the State's population receives its drinking water from surface water, the rest from ground water (NJDEP 2024)

7.1.3 Extent

The severity of a drought depends on the degree of moisture deficiency, the duration, and the size and location of the affected area. The longer the duration of the drought and the larger the area impacted, the more severe the potential impacts (NIDIS 2023). The State of New Jersey uses a multi-index system that takes advantage of multiple indices to determine the severity of a drought or extended period of dry conditions (NJDEP 2024).

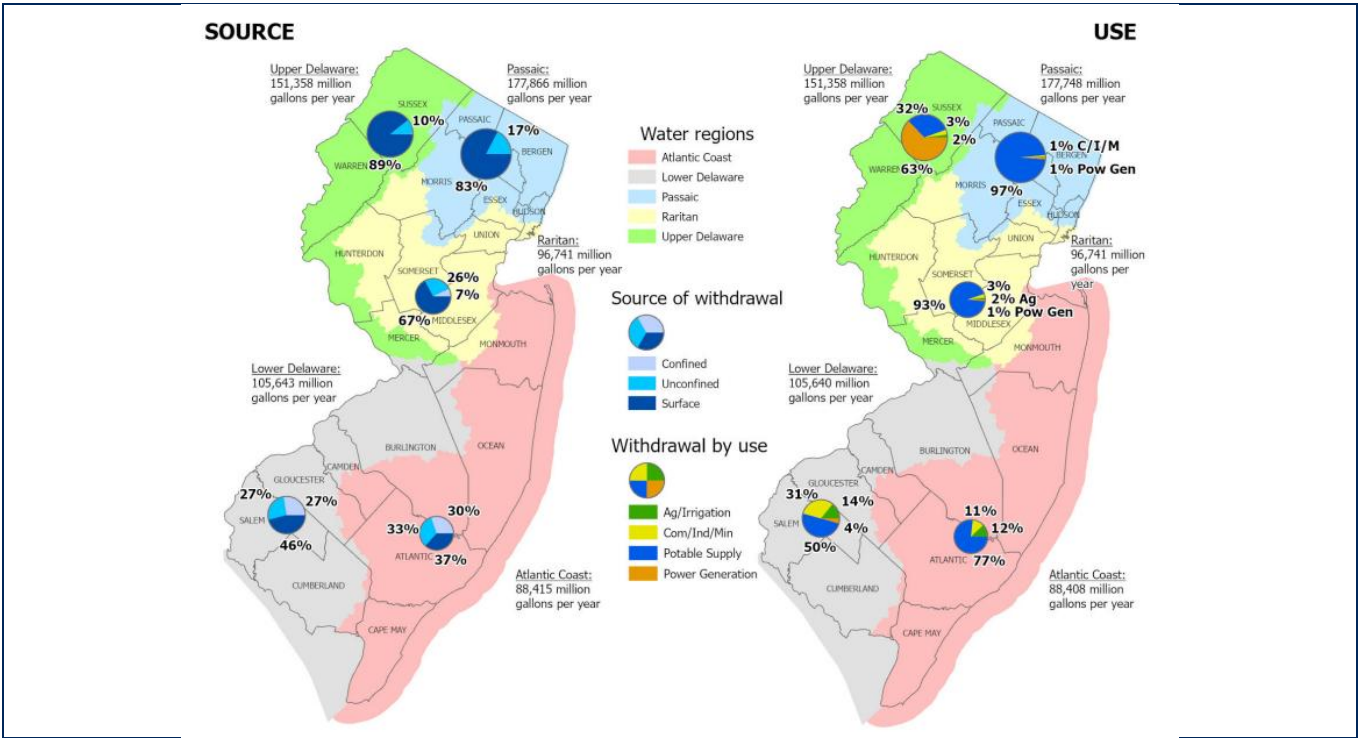


Figure 7-1. New Jersey Drought Regions



Source: NJDEP

Figure 7-2. New Jersey Water Regions, Sources, and Withdrawals by Sector



Source: (NJDEP 2024)





PALMER DROUGHT SEVERITY INDEX

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 7-1 lists the PDSI classifications. At the one end of the spectrum, zero is used as normal and drought is indicated by negative numbers. For example, -2 is moderate drought, -3 is severe drought, and -4 is extreme drought. The PDSI also reflects excess precipitation using positive numbers; however, this information is not included in Table 7-1 (NCAR 2023).

Table 7-1. Palmer Drought Category Descriptions

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: NCAR 2023

WATCHES, WARNINGS, AND EMERGENCIES

The Division of Water Supply and Geoscience within the NJDEP regularly monitors various water supply conditions within the State based on the five different Water Supply Regions. The water supply conditions aid NJDEP in declaring the regions as being within one of the four stages of water supply drought, Normal, Drought Watch, Drought Warning, and Drought Emergency (NJDEP 2024):

- **Normal Conditions** indicate no drought conditions are present. There is routine monitoring of water supply and meteorological indicators.
- A **Drought Watch** is an administrative designation made by NJDEP when drought or other factors begin to adversely affect water supply conditions. A Drought Watch indicates that conditions are dry but not yet significantly so. During a Drought Watch, NJDEP closely monitors drought indicators (including precipitation, stream flows and reservoir and ground water levels, and water demands) and consults with affected water suppliers. The aim of a Drought Watch is to avert a more serious water shortage that would necessitate declaration of a water emergency and the imposition of mandatory water use restrictions, bans on water use, or other potentially drastic measures.



- A **Drought Warning** represents a non-emergency phase of managing available water supplies during the developing stages of drought and falls between the Drought Watch and Drought Emergency levels of drought response. Under a Drought Warning, the commissioner of the DEP may order water purveyors to develop alternative sources of water or transfer water between areas of the State with relatively more water to those with less. While mandatory water use restrictions are not imposed under a Drought Warning, the general public is strongly urged to use water sparingly in affected areas.
- 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 a water emergency focus on reducing water demands. During a water emergency, a phased approach to restricting water consumption is typically initiated. Phase I water use restrictions typically target non-essential, outdoor water use.

The National Weather Service Climate Prediction Center provides seasonal outlooks for droughts that last for three-month increments (NIDIS n.d.). Predicting the extent or severity of drought depends on the ability to forecast precipitation and temperature. Anomalies of precipitation and temperature may last from several months to several decades. How long they last will depend on interactions between the atmosphere and the oceans, soil moisture and land surface processes, topography, internal dynamics, and the accumulated influence of weather systems on the global scale (NIDIS n.d.).

7.1.4 Previous Occurrences

FEMA MAJOR DISASTER AND EMERGENCY DECLARATIONS

Between 1954 and 2023, Hudson County was included in two major disaster (DR) or emergency (EM) declarations for drought-related events (FEMA 2024). Table 7-2 lists these declarations.

Table 7-2. FEMA Declarations for Drought Events in Hudson County (1954 to 2023)

Event Date	Declaration Date	Declaration Number	Description
August 18, 1965	August 18, 1965	DR-205-NJ	New Jersey Water Shortage
October 19, 1980	October 19, 1980	EM-3083-NJ	New Jersey Water Shortage

Sources: FEMA 2023

USDA DECLARATIONS

The Secretary of Agriculture from the U.S. Department of Agriculture (USDA) is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in contiguous counties. Between 2017 and 2023, Hudson County was included in one USDA drought-related agricultural disaster declarations. For declarations that occurred between 2017 and 2023, refer to Table 7-3.

Table 7-3. USDA Declarations for Drought Events in Hudson County (2019 to 2023)

Event Date	USDA Declaration Number	Description
August 9, 2022	S5305	Drought

Sources: USDA 2024



PREVIOUS EVENTS

Known hazard events that impacted Hudson County between August 2019 and December 2023 are discussed in Table 7-4. For events prior to 2019, refer to the 2019 Hudson County HMP.

Table 7-4. Drought Events in Hudson County (2019 to 2023)

Event Date	FEMA Declaration or State Proclamation Number	Hudson County included in declaration?	Location Impacted	Description
July 26 – August 25, 2022	N/A	N/A	Statewide	Water conservation urged in New Jersey as some reservoirs drop rapidly.
August 9 – November 11, 2022	USDA S5305	N/A	Statewide	New Jersey was under a statewide drought watch as drought and heat strain water supplies. USDA declaration issued for Hudson County, S5305.
June 20 – July 20, 2023	N/A	N/A	Statewide	Gov. Phil Murphy’s administration urged residents and businesses to use water wisely due to the state’s dry conditions.

Sources: USDA 2024, NOAA NCEI 2024. FEMA 2023

7.1.5 Probability of Future Occurrences

PROBABILITY BASED ON PREVIOUS OCCURRENCES

Table 7-5 provides calculated probability of future drought events in Hudson County. It is expected that Hudson County will continue to experience direct and indirect impacts of drought on occasion, with the secondary effects causing potential disruption or damage to agricultural activities and creating shortages in water supply within communities. Based on historical records and input from the Steering Committee, the probability of occurrence for drought in the County is considered “occasional.”

Table 7-5. Future Occurrence of Drought Events in Hudson County

Hazard Type	Number of Occurrences Between 1950 and 2023	% Chance of Occurrence in Any Given Year
Drought	14	19%

Source: FEMA 2024; NJOEM 2024; NOAA NCEI 2024

Notes: Disaster occurrences include federally declared disasters since the 1950 Federal Disaster Relief Act, and selected drought events since 1968. Due to limitations in data, not all drought events occurring between 1950 and 1996 are accounted for in the tally of occurrences. As a result, the number of hazard occurrences is underestimated.

EFFECT OF CLIMATE CHANGE ON FUTURE PROBABILITY

The pressure on water resources due to diverse water demands are likely to be worsened by future climate change. Warming is projected by the end of the 21st century. Increases in the number of extremely hot days and decreases in the number of extremely cold days are projected to accompany the overall warming. According to state-level analysis,



by the middle of the 21st century an estimated 70 percent of summers in the northeast region are anticipated to be hotter than what the current warmest summers on record (National Centers for Environmental Information 2022). These trends will affect the probability and frequency of dry conditions that could lead to drought events in Hudson County.

7.1.6 Cascading Impacts on Other Hazards

Drought increases conditions that may trigger fires in the County, such as dead and dying trees, and grasses. Drought can lead to increasing temperatures and evaporation of moisture, which are ideal dry conditions for wildfire events to occur. Dry, hot, and windy weather combined with dry vegetation makes some areas more susceptible to sparking wildfires when met with a spark created by humans or natural events, including lightning. Additionally, droughts can lead to the following (NIDIS 2019):

- Long-term damage to crop quality and crop losses.
- Insect infestation leading to crop losses and reduced tree canopy.
- Reduction in the ability to perform outdoor activities, which could result in loss of tourism and recreation opportunities.

7.2 Vulnerability and Impact Assessment

To understand risk, a community must evaluate assets exposed and vulnerable within the identified hazard area. For the drought hazard, all Hudson County has been identified as the hazard area. Therefore, all assets (population, structures, critical facilities, and lifelines) described in the County Profile (Chapter 3) are potentially vulnerable to a drought. The following text provides a qualitative evaluation of the potential impact of the drought hazard on the county.

7.2.1 Life, Health, and Safety

The entire population of Hudson County (724,854) 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.

OVERALL POPULATION

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. Some drought-related health effects are short-term while others can be long-term (Centers for Disease Control and Prevention 2021).



Drought affects groundwater sources, but generally not as quickly as surface water supplies. Groundwater supplies generally take longer to recover. Reduced precipitation during a drought means that groundwater supplies are not replenished at a normal rate. This can lead to a reduction in groundwater levels and problems such as reduced pumping capacity or wells going dry. Shallow wells are more susceptible than deep wells. Reduced replenishment of groundwater affects streams also. Much of the flow in streams comes from groundwater, especially during the summer when there is less precipitation and after snowmelt ends. Reduced groundwater levels mean that even less water will enter streams when stream flows are lowest (New Jersey Department of Environmental Protection 2021).

SOCIALLY VULNERABLE POPULATION

Socially vulnerable populations are most susceptible to drought events based on several factors, including their physical and financial ability to react or respond during a drought. Vulnerable populations include homeless persons, elderly (over 65 years old), low income or linguistically isolated populations, people with life-threatening illnesses, and residents that may have limited access to water as is. The population over the age of 65 is also more vulnerable. They may require extra water supplies or need assistance to obtain water and are more likely to seek or need medical attention.

Without a quantitative assessment of potential impacts of a drought on socially vulnerable populations, the Planning Partners can best assess mitigation options through an understanding of the general numbers and locations of such populations across Hudson County. Section 3.6.4 provides detailed data on socially vulnerable populations within the planning area. Table 7-6 summarizes highlights of this information. For planning purposes, it is reasonable to assume that percentages and distribution of socially vulnerable populations affected by a drought will be similar to the countywide numbers.

Table 7-6. Distribution of Socially Vulnerable Populations by Municipality

Category	Countywide Total		Municipality Highest in Category		Municipality Lowest in Category	
	Number	Percent	Number	Percent	Number	Percent
Population Over 65	86,664	12.0%	Jersey City 32,671	North Bergen 16.6%	East Newark 308	Hoboken 6.4%
Population Under 5	86,664	12.0%	Jersey City 20,476	Bayonne 7.1%	East Newark 106	East Newark 4.1%
Non-English-Speaking Population	93,494	12.9%	Jersey City 29,070	West New York 24.5%	East Newark 474	Hoboken 4.3%
Population With Disability	61,174	8.4%	Jersey City 22,396	Union City 11.2%	East Newark 209	Weehawken 6.2%
Population Below Poverty Level	99,546	13.7%	Jersey City 43,134	East Newark 24.6	East Newark 638	Seacaucus 5.1%
Households Below ALICE Threshold	63,893	21%	Jersey City 119,278	Union City 49%	East Newark 846	Hoboken 20%

7.2.2 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 wildland-urban interface or where areas are made up of species that are highly susceptible to erupting into wildfire events. Therefore, all assets in and adjacent to the wildland-urban interface zone and wildfire fuel hazard areas, including population, structures, critical facilities, lifelines, and businesses are considered vulnerable to wildfire. Refer to Chapter 13 for the Wildfire risk assessment.

7.2.3 Community Lifelines and Other Critical Facilities

As mentioned, drought events generally do not impact buildings; however, droughts have the potential to impact agriculture-related facilities, critical facilities, and lifelines that are associated with water supplies such as potable water used with fire-fighting services. Critical facilities and lifelines in and adjacent to the wildfire hazard areas are also considered vulnerable to drought.

Water systems and thus distribution to the population may also be impacted by drought conditions. The County's water supply sources are from surface water and unconfined groundwater sources (New Jersey Department of Environmental Protection 2022). In terms of annual water withdrawal by sector, the second highest sector is potable water supply. Water use trends, like withdrawal trends, vary from month to month with water use typically peaking during summer months when outdoor and irrigation demands are high (United States Environmental Protection Agency 2010).

7.2.4 Economy

Drought can produce a range of impacts that span many economic sectors and can reach beyond an area experiencing physical drought. As previously discussed, water withdrawals are not only used for potable water but for use in the commercial/industrial/mining sectors and power generation. When a state of water emergency is declared by the Governor (when a potential or actual water shortage endangers the public health, safety, and welfare), 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 (New Jersey Department of Environmental Protection 2017).

A prolonged drought can have a serious economic impact on a community. When drought conditions persist with little to no relief, water restrictions may be put into place by local or state governments. These restrictions may include placing limitations on when or how frequent lawns can be watered, car washing services, or any other recreational/commercial outdoor use of water supplies. In exceptional drought conditions, watering of lawns and crops may not be an option. If crops are not able to receive water, farmland will dry out and crops will die. This can lead to crop shortages, which, in turn, increases the price of food (North Carolina State University 2013).

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



7.2.5 Natural, Historic and Cultural Resources

NATURAL

Droughts can exacerbate conditions conducive to wildfires, increase insect infestations, and exacerbate the spread of disease (Intergovernmental Panel on Climate Change 2016). Droughts will also impact water resources that are relied upon by aquatic and terrestrial species. Ecologically sensitive areas, such as wetlands, can be particularly vulnerable to drought periods because they are dependent on steady water levels and soil moisture availability to sustain growth (New Jersey Department of Environmental Protection 2017).

If water is not getting into the soils, the ground will dry up and become unstable. Unstable soils increase the risk of erosion and loss of topsoil. Droughts also have the potential to lead to water pollution due to the lack of rainwater to dilute any chemicals in water sources. Contaminated water supplies may be harmful to plants and animals (North Carolina State University 2013).

Drought affects groundwater sources, but generally not as quickly as surface water supplies. Groundwater supplies generally take longer to recover. Reduced precipitation during a drought means that groundwater supplies are not replenished at a normal rate. This can lead to a reduction in groundwater levels. Reduced replenishment of groundwater affects streams also. Much of the flow in streams comes from groundwater, especially during the summer when there is less precipitation and after snowmelt ends. Reduced groundwater levels mean that even less water will enter streams when stream flows are lowest (NJDEP 2021).

HISTORIC

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

CULTURAL

Prolonged drought and seasonal aridity can exacerbate soil deflation and erosion, potentially uncovering previously buried archaeological sites (USDA Forest Service 2018). This exposure increases the vulnerability of these sites to further damage and loss, posing a significant threat to the preservation of cultural heritage.

7.3 Future Changes That May Affect Risk

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

7.3.1 Potential or Planned Development

As discussed in Chapter 3 (County Profile), areas targeted for future growth and development have been identified across Hudson County. Development and urbanization reduce natural landscapes that help recharge groundwater and



maintain ecological balance, further reducing water availability during droughts. The New Jersey Water Supply Plan indicates seasonal outdoor water use is rising statewide 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 (New Jersey Department of Environmental Protection 2017).

7.3.2 Projected Changes in Population

The New Jersey Department of Labor and Workforce Development produced populations projections by County from 2014 to 2019, 2024, 2029, and 2034. According to these projections, Hudson County is projected to have an increase in population in the upcoming years. These projection totals include a population of 747,400 by 2029, and 766,500 by 2034 (State of New Jersey 2017).

Projected population increases can intensify the impacts of drought in several ways. A larger population will lead to higher demand for water for residential, agricultural, and industrial uses, making management during drought conditions more challenging (NEEF 2024). This increased demand will also put additional pressure on water infrastructure, leading to more frequent breakdowns and maintenance issues, complicating water distribution. With more people relying on the same water sources, the risk of water shortages during prolonged dry periods increases, leading to stricter water use restrictions and competition for limited resources.

Higher population density can also increase the risk of wildfires, as more human activity can lead to accidental fires, which are exacerbated by drought conditions, leading to more frequent and severe wildfires that threaten both natural and developed areas (WRI 2024). Overall, the projected population growth in Hudson County will likely intensify the challenges associated with managing water resources and mitigating the impacts of drought. Refer to Chapter 3 (County Profile), which includes a more thorough discussion about population trends for the County.

7.3.3 Climate Change

Most studies project that New Jersey will experience more frequent droughts, which may affect the availability of water supplies, primarily placing an increased stress on the population and their available potable water. Agricultural 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 future changes.

7.3.4 Other Identified Conditions

As mentioned previously, resources indicate that New Jersey will experience a rise in average annual temperatures. Furthermore, there is a projected increase in the occurrence of droughts, which could impact the availability of water supplies and place added strain on the population and their access to clean drinking water. A decrease in water supply, or an increase in demand for water, may heighten the County's susceptibility to structural fires and wildfires. Consequently, it may be necessary for critical water-related service sectors to modify their management strategies and proactively allocate resources to adapt to forthcoming shifts.



8. EXTREME TEMPERATURES

8.1 Hazard Profile

8.1.1 Hazard Description

Extreme temperature includes both heat and cold events, which can adversely affect human health and the economy, as well as cause primary and secondary effects on infrastructure (such as burst pipes and power failure). What constitutes “extreme cold” or “extreme heat” can vary across different areas of the country, based on the typical climate and seasonal patterns.

EXTREME COLD

Extreme cold events occur when temperatures drop well below normal in an area. For example, near-freezing temperatures are considered “extreme cold” in regions relatively unaccustomed to winter weather. Conversely, “extreme cold” might be used to describe temperatures below 0 degrees Fahrenheit (°F) in regions that are subjected to temperatures below freezing on more of a regular basis. For the purposes of this HMP, extreme cold temperatures are characterized when the ambient air temperature drops to 0 °F approximately or below (NWS n.d.). Extensive exposure to extreme cold temperatures can cause frostbite or hypothermia and can become life-threatening.

EXTREME HEAT

Extreme heat is defined as temperatures that hover above the average high temperature for a region by 10 °F or more and that last for several weeks (CDC 2024). Humid or muggy conditions occur when a dome of high atmospheric pressure traps hazy, damp air near the ground. A heat wave is a period of abnormally and uncomfortably hot and unusually humid weather. A heat wave will typically last two or more days (NOAA n.d.).

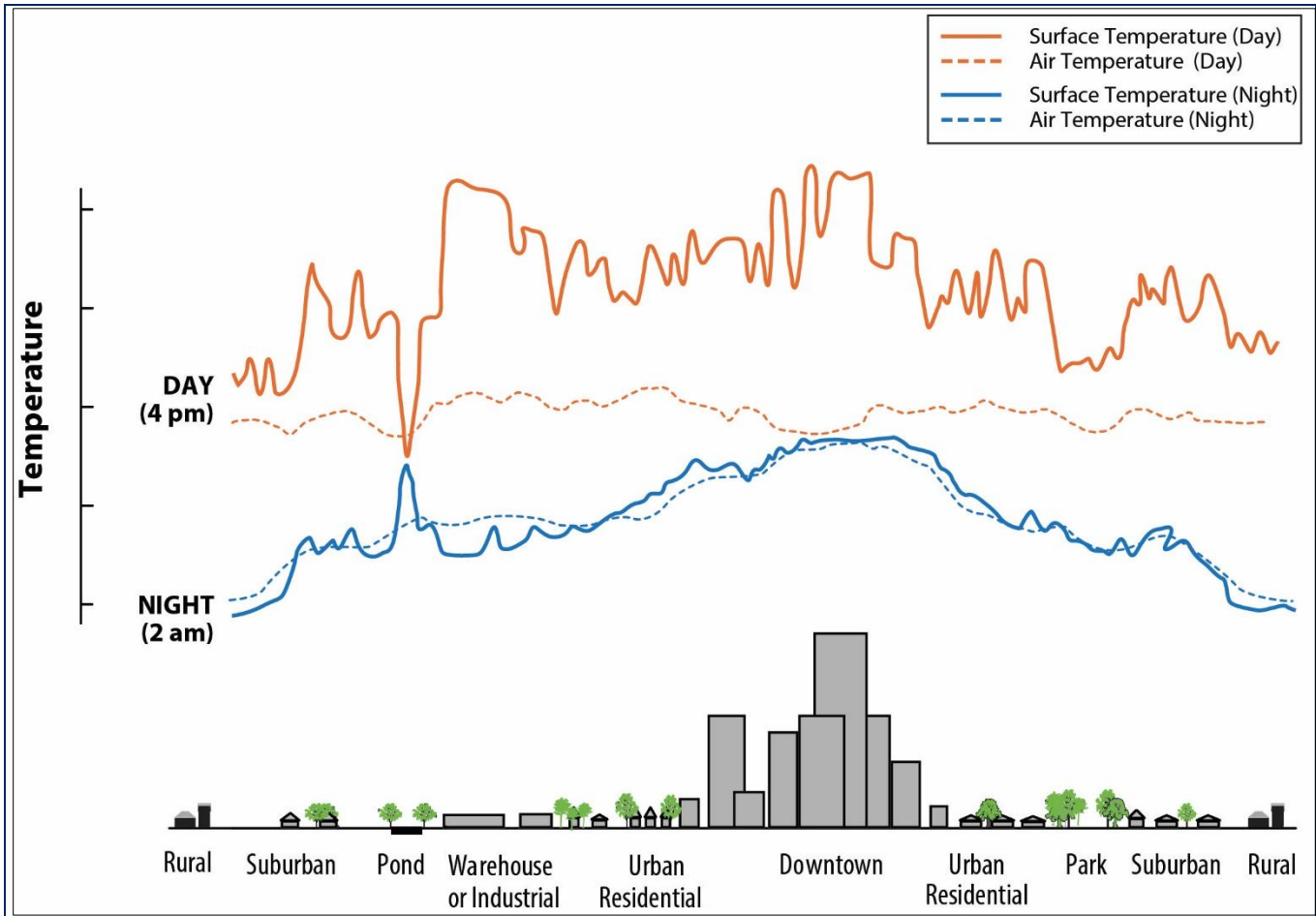
Urban areas and urbanization exacerbate risk during an extreme heat event, compared to rural and suburban areas. As defined by the U.S. Census, Urban areas are those with at least 5,000 people (US Census 2022). As these urban areas develop and change, so does the landscape. Buildings, roads, and other 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 known as an Urban Heat Island (UHI) (EPA 2024).

The term ‘urban heat island’ describes built up areas that are hotter than nearby rural areas. The annual mean air temperature of a city with more than one million people can be between 1.8 °F and 5.4 °F warmer than its surrounding areas. In the evening, the difference in air temperatures can be as high as 22 °F. 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 50 °F to 90 °F 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 (EPA 2024).



As shown in Figure 8-1, surface temperatures vary more than atmospheric air temperatures during the day, but they are generally similar at night. The dips and spikes in surface temperatures over the pond area show how water maintains a nearly constant temperature day and night because it does not absorb the sun's energy the same way as buildings and paved surfaces. Parks, open land, and bodies of water can create cooler areas within a city. Temperatures are typically lower at suburban-rural borders than in downtown areas.

Figure 8-1. Urban Heat Island Effect Diagram



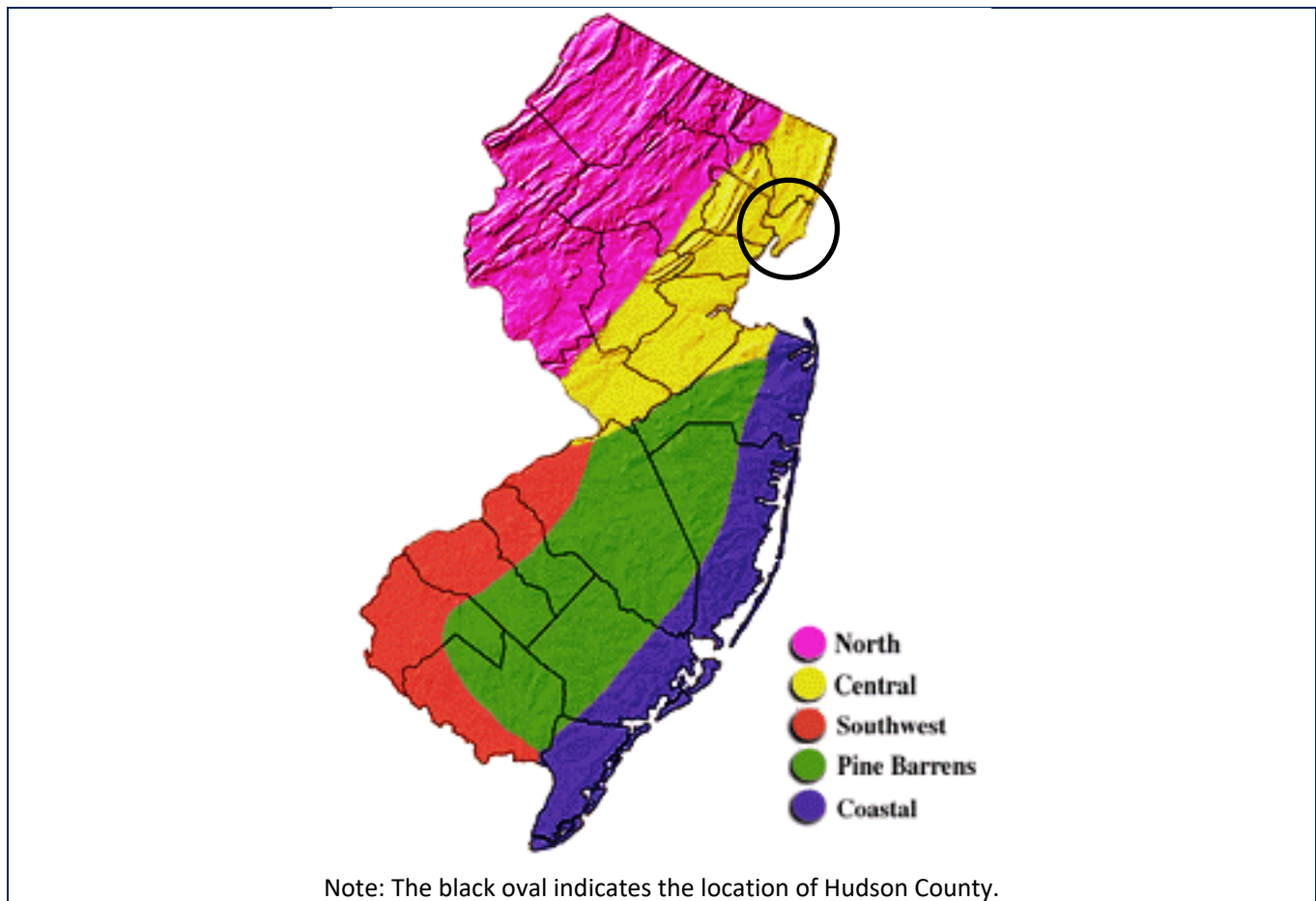
Source: US EPA 2023

8.1.2 Location

According to the Office of the New Jersey State Climatologist, New Jersey has five distinct climate zones. Elevations, latitude, distance from the Atlantic Ocean, and landscape (e.g., urban, sandy soil) produce distinct variations in the daily weather between each of the zones. The five zones include: North, Central, Pine Barrens, Southwest, and Coastal (Rutgers University 2019). Figure 8-2 depicts these zones. Hudson County is located within the Central Climate Zone.



Figure 8-2. Climate Zones of New Jersey



Source: Rutgers University 2019

The Central Climate Zone has a northeast to southwest orientation, running from New York Harbor and the Lower Hudson River to the great bend of the Delaware River in the vicinity of Trenton. The northern edge of the Central Climate Zone is often the boundary between freezing and non-freezing precipitation during wintertime. In summer, the northern reaches often mark the boundary between comfortable and uncomfortable sleeping conditions. Areas to the south of the Central Climate Zone tend to have nearly twice as many days with temperatures above 90 °F than the 15 to 20 commonly observed in the central portion of the state. (Rutgers University 2019).

8.1.3 Extent

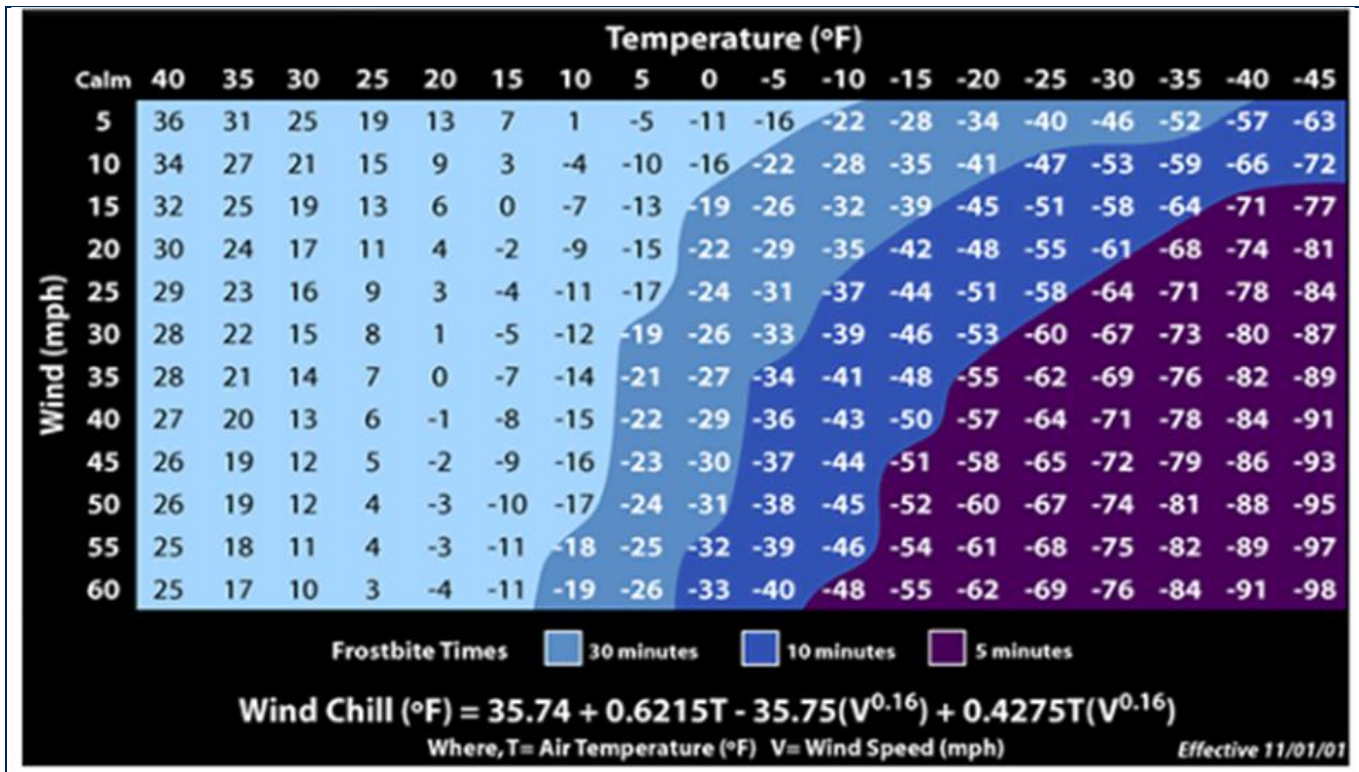
Meteorologists can accurately forecast extreme temperature event development and the severity of the associated conditions with several days lead time. These forecasts provide an opportunity for public health and other officials to notify vulnerable populations to allow sufficient time to prepare for the change in temperature.



EXTREME COLD

The severity of extreme cold temperatures is generally measured through the Wind Chill Temperature Index, presented in Figure 8-3. The index uses advances in science, technology, and computer modeling to provide an accurate, understandable, and useful formula for calculating the dangers from wind chill.

Figure 8-3. Wind Chill Index



Source: NWS 2021

Winter temperatures may fall to extreme cold readings with no wind occurring. Currently, the only way to headline very cold temperatures is with the use of 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 (NWS 2021).

As the wind increases, heat is carried away from the body at an accelerated rate, driving down the body temperature. Wind amplifies the cooling effect by blowing away the thin layer of warm air near a person's skin, making it feel colder than the actual air temperature. The following health hazards are related to extreme cold temperatures (NWS 2022):

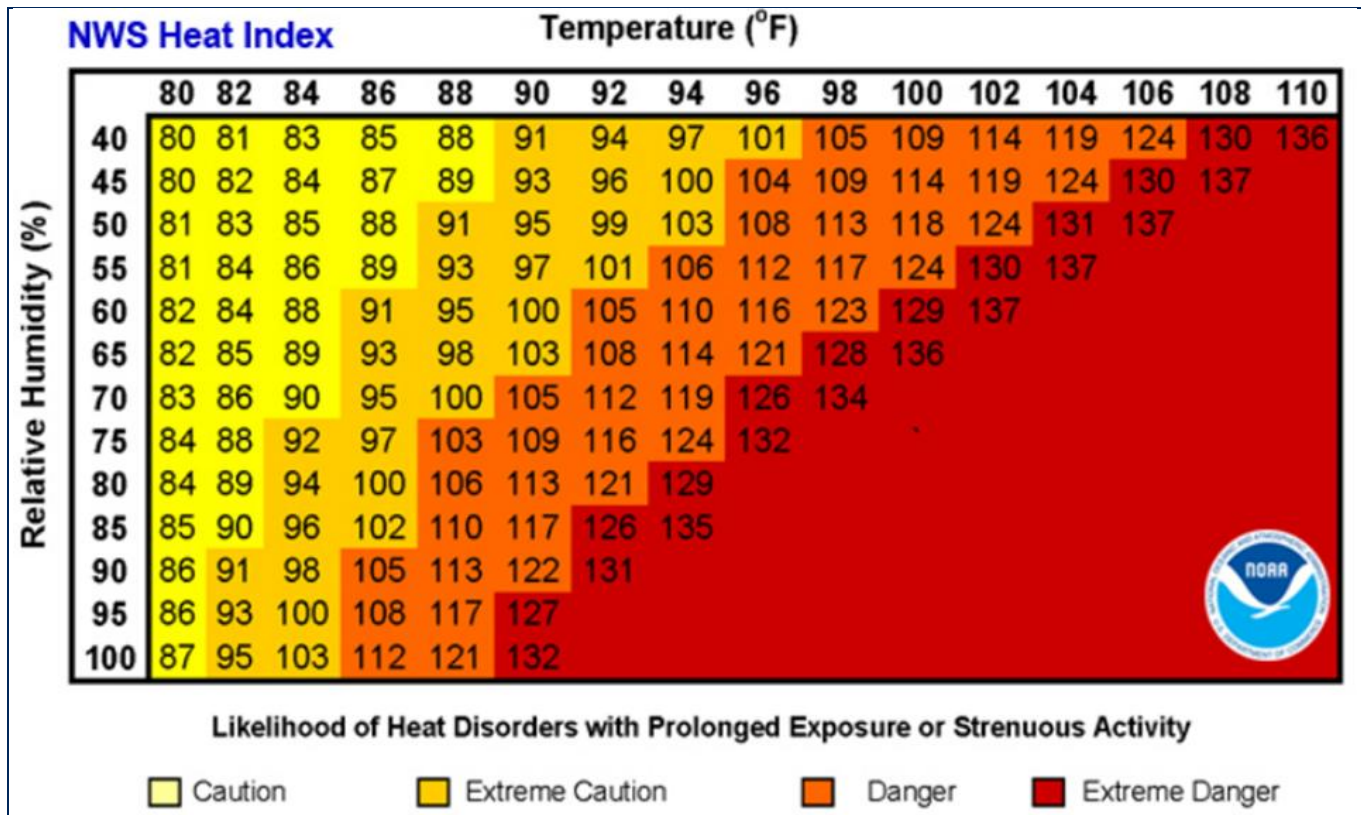
- Frostbite is damage to body tissue caused by extreme cold. A wind chill of -20 °F will cause frostbite in just 30 minutes. Frostbite can cause a loss of feeling and a white or pale appearance in extremities.
- Hypothermia is a condition brought on when the body temperature drops to less than 95 °F,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



EXTREME HEAT

The extent of extreme heat temperatures is generally measured through the Heat Index, identified in Figure 8-4. Created by the NWS, the Heat Index is a chart that accurately measures apparent temperature of the air as it increases with the relative humidity. The temperature and relative humidity are needed to determine the Heat Index. Once both values have been identified, the Heat Index is the corresponding number of both values. This index provides a measure of how temperatures feel; however, the values are devised for shady, light wind conditions. Table 8-1 outlines the effects of prolonged exposure to direct sunlight on the human body during extreme heat events.

Figure 8-4. NWS Heat Index Chart – Shaded Areas



Source: NWS 2021

Table 8-1. Adverse Effects of Prolonged Exposure to Direct Sunlight

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

Source: NWS n.d.



The NWS issues excessive heat outlooks when the potential exists for an excessive heat event in the next three to seven 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 (NWS 2021).

The following health hazards are related to extreme high temperatures (CDC 2024):

- Heat exhaustion is the body’s response to an excessive loss of water and salt, usually through excessive sweating. Symptoms can include headache, cramping, dizziness, and weakness.
- Heat stroke occurs when the body can no longer control its temperature: the body’s temperature rises rapidly, the sweating mechanism fails, and the body is unable to cool down. When heat stroke occurs, the body temperature can rise to 106 °F or higher within 10 to 15 minutes. Heat stroke can cause permanent disability or death if the person does not receive emergency treatment.

8.1.4 Previous Occurrences

FEMA MAJOR DISASTER AND EMERGENCY DECLARATIONS

Between 1954 and 2023, Hudson County was not included in any major disaster (DR) or emergency (EM) declarations for Extreme Temperature-related events (FEMA 2023).

USDA DECLARATIONS

The Secretary of Agriculture from the U.S. Department of Agriculture (USDA) is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in contiguous counties. Between 2017 and 2023, Hudson County was included in one USDA extreme temperature-related agricultural disaster declarations. For declarations that occurred between 2017 and 2023, refer to Table 8-2.

Table 8-2. USDA Declarations for Extreme Temperature Events in Hudson County (2017 to 2023)

Event Date	USDA Declaration Number	Description
August 9, 2022	S5305	Drought; Persistent Dry/Hot Conditions

Sources: USDA 2024

PREVIOUS EVENTS

Known hazard events that impacted Hudson County between August 2019 and December 2023 are discussed in Table 8-3. For events prior to 2019, refer to the 2020 Hudson County HMP.

Table 8-3. Extreme Temperature Events in Hudson County (2019 to 2023)

Event Date	FEMA Declaration or State Proclamation Number	Hudson County included in declaration?	Location Impacted	Description
August 9, 2022	USDA declaration S5305	N/A	Countywide	Drought

Sources: NOAA NCEI 2024; USDA 2024





8.1.5 Probability of Future Occurrences

PROBABILITY BASED ON PREVIOUS OCCURRENCES

Information on previous extreme temperature occurrences in the County was used to calculate the probability of future occurrence of such events, as summarized in Table 8-4. Based on historical records and input from the Steering Committee, the probability of occurrence for extreme temperature in the County is considered “frequent.”

Table 8-4. Probability of Future Extreme Temperature Events in Hudson County

Hazard Type	Number of Occurrences Between 1996 and 2023	Percent Chance of Occurring in Any Given Year
Extreme Cold/Wind Chill	3	10%
Cold/Wind Chill	1	3%
Excessive Heat	13	46%
Heat	5	18%
Total	22	79%

Sources: FEMA 2023; NOAA NCEI 2024; USDA 2024

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

EFFECT OF CLIMATE CHANGE ON FUTURE PROBABILITY

Climate change includes major changes in temperature, precipitation, or wind patterns, which occur over several decades or longer. Due to the increase in greenhouse gas concentrations since the end of the 1890s, New Jersey has experienced a 3.5 °F increase in the State’s average temperature, which is faster than the rest of the Northeast region (2 °F) and the world (1.5 °F) (IPCC 2014). This warming trend is expected to continue. By 2050, temperatures in New Jersey are expected to increase by 4.1 °F to 5.7 °F. Thus, New Jersey can expect to experience an average annual temperature that is warmer than any to date (low emissions scenario) and future temperatures could be as much as 10 °F warmer (high emissions scenario). New Jersey can also expect that by the middle of the 21st century, 70 percent of summers will be hotter than the warmest summer experienced to date. The increase in temperatures is expected to be felt more during the winter months (December, January, and February), resulting in less intense cold waves, fewer sub-freezing days, and less snow accumulation (NJDEP 2020).

8.1.6 Cascading Impacts on Other Hazards

Extreme temperature events can exacerbate the drought hazard, increase the potential risk of wildfires, and escalate severe weather and severe winter weather events for the County. For example, extreme heat events may accelerate evaporation rates, which may dry out the air and soils making some terrestrial plants and soil more susceptible to catching fire. Extreme variation in temperatures could also create ideal atmospheric conditions for severe storms or worsen the outcome of severe winter weather during freezing and thawing periods. Extreme cold may result in an increase in flooding as a result of ice jams altering the flow and release of water. For more information ice jams, see Chapter 9 Flood.



8.2 Vulnerability and Impact Assessment

To understand risk, a community must evaluate what assets are exposed or vulnerable in the identified hazard area. For the extreme temperature hazard, all of Hudson County has been identified as the hazard area. Therefore, all assets in the County (population, structures, critical facilities, and lifelines), as described in the County Profile (Chapter 3), are vulnerable to the extreme temperature hazard. The following text provides a qualitative evaluation of the potential impact of the extreme temperature hazard on the county.

8.2.1 Life, Health, and Safety

OVERALL POPULATION

The entire population of Hudson County (724,854) is exposed to extreme temperature events. Extreme temperature events have potential health impacts including injury and death. Health hazards related to extreme cold temperatures include wind chill, frostbite, and hypothermia. Health hazards related to extreme high temperatures include heat exhaustion and heat stroke. Adhering to extreme temperature warnings and conducting appropriate mitigation and preparation measures can significantly reduce the risk of temperature-related deaths.

Workers who are exposed to extreme heat may be at risk of heat stroke, heat exhaustion, heat cramps, or heat rashes. Heat can also increase the risk of injuries in workers as it may result in sweaty palms, fogged-up safety glasses, and dizziness. Burns may occur as a result of accidental contact with hot surfaces. Working outdoors increases the chances of getting sunburned (Centers for Disease Control and Prevention 2020, Centers for Disease Control and Prevention 2018). Workers exposed to extreme cold temperatures may experience cold stress, leading to cold-related illnesses such as hypothermia, frostbite, trench foot, and chilblains (CDC 2024).

SOCIALLY VULNERABLE POPULATION

Socially vulnerable populations, such as low-income groups, the elderly, and those with pre-existing health conditions, are disproportionately affected by extreme temperatures (EPA 2024). Extreme heat can lead to heat-related illnesses such as heatstroke and dehydration, with vulnerable groups often having limited access to air conditioning and cooling centers, increasing their risk (NIHHIS n.d.). Many socially vulnerable individuals work in outdoor or non-climate-controlled environments, such as construction and agriculture, making them more susceptible to heat-related health issues and reduced productivity.

Extreme cold can exacerbate chronic conditions like cardiovascular and respiratory diseases, particularly for vulnerable populations who struggle to afford adequate heating, increasing their risk of hypothermia and frostbite (NIEHS 2022). Poorly insulated housing and homelessness significantly heighten these risks, as these groups often lack the resources to improve their living conditions. Additionally, extreme cold can disrupt transportation and access to essential services, such as healthcare and food supplies, disproportionately affecting those with limited mobility or financial resources (EPA 2024). Emergencies can arise for those without shelter, those stranded, or those living in poorly insulated or unheated homes, such as mobile homes. Infants and the elderly are especially susceptible to extreme temperature changes, but anyone can be affected (NCHH 2022).



Without a quantitative assessment of potential impacts of extreme temperatures on socially vulnerable populations, the Planning Partners can best assess mitigation options through an understanding of the general numbers and locations of such populations across Hudson County. Section 3.6.4 provides detailed data on socially vulnerable populations within the planning area. Table 8-5 summarizes highlights of this information. For planning purposes, it is reasonable to assume that percentages and distribution of socially vulnerable populations affected by extreme temperatures will be similar to the countywide numbers.

Table 8-5. Distribution of Socially Vulnerable Populations by Municipality

Category	Countywide Total		Municipality Highest in Category		Municipality Lowest in Category	
	Number	Percent	Number	Percent	Number	Percent
Population Over 65	86,664	12.0%	Jersey City 32,671	North Bergen 16.6%	East Newark 308	Hoboken 6.4%
Population Under 5	86,664	12.0%	Jersey City 20,476	Bayonne 7.1%	East Newark 106	East Newark 4.1%
Non-English-Speaking Population	93,494	12.9%	Jersey City 29,070	West New York 24.5%	East Newark 474	Hoboken 4.3%
Population With Disability	61,174	8.4%	Jersey City 22,396	Union City 11.2%	East Newark 209	Weehawken 6.2%
Population Below Poverty Level	99,546	13.7%	Jersey City 43,134	East Newark 24.6	East Newark 638	Seacaucus 5.1%
Households Below ALICE Threshold	63,893	21%	Jersey City 119,278	Union City 49%	East Newark 846	Hoboken 20%

8.2.2 General Building Stock

All the building stock in the County is exposed to the extreme temperature hazard. Refer to Section 3 (County Profile), which summarizes the building inventory in Hudson County. Extreme heat generally does not impact buildings; however, elevated summer temperatures increase the energy demand for cooling. Losses can be associated with the overheating of heating, ventilation, and air conditioning (HVAC) systems.

Extreme cold temperature events can damage buildings through freezing/bursting pipes and freeze/thaw cycles, as well as increasing vulnerability to home fires. Additionally, manufactured homes (mobile homes) and antiquated or poorly constructed facilities can have inadequate capabilities to withstand extreme temperatures.

8.2.3 Community Lifelines and Other Critical Facilities

Similar to the general building stock, all critical facilities in the County are exposed to the extreme temperature hazard; however, direct impacts are expected to be minimal. Impacts to critical facilities are the same as were described for general building stock. Additionally, it is essential that critical facilities remain operational during natural hazard events. Extreme heat events can sometimes cause short periods of utility failures, commonly referred to as “brown outs,” created by increased usage from air conditioners, appliances, and similar equipment. Similarly, heavy snowfall and ice storms, associated with extreme cold temperature events, can interrupt power as well. Backup power is recommended for critical facilities and infrastructure. Additionally, designating and developing emergency cooling or heating facilities can also enhance the resilience and safety of communities.



8.2.4 Economy

Extreme temperature events also have impacts on the economy, including loss of business function and damage and loss of inventory. Business owners may be faced with increased financial burdens due to unexpected repairs caused to the building (pipes bursting), higher than normal utility bills, or business interruption caused by power failure (loss of electricity and telecommunications) (NJOEM 2024). The agricultural industry is most at risk in terms of economic impact and damage caused by extreme temperature events. Extreme heat events can result in drought and dry conditions and directly affect livestock and crop production.

8.2.5 Natural, Historic and Cultural Resources

NATURAL

During periods of extreme heat, air quality in Hudson County deteriorates significantly. The high temperatures accelerate ozone production, which can aggravate respiratory and cardiovascular illnesses, particularly in sensitive populations (NJOEM 2024). Additionally, the combination of high temperatures and little rainfall creates ideal conditions for forest fires, which further degrade air quality by producing fine particulate matter from smoke.

Water resources are also heavily impacted by extreme heat. The prolonged high temperatures lengthen the growing season, increasing the demand for irrigation and affecting groundwater volumes. Drought conditions, often associated with extreme heat, can strain both surface and groundwater supplies, especially in areas with limited reservoirs. Freshwater and coastal wetlands face challenges as well. Increased drought frequency and intensity reduce the availability of freshwater vernal pools, which are crucial habitats for many sensitive wildlife species. Rising temperatures also create favorable conditions for invasive species like the clinging jellyfish (NJDEP 2020). Moreover, runoff from hot surfaces elevates the temperature of waterways, further stressing aquatic ecosystems.

Forests and vegetated lands are at heightened risk during extreme heat events. The dry conditions and high temperatures increase the likelihood and duration of wildfires (NJDEP 2020). Additionally, the warmer climate accelerates the maturation of insect pests, allowing them to invade new vegetated areas that previously did not experience such pressures.

Extreme cold temperatures bring their own set of challenges to Hudson County. Prolonged cold spells can freeze wetland soils, reducing water seepage and causing snowmelt runoff to bypass wetlands (NJOEM 2024). This makes water unavailable during the crucial spring and summer months. Forests and vegetated lands suffer as well. Heavy snow and ice accumulation during extreme cold weather can damage trees and crops by breaking vegetation and tree limbs. Prolonged periods of extreme cold can also harm vegetation and crops, negatively impacting the agricultural industry in the region (NJOEM 2024).

HISTORIC

Historic buildings may be susceptible to damage from extreme temperature conditions. Extreme heat can increase the risk of ignition of fires and their propagation. Fire may increase the probability of cracking or splitting in built structures. Long-term impacts include weakened stones and increased susceptibility to deterioration processes such as salt weathering and temperature cycling (Sesana, et al. 2021).



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

CULTURAL

Historical buildings and homes, which house many cultural artifacts, may not be built to withstand extreme temperature fluctuations, making them more vulnerable to damage. Changes in temperature can affect the structure and composition of building materials, accelerating physical, chemical, and biological degradation processes (Sesana, et al. 2021). Extreme heat can increase the risk of ignition of fires and their propagation. Fire causes material loss and deformation of cultural heritage assets.

8.3 Future Changes That May Affect Risk

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

8.3.1 Potential or Planned Development

The ability of new development to withstand extreme temperature impacts can be enhanced through land use practices and consistent enforcement of codes and regulations for new construction. New development will change the landscape where buildings, roads, and other infrastructure potentially replace open land and vegetation. Transformation of pervious surfaces (including vegetation) to impervious surfaces causes an island of higher temperatures. Specific areas of recent and new development are indicated in tabular form and/or on the hazard maps included in the jurisdictional annexes in Volume II, Section 9 (Jurisdictional Annexes) of this plan.

8.3.2 Projected Changes in Population

The New Jersey Department of Labor and Workforce Development produced populations projections by County from 2014 to 2019, 2024, 2029, and 2034. According to these projections, Hudson County is projected to have an increase in population in the upcoming years. These projection totals include a population of 747,400 by 2029, and 766,500 by 2034 (State of New Jersey 2017).

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



8.3.3 Climate Change

Projections indicate that New Jersey will continue to warm, with annual temperatures expected to be as warm as the warmest years in the historical record by 2050. This increase in average annual temperatures will lead to more intense heat waves and fewer cold waves, extending the growing season and decreasing the number of sub-freezing days and snow accumulation. As the climate warms, extreme cold events might decrease in frequency, while extreme heat events might increase in frequency and intensity.

Vulnerable populations could face increased risks of heat-related illnesses, and more buildings, facilities, and infrastructure systems may exceed their ability to cope with the heat. Thus, improving building efficiency and upgrading heating and cooling technology will become increasingly important for businesses and homeowners.

8.3.4 Other Identified Conditions

Extreme temperatures can place significant stress on infrastructure, including roads, bridges, and buildings. High temperatures cause materials to expand and contract, leading to cracks and other forms of damage. Additionally, there is often an increased demand for energy during extreme temperatures, particularly for heating and cooling. This surge in energy use can lead to power outages and increased stress on energy grids. Transportation systems are also affected by extreme heat, with rail tracks potentially buckling and asphalt softening.



9. FLOOD

9.1 Hazard Profile

9.1.1 Hazard Description

A flood is an overflow of water from oceans, rivers, groundwater, or rainfall that submerges areas that are usually dry. This natural phenomenon can be exacerbated by features of the built environment.

Flooding is a natural hazard that can occur during any season. Flooding in Hudson County can be the result of heavy rainfall produced by hurricanes moving up the coast, large frontal storms from the west and south, and local thunderstorms (FEMA FIS 2015). Flooding can also result from the failure of a water control structure, such as a dam or levee (NWS 2019) (refer to Chapter 6 Dam and Levee Failure for more information). Flooding can be exacerbated by other hazards such as sea level changes and increased precipitation or severe storms. Additional information regarding severe storms is available in Chapter 11 Severe Weather.

Flooding is a temporary condition of partial or complete inundation on normally dry land from the following (NWS 2019):

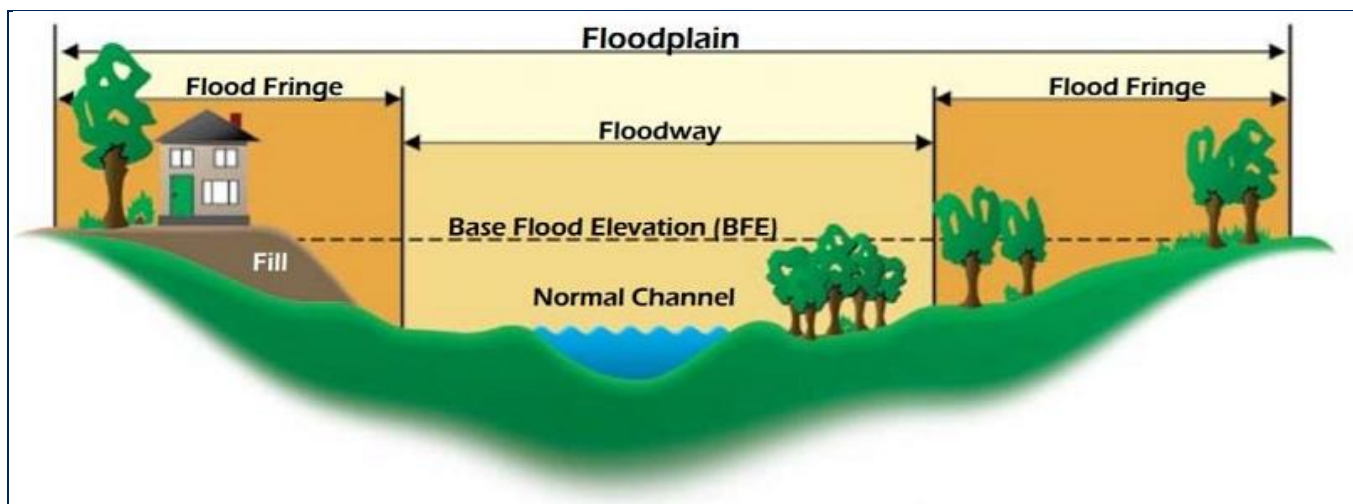
- Riverine overbank flooding
- Flash floods
- Alluvial fan floods
- Mudflows or debris floods
- Dam- and levee-break floods
- Local draining or high groundwater levels
- Fluctuating lake levels
- Ice-jams

Flooding in Hudson County is primarily attributed to riverine (inland) and coastal (tidal/surge) flooding from the Hackensack River, Hudson River, Kill Van Kull, Passaic River, and Upper New York Bay (FEMA FIS 2013). In addition, Hudson County also experiences urban flooding, which is the result of precipitation and insufficient drainage. Hudson County's flood types of concern discussed in this section are riverine flooding, flash flooding, stormwater/urban flooding, coastal flooding, coastal erosion, and sea level rise.

RIVERINE FLOODING

Riverine floods are the most common flood type. They occur along the channels of rivers, creeks, streams, or ditches. When a channel receives too much water, the excess water flows over its banks and inundates low-lying areas (FEMA 2019). The inundated area is called the floodplain (NWS n.d.). Floodplains are typically flat land adjacent to a watercourse that is subject to periodic inundation. A floodplain is made up of the following components (refer to Figure 9-1) (FEMA 2019, US DHS 2019):

Figure 9-1. Characteristics of a Floodplain



Source: FEMA 2022

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

Riverine flooding is measured by how frequently a given level of flooding occurs. The 1 percent annual chance flood, also referred to as the base flood or 100-year flood, is a flood with a level that has a 1 percent chance of equaling or exceeding in any given year. Though commonly called the 100-year flood, this flood can occur more than once in a relatively short period of time. Similarly, the flood with a 0.2 percent chance of being equaled or exceeded each year is often called the 500-year flood but can occur more frequently than that (FEMA 2020).

FEMA prepare maps of the expected floodplains along water courses, based on historical riverine and coastal flooding conditions. In FEMA flood maps, the floodplain inundated by the 1 percent annual chance flood is identified as Special Flood Hazard Area (SFHA). This is the area where flood insurance and floodplain management requirements apply (FEMA 2020).

The following are additional definitions relating to flood map:

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

Mapped floodplain boundaries may require updating as a result of changes in land use or the amount of impervious surface, the placement of obstructing structures in floodways, changes in precipitation and runoff patterns, improvements in technology for measuring topographic features, or new hydrologic modeling techniques (USGS 2016). Flooding outside of the SFHA area may include stormwater or urban flooding and flash flooding. Urban and stormwater



flooding and future conditions (e.g., sea level rise and rainfall areas) are not reflected in FEMA floodplain mapping. As such, FEMA floodplain maps may underestimate flood risk in many areas.

COASTAL FLOODING

Coastal floods are the submersion of land areas along the ocean coast and other inland waters caused by seawater over and above normal tide action. Hurricanes and tropical storms, severe storms, and Nor'easters cause most of the coastal flooding in Hudson County. Coastal flooding can impact structures and infrastructure, similar to riverine flooding, and can cause beach erosion; loss or submergence of wetlands and other coastal ecosystems; saltwater intrusion; high water tables; loss of coastal recreation areas, beaches, protective sand dunes, parks, and open space; and loss of coastal structures (i.e., sea walls, piers, bulkheads, bridges, buildings) (FEMA 2011).

There are several forces that occur with coastal flooding, including the following:

- *Hydrostatic forces* against a structure are created by standing or slowly moving water. Flooding can cause vertical hydrostatic forces, or flotation. These types of forces are one of the main causes of flood damage.
- *Hydrodynamic forces* on buildings are created when coastal floodwaters move at high velocities. These high-velocity flows are capable of destroying solid walls and dislodging buildings with inadequate foundations. High-velocity flows can also move large quantities of sediment and debris that can cause additional damage. In coastal areas, high-velocity flows are typically associated with one or more of the following:
 - Storm surge and wave run-up flowing landward through breaks in sand dunes or across low-lying areas.
 - Tsunamis.
 - Outflow of floodwaters driven into bay or upland areas.
 - Strong currents parallel to the shoreline, driven by waves produced from a storm.
 - High-velocity flows.

High-velocity flows can be created or exacerbated by the presence of manmade or natural obstructions along the shoreline and by weak points formed by roads and access paths that cross dunes, bridges or canals, channels, or drainage features (FEMA 2011).

- *Waves* can affect coastal buildings from breaking waves, wave run-up, wave reflection and deflection, and wave uplift. The most severe damage is caused by breaking waves. The force created by these types of waves breaking against a vertical surface is often at least 10 times higher than the force created by high winds during a coastal storm.
- *Flood-borne debris* produced by coastal flooding events and storms typically includes decks, steps, ramps, breakaway wall panels, portions of, or entire houses, heating oil and propane tanks, cars, boats, decks and pilings from piers, fences, erosion control structures, and many other types of smaller objects. Debris from floods are capable of destroying unreinforced masonry walls, light wood-frame construction, and small-diameter posts and piles.

In addition to coastal flood events that can cause damage, nuisance flooding can impact low-lying areas of Hudson County along tidal waterways. Nuisance flooding, also known as high tide flooding, causes public inconveniences, such as frequent road closures, overwhelmed storm drains, and compromised infrastructure. The threshold for nuisance flooding is site specific based on the regional tidal regime and is established by NOAA. Nuisance flooding is 300 percent



to 900 percent more frequent than it was 50 years ago (NOAA 2023). As sea level rises, the number of nuisance flooding days and the severity of nuisance flooding will continue to increase. The nearest NOAA tidal gauge to Hudson County is across the Hudson River at the Battery in New York City.

FLASH FLOODING

Flash floods are defined by the National Weather Service as “a flood caused by heavy or excessive rainfall in a short period of time, generally less than six hours (NWS n.d.). Flash floods are usually characterized by raging torrents after heavy rains that rip through riverbeds, urban streets, or mountain canyons sweeping everything before them. They can occur within minutes or a few hours of excessive rainfall. They can also occur even if no rain has fallen, for instance after a levee or dam has failed, or after a sudden release of water by a debris or ice jam (NSSL n.d.).

STORMWATER/URBAN FLOODING

Stormwater/urban flooding is due to local drainage issues and high groundwater levels. Locally, heavy precipitation may produce flooding in areas other than delineated floodplains or along recognizable channels. If local conditions cannot accommodate intense precipitation through a combination of infiltration and surface runoff, water may accumulate and cause flooding problems. During winter and spring, frozen ground and snow accumulations may contribute to inadequate drainage and localized ponding. Flooding issues of this nature generally occur in areas with flat gradients and generally increase with urbanization which speeds the accumulation of floodwaters because of impervious areas. Shallow street flooding can occur unless channels have been improved to account for increased flows (FEMA 2007).

High groundwater levels can be a concern and cause problems even where there is no surface flooding, due to the soil being unable to absorb any additional moisture from persistent rainfall. Basements are susceptible to high groundwater levels. Seasonally high groundwater is common in many areas, while elsewhere high groundwater occurs only after a long period of above-average precipitation (USGS 2016).

Heavy rainfall that overwhelms a developed area’s stormwater infrastructure causing flooding is commonly referred to as urban flooding. Urban flooding can be worsened by aging and inadequate infrastructure and over development of land. The growing number of extreme rainfall events that produce intense precipitation are resulting in increased urban flooding (Center for Disaster Resilience 2018). While coastal, riverine, and lakeshore flooding is mapped and studied by FEMA, urban flooding is not.

NOAA defines urban flooding as the flooding of streets, underpasses, low lying areas, or storm drains (NWS 2009). Urban drainage flooding is caused by increased water runoff due to urban development and inadequate drainage systems. Drainage systems are designed to remove surface water from developed areas as quickly as possible to prevent localized flooding on streets and other urban areas. The systems make use of a closed conveyance system that channels water away from an urban area to surrounding streams. This bypasses the natural processes of water filtration through the ground, containment, and evaporation of excess water. Because drainage systems reduce the amount of time the surface water takes to reach surrounding streams, flooding in those streams can occur more quickly and reach greater depths than prior to development in that area (Harris 2023).



COASTAL EROSION

Erosion is the geological process in which earthen materials are worn away and transported by natural forces such as wind or water. Most erosion is performed by liquid water, wind, or ice. Liquid water is the major agent of erosion on Earth. Rain, rivers, floods, and lakes carry away bits of soil and sand and slowly wash away the sediment (National Geographic 2023).

More specifically, coastal erosion is the gradual breakdown and removal of land material into a sea or lake due to physical and chemical processes, such as wind, wave, and tidal action, with contribution from man-made interferences. Coastal erosion can take place at two different rates: gradual erosion, which occurs continually along all coastlines, and sudden or catastrophic erosion primarily due to storm events, which can result in changes to coasts over a very short period of time.

Many natural factors affect erosion of the shoreline, including shore and nearshore morphology, shoreline orientation, and the response of these factors to storm frequency and sea level rise. Coastal shorelines change constantly in response to wind, waves, tides, sea-level fluctuation, seasonal and climatic variations, human alteration, and other factors that influence the movement of sand and material within a shoreline system.

Unsafe tidal conditions, as a result of high winds, heavy surf, erosion, and fog are ordinary coastal hazard phenomena. Some or all of these processes can occur during a coastal storm, resulting in an often-detrimental impact on the surrounding coastline. Factors that contribute to these coastal hazards include storms such as Nor'easters and hurricanes, decreased sediment supplies, and sea-level rise.

Coastal erosion can result in significant economic loss through the destruction of buildings, roads, infrastructure, natural resources, and wildlife habitats. Damage often results from an episodic event with the combination of severe storm waves and dune or bluff erosion.

SEA LEVEL RISE

Evidence supports that global sea level is rising at an increased rate and will continue rising over the next century. The two major causes of sea level rise are thermal expansion, caused by the warming of the oceans, and the loss of land-based ice (glaciers and polar ice caps) due to increased melting. Thermal expansion can account for a significant portion of sea level rise and is a result of warming atmospheric temperatures and subsequent warming of ocean waters. Since 1900, records and research have shown that sea level has been steadily rising at a rate of 0.04 to 0.1 inches per year (NOAA 2013).

For the most current information, NASA Earth Observatory reports that the global mean sea level has risen approximately 10.1 centimeters (3.98 inches) since 1992, and over the past 140 years, global sea level has risen between 21 to 24 centimeters (8 to 9 inches). The rate of sea level rise is accelerating, with human interference now dwarfing natural cycles (NASA Earth Observatory 2025).

Global sea level rise refers to the increase currently observed in the average global sea level trend, primarily attributed to changes in ocean volume due to ice melt and thermal expansion. The melting of glaciers and continental ice masses can contribute significant amounts of freshwater input to the earth's oceans. In addition, a steady increase in global atmospheric temperature creates an expansion of salt water molecules, increasing ocean volume.



Relative sea level refers to the height of the water as measured along the coast relative to a specific point on land. Water level measurements at tide stations are referenced to stable vertical points on the land, and a known relationship is established. Measurements at any given tide station include both global sea level rise and vertical land motion (subsidence, glacial rebound, or large-scale tectonic motion). The heights of both the land and water are changing; therefore, the land-water interface can vary spatially and temporally and must be defined over time. Relative sea level trends reflect changes in local sea level over time and are typically the most critical sea level trend for many coastal applications, such as coastal mapping, marine boundary delineation, coastal zone management, coastal engineering, and sustainable habitat restoration (NOAA 2021).

Short-term variations in sea level typically occur daily and include waves, tides, or specific flood events. Long-term variations in sea level occur over various time scales, from monthly to several years, and can be repeatable cycles, gradual trends, or intermittent differences. Seasonal weather patterns, changes in coastal and ocean circulation, anthropogenic influences, and vertical land motion can influence changes in sea level over time. When estimating sea level trends, a minimum of 30 years of data are used to account for long-term sea level variations and reduce errors in computing sea level trends based on monthly mean sea level (NOAA n.d.).

9.1.2 Location

According to the 2013 preliminary FEMA Flood Insurance Study, flooding in Hudson County is caused primarily by tidal flooding, from such sources as Upper New York Bay, New York Bay, and Kill Van Kull, which in turn affect the riverine sources, such as the Hudson River, Hackensack River, and Passaic River (FEMA FIS 2013). Flooding potential for each type of flooding that affects Hudson County is described in the subsections below.

RIVERINE FLOODING

Flooding potential is influenced by climatology, meteorology, and topography. Extensive development, such as that seen in Hudson County, can impact flooding potential because it leaves fewer natural surfaces available to absorb rainwater. Development forces water directly into streams, rivers, and existing drainage systems, swelling them more than when more natural surface buffered the runoff rate.

Locations of flood zones in Hudson County, as depicted on the FEMA preliminary Digital Flood Insurance Rate Map (DFIRM), are illustrated in Figure 9-2. The total land area in the floodplain, excluding water bodies, is summarized in Table 9-1.

The New Jersey Meadowlands are a large ecosystem of wetlands located in northeastern New Jersey. The Meadowlands stretch mainly along the Hackensack and Passaic Rivers as they flow into Newark Bay. Tributaries of the Hackensack River (Sawmill Creek, Berrys Creek, and Overpeck Creek) also make up the Meadowlands. This area in the State of New Jersey consists of approximately 30.4 square miles of open, undeveloped space, in addition to developed areas. Four communities in Hudson County are located in the Meadowlands and are prone to flooding: Jersey City, Kearny, North Bergen, and Secaucus.



Figure 9-2. FEMA Flood Hazard Areas in Hudson County

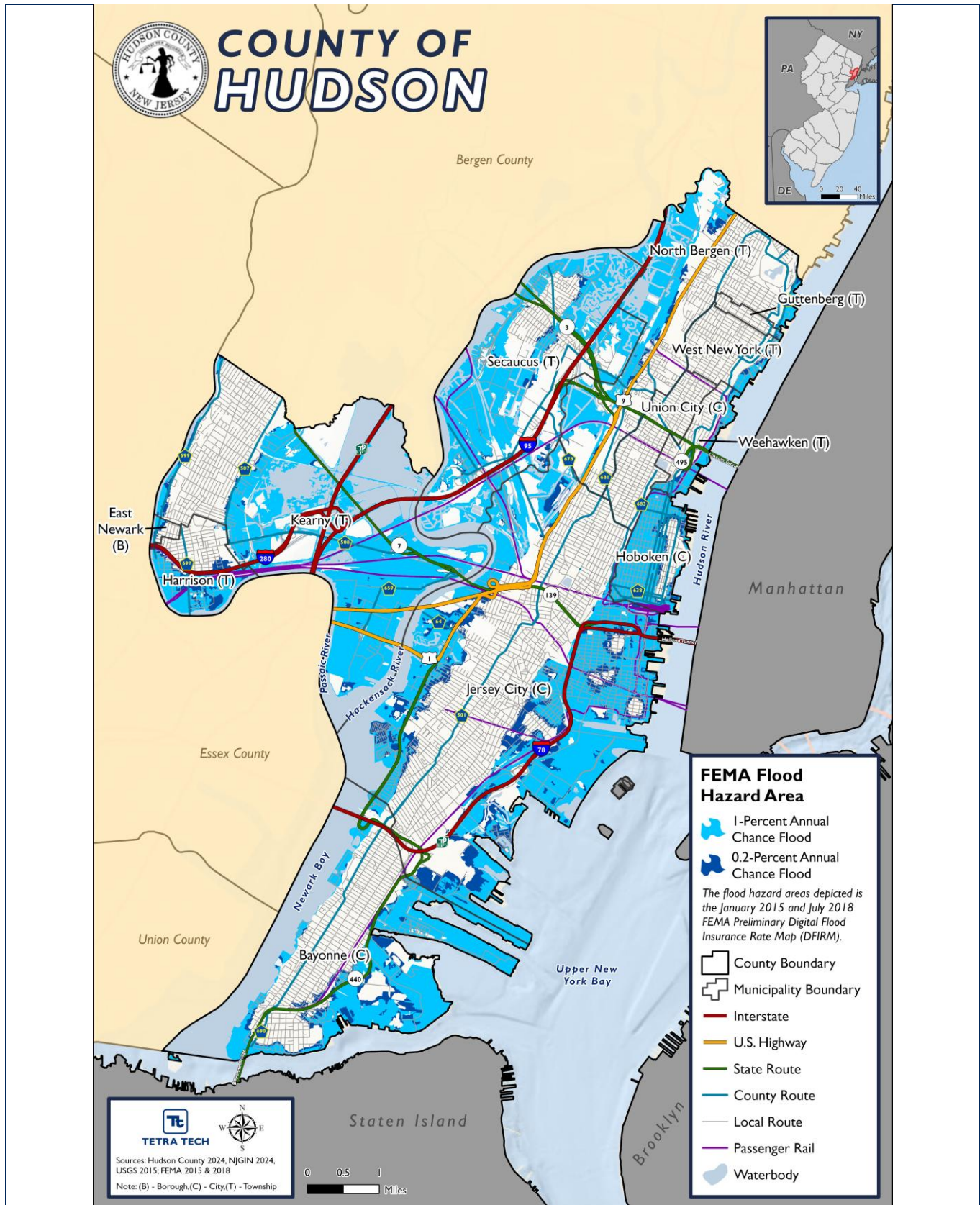


**Table 9-1. Number of Acres in Hudson County Exposed to 1 Percent and 0.2 Percent Annual Chance Flood**

Jurisdiction	Total Land Area (Excluding Water Bodies) (acres)	Land Area (Excluding Water Bodies) in the 1% Annual Chance Flood Hazard Area		Land Area (Excluding Water Bodies) in the 0.2% Annual Chance Flood Hazard Area	
		Total Area (acres)	% of Jurisdiction Total	Total Area (acres)	% of Jurisdiction Total
Bayonne (C)	3,679	1,568	42.6%	1,849	50.3%
East Newark (B)	63	14	21.9%	23	36.5%
Guttenberg (T)	124	6	4.6%	8	6.5%
Harrison (T)	773	277	35.9%	382	49.5%
Hoboken (C)	794	578	72.7%	644	81.2%
Jersey City (C)	9,348	3,557	38.1%	4,508	48.2%
Kearny (T)	4,691	2,560	54.6%	2,659	56.7%
North Bergen (T)	3,191	971	30.4%	1,064	33.3%
Secaucus (T)	3,546	2,010	56.7%	2,092	59.0%
Union City (C)	824	5	0.6%	5	0.6%
Weehawken (T)	499	168	33.7%	187	37.5%
West New York (T)	635	53	8.3%	69	10.9%
Hudson County (Total)	28,167	11,766	41.8%	13,489	47.9%

Source: Hudson County 2024

The Hackensack Meadowlands Floodplain Management Plan indicated the following problems areas in Hudson County (New Jersey Meadowlands Commission 2005):

- **Meadowlands Park, Town of Secaucus** – Flooding has been reported in the vicinity of the Route 3 access ramps from Meadowlands Parkway, which is located in the western section of the Town of Secaucus. It travels in a north-south direction parallel to the Hackensack River. Flooding occurs on both the northbound and southbound shoulders of the roadway near Block 11, Lot 1. Flooding also occurs along the roadway, blocking traffic, and causing significant delays. Flooding is tidally influenced. Heavy rain events cause the Parkway to flood and back up to Tenth Street.
- **Penhorn Avenue, Town of Secaucus** – Penhorn Avenue is located in the southern section of the Town of Secaucus. Flooding occurs along this roadway during moderate to severe storm events. It has been reported that each time it rains, the street floods, and with heavy rainfall, flooding is worse. During rain events, the street is inundated with approximately four feet of water and takes approximately three to four days for the water to drain. In the area of flooding, ground elevation varies from two to eight feet. Penhorn Creek is separated from the Hackensack River, approximately two miles south of Penhorn Avenue.
- **Fish House Road, Town of Kearny** – Flooding has been reported in the vicinity of Fish House Road, which is located in the eastern section of the Town of Kearny. Flooding in this area is due primarily to the elevation of the roadway being at or below extreme high tide. Flooding occurs beneath the PATH and CSX bridges adjacent to the Hackensack River and at the industrial building next to the entrance ramp to Route 7. Flooding also occurs under the Newark Turnpike Causeway where the road can be inundated with water up to four feet. Areas under the Amtrak Bridge flood, and water can reach over a foot in depth. The old cobblestone Newark



Turnpike floods, which is now a side street off Route 7. The drainage for this road is tied to the DOT drains by Owens Corning and in the middle of the wide traffic median that eventually drains to the Hackensack River. Two stormwater catch basins on the Route 7 West exit ramp to Belleville Turnpike are clogged at their outlet.

- **New Jersey Route 7/Belleville Turnpike, Town of Kearny** – Route 7/Belleville Turnpike is located in the eastern section of the Town of Kearny. Flooding occurs in the loading docks of several private properties, on the entrance ramp from Belleville Turnpike southbound to Newark-Jersey City Turnpike eastbound, each of the overpasses on Route 7/Belleville Turnpike between Sellers Street and Newark-Jersey City Turnpike, and in front of 720 Route 7/Belleville Turnpike. During heavy rains, tidal blow backs up drains on Belleville Turnpike. The truck yard of the impacted property can be inundated with up to two feet of water, making it difficult for trucks to unload and make deliveries.

COASTAL FLOODING

The coastal areas of Hudson County are vulnerable to the damaging impacts of coastal storms. The coastal boundary of New Jersey encompasses the Coastal Area Facility Review Act (CAFRA) zone and the New Jersey Meadowlands District. Hudson County is not located in the CAFRA zone; however, four municipalities in the County (Jersey City, Kearny, North Bergen and Secaucus) are located in the Meadowlands. Figure 9-3 provides a detailed representation of the Hudson County shoreline.

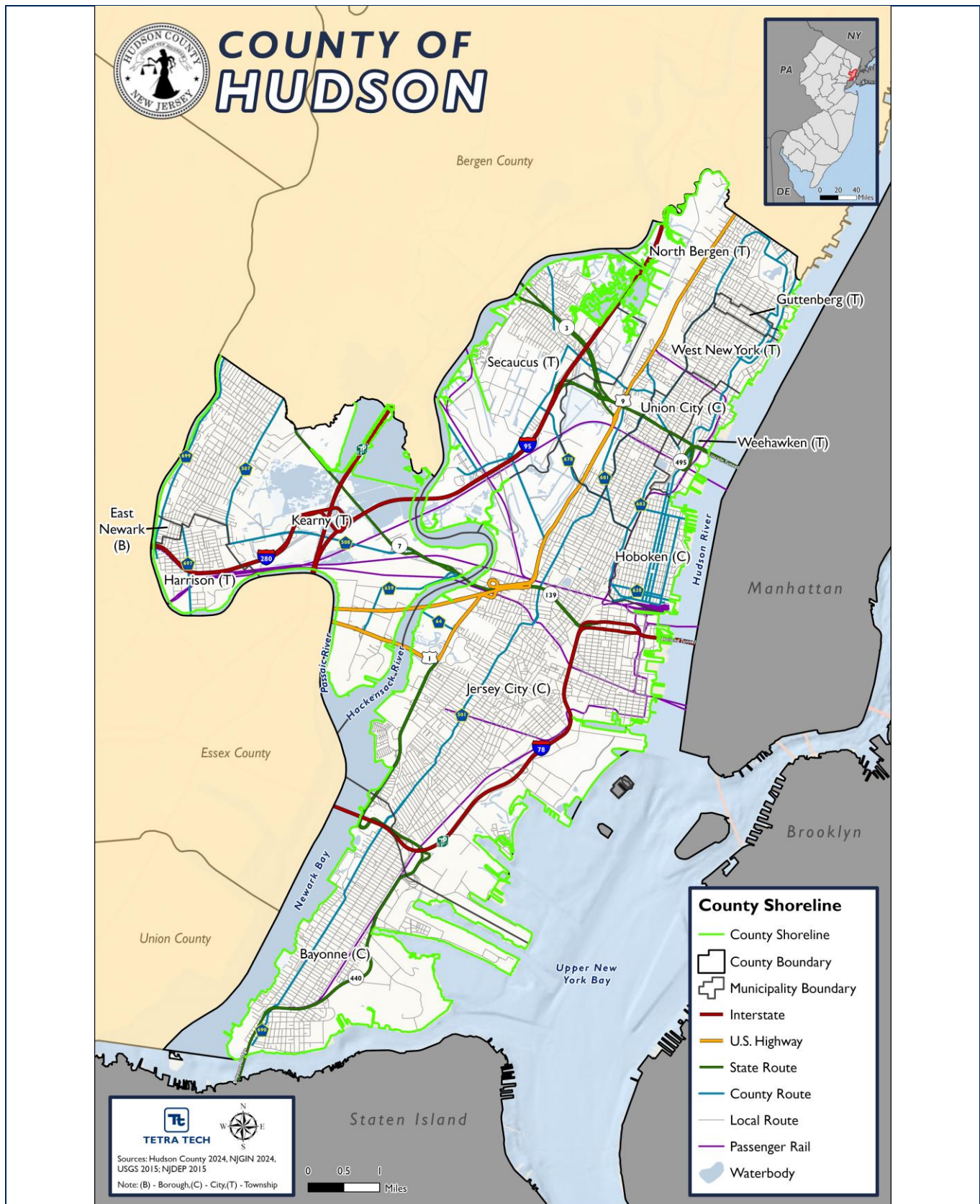
Storm surge also contributes to coastal flooding. Storm surges inundate coastal floodplains by tidal elevation rise in inland bays and harbors and backwater flooding through coastal river mouths. Strong winds can increase in tide levels and water-surface elevations. Storm systems generate large waves that run up and flood coastal areas and adjacent low-lying floodplains. For more on storm surge, refer to Chapter 11 (Severe Weather).

There are no flood control measures that would alter flood hazards due to coastal flooding within Hudson County (FEMA FIS 2013). However, the following projects are in progress:

- **USACE NY & NJ Harbor & Tributaries Focus Area Feasibility Study (HATS)**
 - The US Army Corps of Engineers (USACE) is investigating measures to manage future flood risk in ways that support the long-term resilience and sustainability of the coastal ecosystem and surrounding communities, and reduce the economic costs and risks associated with flood and storm events (USACE 2019).
- **Hoboken Flood-Resilience Project**
 - The U.S. Department of Housing and Urban Development has recently released \$230 million for construction of a flood-resistance system to protect Hoboken as well as parts of Weehawken and Jersey City. The project calls for construction of flood structures and stormwater control systems to protect areas vulnerable to flooding. The strategically placed system will utilize natural higher ground to maximize protection and will be designed to blend in seamlessly with the urban streetscape. It will provide protection for critical infrastructure such as the North Hudson Sewerage Authority, as well as public safety facilities such as three fire stations and a hospital.



Figure 9-3. Coastline of Hudson County





The 2013 FEMA preliminary Flood Insurance Study, noted the following principal flood problems in Hudson County (FEMA FIS 2013):

- **Weehawken, Guttenburg, West New York**—Flooding in the Township of Weehawken and Towns of Guttenburg and West New York is caused primarily by tidal flooding of the Hudson River in the low-lying areas along the shore.
- **Bayonne, Hoboken, Jersey City**—In the Cities of Bayonne, Hoboken, and Jersey City, the most severe flooding events have been due to hurricanes and related storm surge.
- **Kearny, Harrison**—The Towns of Kearney and Harrison are subject to tidal flooding from the Passaic River, which usually occurs when the annual peak rainfall coincides with high tide.
- **North Bergen**—In the Township of North Bergen, flooding results from the tidal stages of Newark Bay which affect the Hackensack River, and, in turn, Bellmans Creek, Cromakill Creek, and Penhorn Creek, which wind their way through the Hackensack Estuary. Tidal elevation from the Hackensack River also affects the New Jersey Meadowlands Commission district within the Township of North Bergen.

Hudson County is located within the New York-New Jersey Harbor Estuary (Newark Bay). An estuary is a body of water where rivers meet the ocean and saltwater meets fresh water. The Harbor Estuary is positioned at the confluence of the Hudson River and smaller rivers such as the East, Hackensack, and Raritan Rivers. It then opens into the New York Bight and Long Island Sound. The watershed of the Harbor Estuary encompasses a large area that includes the Hudson River watershed up to the Troy Dam, as well as the watersheds of the Raritan, Passaic, and Hackensack Rivers. Coastal storms can cause significant impacts to coastlines, both to the built and natural environments. In an urban region like the Harbor Estuary, the impacts to the built environment can exacerbate the level of impact incurred by natural systems (Hudson County 2024). Figure 9-4 shows the location of the New York-New Jersey Harbor Estuary and its boundaries.

Located in the New York and New Jersey Harbor Estuary, Newark Bay is the center of the most urbanized and industrialized parts of the country. Newark Bay is approximately six miles long and one mile wide and is located at the confluence of the Passaic and Hackensack Rivers, between the shores of Newark and Elizabeth to the west, Jersey City and Bayonne to the east, and Staten Island to the south. Newark Bay is linked to Upper and Lower New York Bay by the Kill van Kull and the Arthur Kill. Port Newark is located on the western shore of Newark Bay (Our Newark Bay 2014).

FLASH FLOODING

Flash flooding, like riverine flooding, occurs throughout the County, primarily along the bodies of water that flow through it. There is no standardized mapping system for flash flooding.

STORMWATER/URBAN FLOODING

Stormwater/urban flooding is not mapped by the state or FEMA but is most likely to occur in highly developed areas with high percentages of impervious surface that contribute to high rates of runoff. Locations that have undersized stormwater components or stormwater components that are prone to becoming clogged or failing often experience stormwater flooding.



Figure 9-4. New York-New Jersey Harbor Estuary



Source: New York-New Jersey Harbor & Estuary Program 2014

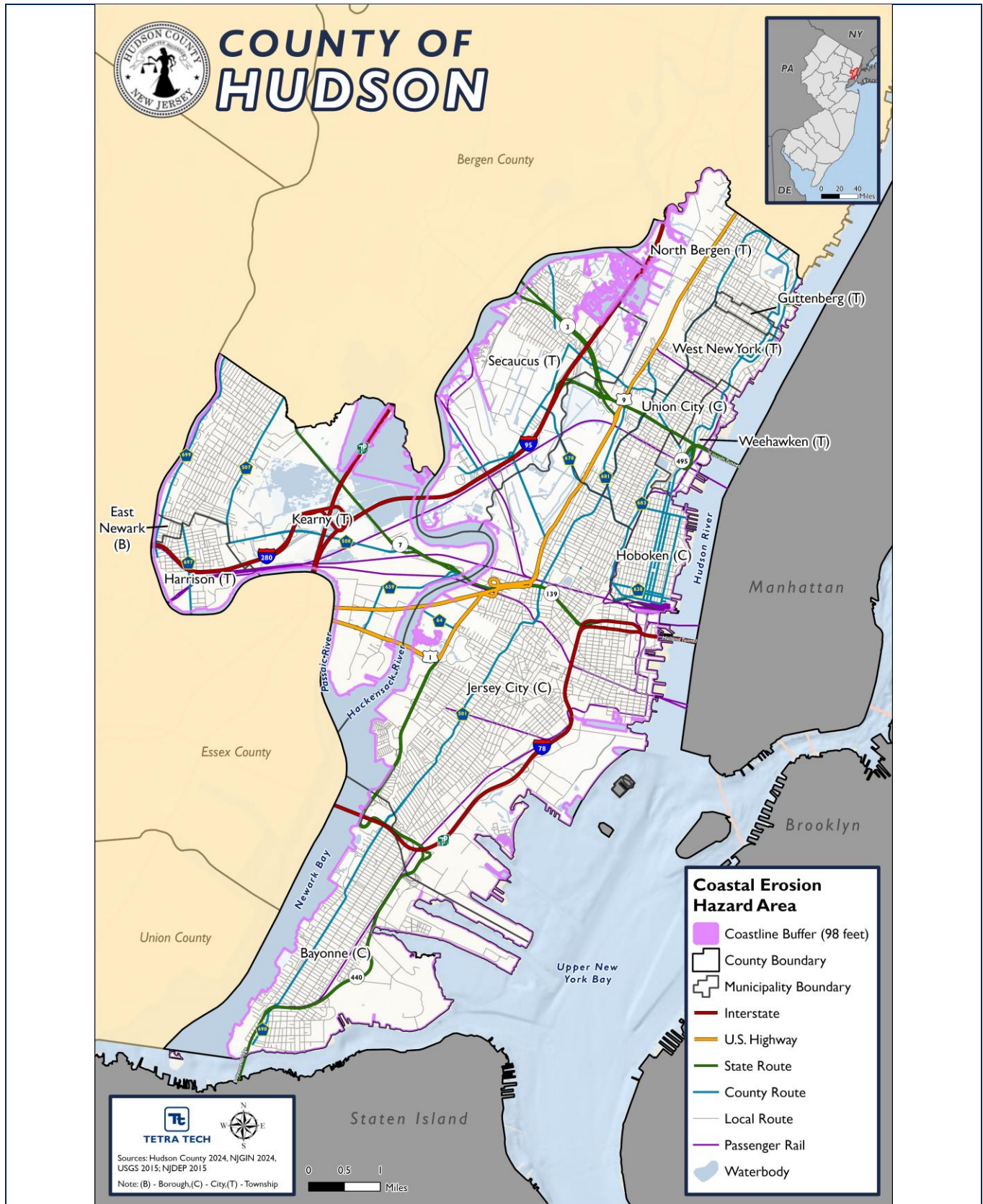
COASTAL EROSION

The coastal boundary of the State of New Jersey encompasses the Coastal Area Facility Review Act area and the New Jersey Meadowlands District. The coastal area includes coastal waters to the limit of tidal influence, including the following areas: the Atlantic Ocean (to the limit of the State Of New Jersey's seaward jurisdiction); Upper New York Bay, Newark Bay, Raritan Bay and the Arthur Kill; the Hudson, Raritan, Passaic, and Hackensack Rivers, and the tidal portions of the tributaries to these bays and rivers.

Hudson County is considered a coastal county because several municipalities are located along the tidal portion of the Hudson River (the Cities of Jersey City and Hoboken). This map is an essential tool for understanding the geographical layout and identifying areas that may be susceptible to various hazards, such as coastal erosion. Additionally, Figure 9-5 shows the coastal erosion hazard areas.



Figure 9-5. Coastal Erosion Hazard Area





SEA LEVEL RISE

Sea-level rise in New Jersey has resulted in an increase in sea level of roughly 18 inches since the early 1900s. The rate of sea-level rise is anticipated to increase as time goes on, with the rate of increase being tied to the rate of greenhouse gas emissions and the corresponding increase in global temperatures (Rutgers 2020). As sea levels continue to rise, an increase in the frequency and severity of coastal flooding events from coastal storms is expected. Rising sea levels can result in permanent inundation of land that is currently above the high tide line, increase flooding risk from coastal storms, increase erosional rates, reduce the effectiveness of infrastructure, such as stormwater systems, and damage or destroy critical habitats.

Hudson County faces significant risks from sea level rise due to its extensive coastline along the Hudson River and proximity to the Atlantic Ocean. Low-lying urban areas and critical infrastructure are particularly vulnerable to flooding and erosion. Historical data shows that sea levels in New Jersey have risen by approximately 18 inches over the past century, with projections indicating an accelerated rise in the future. This increases the risk of frequent and severe coastal flooding, permanent land inundation, and higher erosion rates, impacting population, buildings, and infrastructure near the shoreline. Figure 9-6 visualizes two potential sea level rise scenarios for Hudson County—1-foot and 3-foot levels.

9.1.3 Extent

RIVERINE AND FLASH FLOODING

The severity of riverine and flash flooding is determined by a combination of several factors including stream and river basin topography and physiography; precipitation and weather patterns; recent soil moisture conditions; and degree of vegetative clearing and impervious surface. Generally, floods are long-term events that may last for several days. Severity depends not only on the amount of water that accumulates in a period of time, but also on the land's ability to manage this water. One element is the size of rivers and streams in an area; but an equally important factor is the land's absorbency. When it rains, the soil acts as a sponge. When the land is saturated or frozen, infiltration into the ground slows and any more water that accumulates must flow as runoff (Harris 2023).

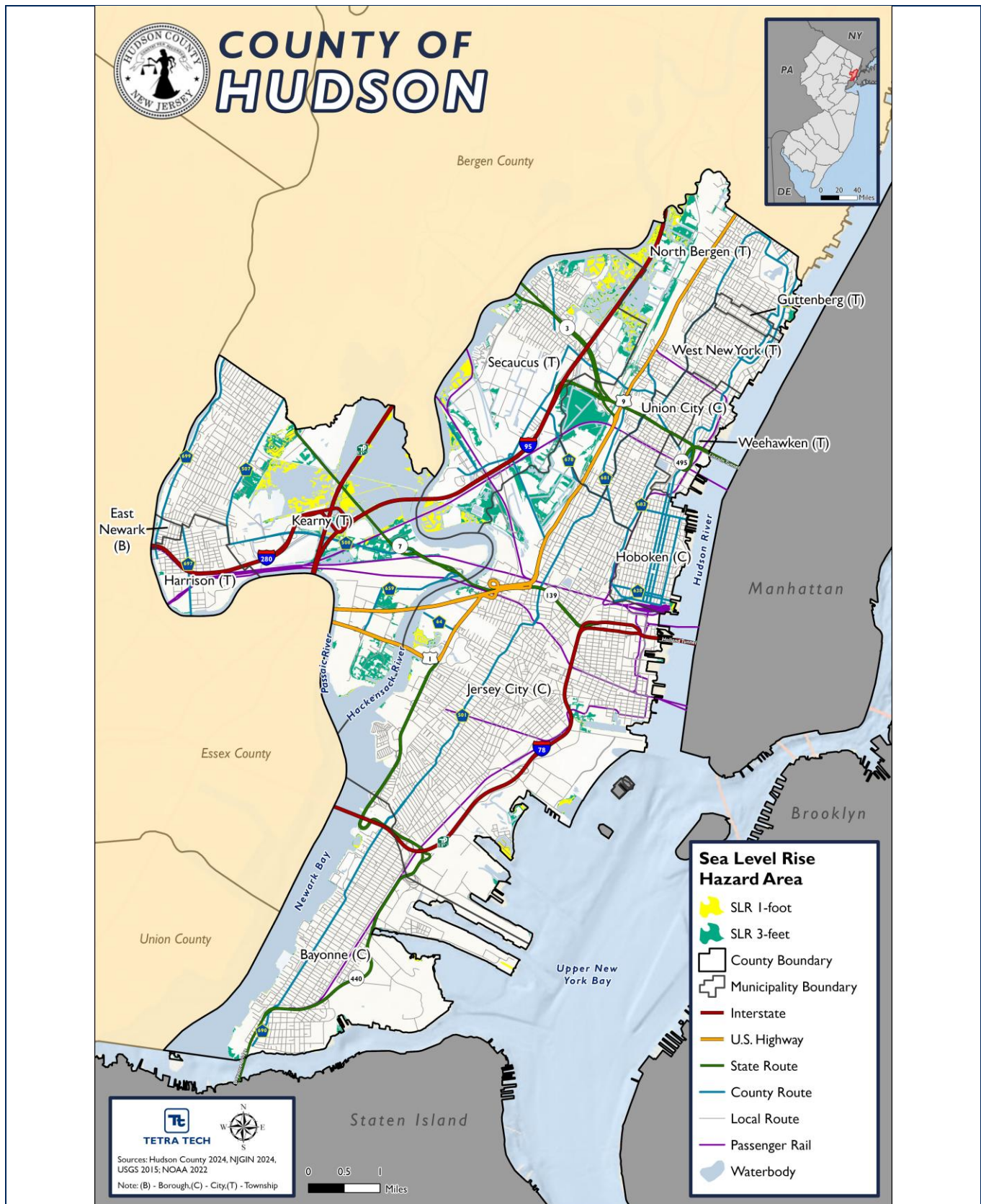
The frequency and severity of riverine flooding are measured using a discharge probability, which is the probability that a certain river discharge (flow) level will be equaled or exceeded in a given year. Flood studies use historical records to determine the probability of occurrence for the different discharge levels.

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

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



Figure 9-6. Sea Level Rise in Hudson County





COASTAL FLOODING

Evidence supports that global sea level is rising at an increased rate and will continue rising over the next century. The two major causes of sea level rise are thermal expansion, caused by the warming of the oceans, and the loss of land-based ice (glaciers and polar ice caps), due to increased melting. Thermal expansion can account for 50 percent of sea level rise and is a result of warming atmospheric temperatures and subsequent warming of ocean waters causing the expansion. Since 1900, records and research have shown that sea level has been steadily rising at a rate of 0.04 to 0.1 inches per year (NOAA 2024).

There are two ways sea level rise is discussed: global and relative. Global sea level rise refers to the increase currently observed in the average global sea level trend (primarily attributed to changes in ocean volume due to ice melt and thermal expansion). The melting of glaciers and continental ice masses can contribute significant amounts of freshwater input to the earth's oceans. In addition, a steady increase in global atmospheric temperature creates an expansion of salt water molecules, increasing ocean volume.

Relative sea level refers to the height of the water as measuring along the coast relative to a specific point on land. Water level measurements at tide stations are referenced to stable vertical points on the land and a known relationship is established. Measurements at any given tide station include both global sea level rise and vertical land motion (subsidence, glacial rebound, or large-scale tectonic motion). The heights of both the land and water are changing; therefore, the land-water interface can vary spatially and temporally and must be defined over time. Relative sea level trends reflect changes in local sea level over time and are typically the most critical sea level trend for many coastal applications (coastal mapping, marine boundary delineation, coastal zone management, coastal engineering, and sustainable habitat restoration) (NOAA n.d.).

Short-term variations in sea level typically occur daily and include waves, tides, or specific flood events. Long-term variations in sea level occur over various time scales, from monthly to several years and can be repeatable cycles, gradual trends, or intermittent differences. Seasonal weather patterns (changes in the earth's declination), changes in coastal and ocean circulation, anthropogenic influences, and vertical land motion can influence changes in sea level over time. When estimating sea level trends, a minimum of 30 years of data are used in order to account for long-term sea level variations and reduce errors in computing sea level trends based on monthly mean sea level (NOAA n.d.).

Sea-level rise in the State of New Jersey has resulted in an increase in sea level of roughly 16 inches in the past century. The rate of sea-level rise is anticipated to increase as time goes on, with the rate of increase being tied to the rate of greenhouse gas emissions and the corresponding increase in global temperatures (Rutgers 2024). As sea levels continue to rise, an increase in the frequency and severity of coastal flooding events from coastal storms is expected. Rising sea levels can result in permanent inundation of land that is currently above the high tide line, increase flooding risk from coastal storms, increase erosional rates, reduce the effectiveness of infrastructure, such as stormwater systems, and damage or destroy critical habitats.

STORMWATER/URBAN FLOODING

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



COASTAL EROSION

Coastal erosion is measured as the rate of change in the position or horizontal displacement of a shoreline over a period of time (NJOEM 2024). Many factors determine whether a community exhibits greater long-term erosion or accretion, including the following (Woods Hole Sea Grant 2003):

- Exposure to high-energy storm waves.
- Sediment size and composition of eroding coastal landforms feeding adjacent beaches.
- Near-shore bathymetric variations which direct wave approach.
- Alongshore variations in wave energy and sediment transport rates.
- Relative sea level rise.
- Frequency and severity of storm events.
- Human interference with sediment supply (e.g., revetments, seawalls, jetties).

Such erosion can be intensified by human activities and effects, such as boat wakes, shoreline hardening, or dredging. Natural recovery after erosive episodes can take months or years (CCRM 2017). If a dune or beach does not recover quickly enough via natural processes, coastal and upland property could be exposed to further damage in subsequent events. Coastal erosion can cause the destruction of buildings and infrastructure (NJOEM 2024).

Erosion is typically expressed as a rate: rate of linear retreat (feet of shoreline recession per year) or volumetric loss (cubic yards of eroded sediment per linear foot of shoreline frontage per year). Erosion rates are cited as positive numbers, with corresponding shoreline change rates as negative numbers. For example, an erosion rate of two feet per year is equivalent to a shoreline change rate of “-2 feet per year”. Accretion rates are stated as positive numbers, with corresponding shoreline change rates as positive numbers. For example, an accretion rate of two feet per year is equivalent to a shoreline change rate of “2 feet per year”.

Erosion rates are usually computed and cited as long-term, average annual rates. However, erosion rates are not uniform in time or space and can vary substantially, including from one location along the shoreline to another (even when the two locations are only a short distance apart), over time at a single location, or seasonally.

SEA LEVEL RISE

Several methods are used to measure sea level rise, including tide gauges and satellite altimetry. Tide gauges provide long-term data on sea level changes at specific coastal locations by measuring the height of the sea relative to a fixed point on land (NOAA n.d.). These gauges have been in use for over a century and offer valuable historical data.

Additionally, satellite altimetry has been used since the early 1990s to measure sea level on a global scale. Satellites equipped with radar altimeters measure the distance between the satellite and the sea surface, providing highly accurate and comprehensive data on sea level changes. This method offers nearly global coverage and helps in understanding planet-wide trends.



9.1.4 Previous Occurrences

FEMA MAJOR DISASTER AND EMERGENCY DECLARATIONS

Between 1954 and 2023, Hudson County was included in nine major disaster (DR) or emergency (EM) declarations for flood-related events (FEMA 2024). Table 9-2 lists these declarations.

Table 9-2. FEMA Declarations for Flood Events in Hudson County (1954 to 2023)

Event Date	Declaration Date	Declaration Number	Description
September 4, 1971	September 4, 1971	DR-310-NJ	Heavy Rains, Flooding
December 10-17, 1992	December 18, 1992	DR-973-NJ	Coastal Storm, High Tides, Heavy Rain, Flooding
September 16-18, 1999	September 17, 1999	EM-3148-NJ	Hurricane Floyd
August 26 – September 5, 2011	August 27, 2011 August 31, 2011	EM-3332-NJ DR-4021-NJ	Hurricane Irene
October 26-November 8, 2012	October 28, 2012 October 30, 2012	EM-3354-NJ DR-4086-NJ	Hurricane Sandy
September 1 – 3, 2021	September 2, 2021 September 5, 2021	EM-3573-NJ DR-4614-NJ	Remnants of Hurricane Ida

Sources: FEMA 2024

USDA DECLARATIONS

The Secretary of Agriculture from the U.S. Department of Agriculture (USDA) is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in contiguous counties. Between 2019 and 2023, Hudson County was not included in any USDA flood-related agricultural disaster declarations (USDA 2024).

PREVIOUS EVENTS

Known hazard events that impacted Hudson County between August 2019 and December 2023 are discussed in Table 9-3. For events prior to 2019, refer to the 2020 Hudson County HMP.

*Table 9-3. Flood Events in Hudson County (2019 to 2023)*

Event Date	FEMA Declaration or State Proclamation Number	Hudson County included in declaration?	Location Impacted	Description
May 29, 2019	N/A	N/A	Secaucus	Low pressure moving along a nearly stationary boundary triggered an area of convection that moved across the region during the evening of May 29th, resulting in isolated flash flooding across northeast New Jersey. Patterson Plank Road was flooding Route 3 in Secaucus.
July 17, 2019	N/A	N/A	Union City	Showers and thunderstorms developed in a sub-tropical environment ahead of the remnants of Post Tropical Cyclone Barry, resulting in flash flooding across portions of urban northeast New Jersey. Several streets flooded in Hoboken with water at least halfway up car tires, including Madison Street between 9th and 10th Streets and 1st Street.
July 22, 2019	N/A	N/A	Harrison	Flow parallel to a stalled frontal boundary across the region allowed showers and thunderstorms to train across the area during the afternoon and evening hours. These storms developed in an environment with precipitable water values around 2.25 inches and produced widespread 1–2-inch rainfall amounts across the region. Numerous roads were closed and water rescues were conducted in Harrison, East Newark, and Kearny, including along Frank E. Rodgers Boulevard South in Harrison and along Passaic Avenue in both East Newark and Kearny.
August 7, 2019	N/A	N/A	Hoboken, West End, and Bayonne	Showers and thunderstorms developed across northeast New Jersey ahead of a cold front during the afternoon of August 7th. These storms developed in an environment with precipitable water values close to 2 inches. Multiple rounds of showers and storms exacerbated the flash flood threat, with many locations receiving 1-3 inches of rain, much of which fell in only a few hours. All lanes of Tonelle Avenue (NJ Routes 1&9) were closed in Jersey City due to flooding.
August 18, 2019	N/A	N/A	Union City	Showers and thunderstorms developed during the afternoon hours as a warm front slowly approached the region from the south. With precipitable water values near 2 inches and relatively slow storm movement, isolated flash flooding was reported in Hudson County.
July 1, 2020	N/A	N/A	East Newark	Energy rotating around an upper-level low over the northeast resulted in the development of scattered showers and thunderstorms. With light steering flow, this resulted in slow moving convection and isolated flash flooding. Multiple water rescues were conducted due to flash flooding on Frank E Rodgers Boulevard South of Bergen Street in Harrison.
July 3, 2020	N/A	N/A	Kearny	A backdoor cold front slowly sank across the area through the day, eventually settling just southwest of the region by evening. Moderate to strong instability ahead of this front aided in the development of showers and thunderstorms across northeast New Jersey during the early evening hours. Most of this rain fell in less than an hour, resulting in isolated flash flooding. A water rescue was conducted at the intersection of Passaic Avenue and Bergen Avenue near K-Mart in Kearny.



Event Date	FEMA Declaration or State Proclamation Number	Hudson County included in declaration?	Location Impacted	Description
July 10, 2020	N/A	N/A	Hoboken and Union City	Tropical Storm Fay tracked northward along the New Jersey coast before passing west of New York City. Several rounds of heavy rain occurred over the New York City metro area as the storm approached. This rain developed in a tropical airmass, with precipitable water values over 2 inches, resulting in numerous reports of flash flooding. There was flooding under a railroad overpass on Grove Street near Newark Street in Jersey City. Water was up to the car doors.
July 22, 2020	N/A	N/A	Hoboken and Union City	Following a warm frontal passage in the morning, an increasingly hot and humid airmass built across the area during the day, with precipitable water values rising above 2 inches by evening based on the 00Z sounding from Upton, NY. A line of convection moving into the region from the west during the early evening hours resulted in flash flooding across portions of urban northeast New Jersey. A car was stranded in flood waters at the intersection of 9th Street and Madison Street in Hoboken.
July 24, 2020	N/A	N/A	Bayonne and Greenville	A cold front slowly sank south across the area during the morning. With plenty of instability in place, showers and thunderstorms developed along the front and slowly moved south across northeast New Jersey during the morning hours. Flooding reported on West 55th Street in Bayonne with manhole covers lifted.
August 4, 2020	N/A	N/A	Countywide	The center of Isaias passed about 65 miles west of New York City at 3 pm on August 4, 2020, with tropical storm force winds east of the center of circulation. The highest sustained wind speeds across northeastern New Jersey ranged from 35 to 50 mph, with gusts 60 to 70 mph, resulting in widespread wind damage and power outages. Rainfall amounts of 1/2 to 4 inches were observed across northeastern NJ, resulting in some localized flooding issues.
June 8, 2021	N/A	N/A	East Newark	A passing shortwave combined with a surface trough resulted in the development of showers and thunderstorms across northeast New Jersey during the early afternoon hours. These thunderstorms developed in an environment with weak steering flow and high precipitable water values, resulting in several reports of flash flooding. Roads impassable and underwater with multiple roads closed due to flooding around the town of Harrison, including Frank E. Rodgers Boulevard.
July 2, 2021	N/A	N/A	Greenville, Kearny and Jersey City Airport	Low pressure meandering along a stalled frontal boundary produced scattered showers and thunderstorms across the region. With light upper-level flow, these storms were generally slow moving, resulting in flash flooding across portions of urban northeast New Jersey. Numerous roads were closed due to flooding in Jersey City.
July 10, 2021	N/A	N/A	Union City	Isolated showers and thunderstorms developed late in the day along a weak frontal boundary. One of these storms was able to produce a quick 0.5-1 inch of rain, resulting in isolated flash flooding in Hudson County. Water rescues were conducted near Tonnelle Avenue in North Bergen due to flooding.



Event Date	FEMA Declaration or State Proclamation Number	Hudson County included in declaration?	Location Impacted	Description
July 17, 2021	N/A	N/A	East Newark	Showers and thunderstorms developed in the vicinity of a stalled frontal boundary. With weak steering flow and precipitable water values approaching 2 inches on the 12Z Upton sounding, this resulted in widespread flash flooding across portions of urban northeast New Jersey during the mid to late afternoon hours. Frank E. Rogers Boulevard was flooded near Pete Higgins Boulevard in Harrison.
August 21, 2021	N/A	N/A	Hoboken and East Newark	Showers and thunderstorms streaming northward well ahead of approaching Hurricane Henri resulted in flash flooding across portions of northeast New Jersey. Madison Street in Hoboken was closed due to flash flooding.
August 27, 2021	N/A	N/A	Jersey City Airport	A backdoor cold front approaching the area sparked a few widely scattered thunderstorms. With weak upper-level flow resulting in slow storm motions and wet antecedent conditions as a result of rainfall associated with Tropical Storm Henri less than a week earlier, this resulted in isolated flash flooding in northeast New Jersey.
September 1 – 3, 2021	DR-4614-NJ EM-3573-NJ	Yes	Harrison, East Newark, Kearny and Jersey City	Extremely heavy rainfall associated with the remnants of Hurricane Ida overspread northeast New Jersey during the evening of September 1 and continued through the early morning hours of September 2. Rainfall totals ranged from 5-8+ inches across much of the region, with much of that rain falling in just a few hours. This resulted in widespread flash flooding leading to numerous road closures and water rescues in addition to extensive river flooding. Eight people died as a result of the flash flooding and one person remains missing.
May 27, 2022	N/A	N/A	Harrison	Several rounds of thunderstorms moved along a warm front of an approaching low-pressure system on May 27th and into the 28th. These thunderstorms produced heavy rainfall over Northeast New Jersey resulting in several rounds of localized flash flooding. Water rescue at the intersection of Johnston Avenue and Passaic Avenue.
April 30, 2023	N/A	N/A	Hoboken	Already saturated grounds from 1 to 3 inches of rain the previous day's set the stage for a localized flash flooding event to unfold on April 30th when an additional 2 to 3 inches of rainfall fell over a period of several hours. Marin Blvd and Grove St. closed due to flooding.

Sources: NOAA NCEI 2024, FEMA 2024



9.1.5 Probability of Future Occurrences

PROBABILITY BASED ON PREVIOUS OCCURRENCES

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

Table 9-4. Probability of Future Flood Events in Hudson County

Hazard Type	Number of Occurrences Between 1996 and 2023	Percent Chance of Occurring in Any Given Year
Coastal Flood	16	59%
Flash Flood	107	100%
Flood	26	96%
Total	149	100%

Sources: NOAA NCEI 2024

Notes: Due to limitations in data, not all Flood events occurring between 1954 and 1996 are accounted for in the tally of occurrences. As a result, the number of hazard occurrences is calculated using the number of occurrences between 1996 and 2023. The NCEI database categorizes flood events into types that do not correspond to the flood types outlined in this profile. Coastal flood, flash flood, and flood events likely represent other types of flooding discussed in this profile, such as riverine flooding and stormwater/urban flooding.

EFFECT OF CLIMATE CHANGE ON FUTURE PROBABILITY

A warmer atmosphere means storms have the potential to be more intense and occur more often. In New Jersey, extreme storms typically include coastal nor’easters, snowstorms, spring and summer thunderstorms, tropical storms, and on rare occasions hurricanes. Most of these events occur in the warmer months between April and October, with nor’easters occurring between September and April. The State will experience more intense rain events, less snow, and more rainfall. The State could also experience an increase in the number of flood events (NJDEP 2020).

Projections of climate change for New Jersey predict more intense rainfall events and increases in total annual precipitation (see Section 3.4.4). By 2050, annual precipitation in New Jersey could increase by 4 to 11 percent (NJDEP 2020). By the end of this century, heavy precipitation events are projected to occur two to five times more often and with more intensity than in the last century.

9.1.6 Cascading Impacts on Other Hazards

Flooding can elevate the risk of dam or levee failures. A failure may occur if water levels exceed a dam’s storage capacity or flood velocities damage equipment. Additionally, flooding can increase the likelihood of a landslide occurring if the water destabilizes slopes. More intense flood events may also amplify potential debris flows or associated damage from landslides.

Depending on a flood’s severity and the substances in its path, floodwaters can be contaminated by pollutants such as sewage, human and animal feces, pesticides, fertilizers, oil, asbestos, and rusting building materials. After flooding



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. Common public health risks associated with flood events also include unsafe food, contaminated drinking or washing water, more disease-carrying organisms (i.e., mosquitos), carbon monoxide poisoning, and even mental stress and fatigue (CDC 2024).

Floods of any type have the potential to result in water and power utilities failures. Such failures may impact public and private use, as well as cause disruption to critical infrastructure. Oversaturated soils from periods of heavy rain and flooding may cause utility poles to tip over or fall completely, interrupting the power grid for a potentially large area, especially if the transformer is impacted.

9.2 Vulnerability and Impact Assessment

To assess Hudson 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 percent annual chance flood events were examined to determine the assets located in the hazard areas and to estimate potential loss using the FEMA HAZUS-MH v6.1 model.

There are no NJDEP-identified shoreline types in Hudson County characterized as vulnerable to erosion. However, to estimate exposure to long-term coastal erosion for purposes of this risk assessment, the entire shoreline was analyzed. To generate the extent of the estimated coastal erosion hazard area (CEHA), an erosion rate of 0.5 meters per year was multiplied by 60 to include all structure types and developed/undeveloped areas (annual erosion rate of 0.5 meters x 60 years = 30 meters or approximately 98 feet). Therefore, population, buildings, and infrastructure within 98 feet of the shoreline are identified as vulnerable to long-term coastal erosion.

These results are summarized below.

9.2.1 Life, Health, and Safety

The impact of flooding on life, health, and safety is dependent upon several factors including the severity of the event and whether or not adequate warning time is provided to residents. Hazard exposure represents the population living in or near floodplain areas that could be impacted should a flood event occur. Additionally, exposure should not be limited to only those who reside in a defined hazard zone, but all individuals who may be affected by the 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.

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



OVERALL POPULATION

Riverine Flooding

To estimate population exposure to the 1 and 0.2 percent annual chance flood events, the DFIRM flood boundaries were used. Based on the spatial analysis, there are an estimated 96,295 residents living in the Special Flood Hazard Area (SFHA, or 1 percent annual chance floodplain), or 13.3 percent of the County's total population. There are an estimated 127,377 residents living in the 0.2 percent annual chance floodplain, or 17.6 percent of the County's total population. The City of Hoboken has the greatest number of residents living in the 1 percent annual chance flood hazard area with approximately 43,257 residents. The City of Jersey City has the highest number of residents living in the 0.2 percent annual chance flood area, approximately 56,099 people. Table 9-5 summarizes the population exposed to the flood hazard by jurisdiction.

Table 9-5. Estimated Hudson County Population Exposed to the 1 and 0.2 Percent Flood Hazard Area

Jurisdiction	Total Population	Population Exposed to the 1 Percent Annual Chance Flood Event Hazard Area		Population Exposed to the 0.2 Percent Annual Chance Flood Event Hazard Area	
		Number of People	Percent Total	Number of People	Percent Total
Bayonne (C)	71,686	4,846	6.8%	7,616	10.6%
East Newark (B)	2,594	6	0.2%	47	1.8%
Guttenberg (T)	12,017	318	2.6%	1,100	9.2%
Harrison (T)	19,450	1,371	7.0%	2,297	11.8%
Hoboken (C)	60,419	43,257	71.6%	51,051	84.5%
Jersey City (C)	292,449	38,984	13.3%	56,099	19.2%
Kearny (T)	41,999	1,298	3.1%	1,547	3.7%
North Bergen (T)	63,361	197	0.3%	457	0.7%
Secaucus (T)	22,181	4,848	21.9%	5,795	26.1%
Union City (C)	68,589	0	0.0%	0	0.0%
Weehawken (T)	17,197	1,008	5.9%	1,044	6.1%
West New York (T)	52,912	162	0.3%	324	0.6%
Hudson County (Total)	724,854	96,295	13.3%	127,377	17.6%

Source: U.S. Census Bureau 2020; FEMA 2015, 2018

The Hazus riverine model estimates the potential shelter needs as a result of a 1 percent annual chance flood event. This data estimates 103,364 persons may be displaced, and 5,411 people may seek short-term shelter. These statistics, by jurisdiction, are presented in Table 9-6. The estimated displaced population and number of persons seeking short-term shelter differs from the number of persons exposed to the 1 percent annual chance flood, because the displaced population numbers take into consideration that not all residents will be significantly impacted enough to be displaced or to require short-term shelter during a flood event.

**Table 9-6. Persons Displaced or Seeking Short-Term Shelter, 1 Percent Annual Chance Flood Event**

Jurisdiction	Total Population (2020 Decennial)	1% Annual Chance Flood Impacts on People	
		Displaced Population	Persons Seeking Short-Term Shelter
Bayonne (C)	71,686	3,197	615
East Newark (B)	2,594	14	14
Guttenberg (T)	12,017	287	87
Harrison (T)	19,450	1,455	161
Hoboken (C)	60,419	35,218	1,183
Jersey City (C)	292,449	51,447	2,668
Kearny (T)	41,999	1,585	204
North Bergen (T)	63,361	1,622	107
Secaucus (T)	22,181	4,507	287
Union City (C)	68,589	50	27
Weehawken (T)	17,197	1,955	9
West New York (T)	52,912	2,027	49
Hudson County (Total)	724,854	103,364	5,411

Source: Hazus v6.1; U.S. Census Bureau 2020; FEMA 2015, 2018

Coastal Erosion

Coastal erosion and sea level rise threaten coastal communities by damaging homes and infrastructure, increasing flooding risks, and disrupting local economies. These processes can lead to displacement, costly repairs, and loss of natural barriers, necessitating significant adaptation efforts to protect vulnerable areas. Table 9-7 shows the population in the coastal erosion hazard area by jurisdiction. There are overall 2,736 persons located in the coastal erosion hazard area; the City of Jersey City has the greatest population of 1,009 persons, or 0.3 percent, of the jurisdictional total.

Sea Level Rise

Table 9-8 shows population in the 1- and 3-foot sea level rise hazard areas. In Hudson County, 231 people are located within the 1-foot hazard area, with City of Jersey City having 196 and Town of Weehawken having 35. For the 3-foot sea level rise hazard area, Hudson County has 628 people, with Town of Secaucus having the highest number at 223.

SOCIALLY VULNERABLE POPULATION

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 the age of 65.

*Table 9-7. Population in the Coastal Erosion Hazard Area*

Jurisdiction	Total Population (2020 Decennial)	Population in the Coastal Erosion Hazard Area	
		Number of Persons	% of Jurisdiction Total
Bayonne (C)	71,686	788	1.1%
East Newark (B)	2,594	6	0.2%
Guttenberg (T)	12,017	215	1.8%
Harrison (T)	19,450	8	<0.1%
Hoboken (C)	60,419	127	0.2%
Jersey City (C)	292,449	1,009	0.3%
Kearny (T)	41,999	0	0.0%
North Bergen (T)	63,361	24	<0.1%
Secaucus (T)	22,181	486	2.2%
Union City (C)	68,589	0	0.0%
Weehawken (T)	17,197	44	0.3%
West New York (T)	52,912	29	0.1%
Hudson County (Total)	724,854	2,736	0.4%

Table 9-8. Population in the 1- and 3-foot Sea Level Rise Hazard Area

Jurisdiction	Total Population (2020 Decennial)	Population in the 1ft Sea Level Rise Hazard Area		Population in the 3ft Sea Level Rise Hazard Area	
		Number of Persons	% of Jurisdiction Total	Number of Persons	% of Jurisdiction Total
Bayonne (C)	71,686	0	0.0%	0	0.0%
East Newark (B)	2,594	0	0.0%	0	0.0%
Guttenberg (T)	12,017	0	0.0%	0	0.0%
Harrison (T)	19,450	0	0.0%	0	0.0%
Hoboken (C)	60,419	0	0.0%	0	0.0%
Jersey City (C)	292,449	196	0.1%	196	0.1%
Kearny (T)	41,999	0	0.0%	100	0.2%
North Bergen (T)	63,361	0	0.0%	74	0.1%
Secaucus (T)	22,181	0	0.0%	223	1.0%
Union City (C)	68,589	0	0.0%	0	0.0%
Weehawken (T)	17,197	35	0.2%	35	0.2%
West New York (T)	52,912	0	0.0%	0	0.0%
Hudson County (Total)	724,854	231	<0.1%	628	0.1%

Source: U.S. Census Bureau 2020; NOAA 2022



Socially vulnerable populations face heightened risks and challenges in adapting to and recovering from the impacts of coastal erosion and sea level rise. Economically disadvantaged individuals may struggle to afford necessary adaptations, such as repairs after storms. Elderly populations are more likely to require medical attention, which may be limited during extreme weather events due to isolation and evacuation difficulties. Limited warning time for extreme weather events exacerbates the vulnerability of these populations. Those at risk due to inadequate warning include individuals lacking internet access, non-English speakers, and those who do not regularly use communication tools like cell phones or social media.

Economically disadvantaged populations are more vulnerable because they are likely to evaluate their risk and make decisions to evacuate based on the net economic impact on their family. The population over the age of 65 is more vulnerable because they are more likely to seek or need medical attention, which may not be available due to isolation during a flood event, and they may have more difficulty evacuating. Special consideration should be taken when planning for disaster preparation, response, and recovery for these vulnerable groups.

Riverine Flooding

Table 9-9 and Table 9-10 presents the estimated socially vulnerable populations living in the 1 and 0.2 percent annual chance flood hazard areas. There are 9,051 persons over the age of 65 years, 6,502 persons under the age of 5 years, 7,259 non-English speakers, 6,407 persons with a disability, and 10,290 living in poverty located in the 1 percent annual chance flood hazard area. There are 12,297 persons over the age of 65 years, 8,622 persons under the age of 5 years, 10,062 non-English speakers, 8,686 persons with a disability, and 14,126 living in poverty located in the 0.2 percent annual chance flood hazard area.

Coastal Erosion

Table 9-11 presents the estimated socially vulnerable populations located in the coastal erosion hazard area. Of the 2,736 persons located in this hazard area, there are 343 persons over the age of 65 years, 175 persons under the age of 5 years, 266 non-English speakers, 231 persons with a disability, and 318 persons living in poverty.

Sea Level Rise

Table 9-12 and Table 9-13 display the estimated socially vulnerable populations located in the 1- and 3-foot sea level rise hazard area. Of the 231 persons located in this 1-foot hazard area, there are 25 persons over the age of 65 years, 15 persons under the age of 5 years, 21 non-English speakers, 17 persons with a disability, and 31 persons living in poverty. Of the 628 persons located in this 3-foot hazard area, there are 83 persons over the age of 65 years, 35 persons under the age of 5 years, 67 non-English speakers, 50 persons with a disability, and 60 persons living in poverty.

**Table 9-9. Estimated Vulnerable Persons Located in the 1 Percent Annual Chance Flood Hazard**

Jurisdiction	Estimated Number of Vulnerable Persons Located in the 1 Percent Annual Chance Flood Hazard Area									
	Persons Over 65	% of Total	Persons Under 5	% of Total	Non-English Speaking Persons	% of Total	Persons with a Disability	% of Total	Persons in Poverty	% of Total
Bayonne (C)	673	6.8%	345	6.8%	382	6.7%	463	6.7%	568	6.7%
East Newark (B)	0	0.0%	0	0.0%	1	0.2%	0	0.0%	1	0.2%
Guttenberg (T)	42	2.6%	21	2.6%	53	2.6%	35	2.6%	49	2.6%
Harrison (T)	145	7.0%	83	7.0%	288	7.0%	101	7.0%	191	7.0%
Hoboken (C)	2,762	71.6%	2,935	71.6%	1,870	71.6%	2,201	71.6%	3,229	71.6%
Jersey City (C)	4,355	13.3%	2,729	13.3%	3,875	13.3%	2,985	13.3%	5,749	13.3%
Kearny (T)	169	3.1%	83	3.1%	173	3.1%	98	3.1%	131	3.1%
North Bergen (T)	32	0.3%	11	0.3%	34	0.3%	19	0.3%	22	0.3%
Secaucus (T)	733	21.9%	230	21.8%	470	21.9%	426	21.8%	245	21.8%
Union City (C)	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Weehawken (T)	120	5.9%	58	5.8%	74	5.9%	62	5.8%	73	5.8%
West New York (T)	20	0.3%	7	0.3%	39	0.3%	17	0.3%	32	0.3%
Hudson County (Total)	9,051	10.4%	6,502	13.9%	7,259	7.8%	6,407	10.5%	10,290	10.3%

Source: US Census Bureau, ACS 5-Year Estimates; FEMA 2015, 2018

**Table 9-10. Estimated Vulnerable Person Located in the 0.2 Percent Annual Chance Flood Hazard**

Jurisdiction	Estimated Number of Vulnerable Persons Located in the 0.2 Percent Annual Chance Flood Hazard Area									
	Persons Over 65	% of Total	Persons Under 5	% of Total	Non-English Speaking Persons	% of Total	Persons with a Disability	% of Total	Persons in Poverty	% of Total
Bayonne (C)	1,058	10.6%	542	10.6%	601	10.6%	728	10.6%	894	10.6%
East Newark (B)	5	1.6%	1	0.9%	8	1.7%	3	1.4%	11	1.7%
Guttenberg (T)	148	9.1%	74	9.1%	184	9.1%	122	9.1%	171	9.1%
Harrison (T)	243	11.8%	139	11.7%	483	11.8%	170	11.8%	321	11.8%
Hoboken (C)	3,260	84.5%	3,464	84.5%	2,207	84.5%	2,598	84.5%	3,811	84.5%
Jersey City (C)	6,267	19.2%	3,927	19.2%	5,576	19.2%	4,296	19.2%	8,274	19.2%
Kearny (T)	201	3.7%	99	3.7%	207	3.7%	117	3.7%	157	3.7%
North Bergen (T)	75	0.7%	27	0.7%	79	0.7%	44	0.7%	53	0.7%
Secaucus (T)	876	26.1%	275	26.0%	562	26.1%	509	26.1%	293	26.1%
Union City (C)	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Weehawken (T)	124	6.1%	60	6.0%	76	6.0%	64	6.0%	76	6.1%
West New York (T)	40	0.6%	14	0.6%	79	0.6%	35	0.6%	65	0.6%
Hudson County (Total)	12,297	14.2%	8,622	18.4%	10,062	10.8%	8,686	14.2%	14,126	14.2%

Source: US Census Bureau, ACS 5-Year Estimates; FEMA 2015, 2018

**Table 9-11. Estimated Number of Vulnerable Persons Located in the Coastal Erosion Hazard Area**

Jurisdiction	Estimated Number of Vulnerable Persons Located in the Coastal Erosion Hazard Area									
	Persons Over 65	% of Total	Persons Under 5	% of Total	Non-English Speaking Persons	% of Total	Persons with a Disability	% of Total	Persons in Poverty	% of Total
Bayonne (C)	109	1.1%	56	1.1%	62	1.1%	75	1.1%	92	1.1%
East Newark (B)	0	0.0%	0	0.0%	1	0.2%	0	0.0%	1	0.2%
Guttenberg (T)	29	1.8%	14	1.7%	36	1.8%	24	1.8%	33	1.8%
Harrison (T)	0	0.0%	0	0.0%	1	<0.1%	0	0.0%	1	<0.1%
Hoboken (C)	8	0.2%	8	0.2%	5	0.2%	6	0.2%	9	0.2%
Jersey City (C)	112	0.3%	70	0.3%	100	0.3%	77	0.3%	148	0.3%
Kearny (T)	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
North Bergen (T)	4	<0.1%	1	<0.1%	4	<0.1%	2	<0.1%	2	<0.1%
Secaucus (T)	73	2.2%	23	2.2%	47	2.2%	42	2.2%	24	2.1%
Union City (C)	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Weehawken (T)	5	0.2%	2	0.2%	3	0.2%	2	0.2%	3	0.2%
West New York (T)	3	<0.1%	1	<0.1%	7	0.1%	3	0.1%	5	<0.1%
Hudson County (Total)	343	0.4%	175	0.4%	266	0.3%	231	0.4%	318	0.3%

Source: U.S. Census Bureau, American Community Survey 5-Year Estimates; NJDEP 2015

**Table 9-12. Estimated Number of Vulnerable Persons Located in the 1-Foot Sea Level Rise Hazard Area**

Jurisdiction	Estimated Number of Vulnerable Persons Located in the 1-Foot Sea Level Rise Hazard Area									
	Persons Over 65	% of Total	Persons Under 5	% of Total	Non-English Speaking Persons	% of Total	Persons with a Disability	% of Total	Persons in Poverty	% of Total
Bayonne (C)	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
East Newark (B)	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Guttenberg (T)	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Harrison (T)	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Hoboken (C)	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Jersey City (C)	21	0.1%	13	0.1%	19	0.1%	15	0.1%	29	0.1%
Kearny (T)	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
North Bergen (T)	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Secaucus (T)	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Union City (C)	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Weehawken (T)	4	0.2%	2	0.2%	2	0.2%	2	0.2%	2	0.2%
West New York (T)	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Hudson County (Total)	25	<0.1%	15	<0.1%	21	<0.1%	17	<0.1%	31	<0.1%

Source: U.S. Census Bureau, American Community Survey 5-Year Estimates; NOAA 2022

**Table 9-13. Estimated Number of Vulnerable Persons Located in the 3-Foot Sea Level Rise Hazard Area**

Jurisdiction	Estimated Number of Vulnerable Persons Located in the 3-Foot Sea Level Rise Hazard Area									
	Persons Over 65	% of Total	Persons Under 5	% of Total	Non-English Speaking Persons	% of Total	Persons with a Disability	% of Total	Persons in Poverty	% of Total
Bayonne (C)	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
East Newark (B)	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Guttenberg (T)	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Harrison (T)	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Hoboken (C)	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Jersey City (C)	21	0.1%	13	0.1%	19	0.1%	15	0.1%	29	0.1%
Kearny (T)	13	0.2%	6	0.2%	13	0.2%	7	0.2%	10	0.2%
North Bergen (T)	12	0.1%	4	0.1%	12	0.1%	7	0.1%	8	0.1%
Secaucus (T)	33	1.0%	10	0.9%	21	1.0%	19	1.0%	11	1.0%
Union City (C)	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Weehawken (T)	4	0.2%	2	0.2%	2	0.2%	2	0.2%	2	0.2%
West New York (T)	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Hudson County (Total)	83	0.1%	35	0.1%	67	0.1%	50	0.1%	60	0.1%

Source: U.S. Census Bureau, American Community Survey 5-Year Estimates; NOAA 2022



9.2.2 General Building Stock

RIVERINE FLOOD

After considering the population exposed and potentially vulnerable to the flood hazard, the built environment was evaluated. Exposure includes those buildings located in the flood hazard zone. Potential damage is the modeled loss that could occur to the exposed inventory, including structural and content replacement cost values. Table 9-14 summarizes these results county-wide.

There are 19,099 buildings located in the 1 percent annual chance flood hazard area with more than an estimated \$34 billion of replacement cost value (i.e., building and content replacement costs). In total, this represents approximately 37.1 percent of the County's total general building stock inventory. In addition, there are 24,372 buildings located in the 0.2 percent annual chance flood boundary with more than an estimated \$42 billion of building stock and contents exposed. This represents approximately 45.8 percent of the County's total general building stock inventory.

Table 9-15 displays the buildings by general occupancy located within the 1 or 0.2 percent annual chance flood hazard areas. For the 1 percent annual chance flood hazard area, the City of Hoboken (9,480) and the City of Jersey City (4,362) have the highest number of residential buildings at risk. The City of Jersey City also has the highest commercial (480) and government, religion, agricultural, and education (343) buildings at risk. The City of Bayonne leads in industrial buildings (713) at risk of the 1 percent annual chance flood event.

For the 0.2 percent annual chance flood hazard area, the City of Hoboken has the highest number of residential buildings (11,188) at risk. The City of Jersey City has the highest number of commercial buildings (697) and government, religion, agricultural, and education buildings (474) are at risk. The City of Bayonne, again, leads to industrial buildings (834) at risk.

The Hazus flood model estimated potential damage to the buildings in Hudson County at the structure level using the custom structure inventory developed for this HMP and the depth grid generated using the effective 2020 DFIRM data. The potential damage estimated by Hazus to the general building stock inventory associated with the 1 percent annual chance flood is approximately \$4.9 million or 5.3 percent of the total building replacement cost value. The City of Hoboken has the greatest estimated building loss, with approximately \$1.6 billion (22.9 percent of the total replacement cost value). Refer to Table 9-16 for the estimated losses by jurisdiction, which also shows the estimated losses for residential, commercial, and other occupancy structures, respectively.

Overall, the data highlights the varying degrees of flood risk across different jurisdictions and building types in Hudson County.

**Table 9-14. General Building Stock Located in the 1 and 0.2 Percent Annual Chance Flood Hazard Areas—All Occupancies**

Jurisdiction	Jurisdiction Total Buildings		1 Percent Annual Chance Flood Event Hazard Area				0.2 Percent Annual Chance Flood Event Hazard Area			
			Number of Buildings		Replacement Cost Value		Number of Buildings		Replacement Cost Value	
	Count	Replacement Cost Value	Count	% of Jurisdiction Total	Value	% of Jurisdiction Total	Count	% of Jurisdiction Total	Value	% of Jurisdiction Total
Bayonne (C)	9,264	\$11,278,964,959	1,337	14.4%	\$3,501,216,916	31.0%	1,797	19.4%	\$4,420,576,417	39.2%
East Newark (B)	434	\$300,712,303	8	1.8%	\$43,390,431	14.4%	25	5.8%	\$93,204,278	31.0%
Guttenberg (T)	2,574	\$1,062,772,505	68	2.6%	\$41,289,646	3.9%	226	8.8%	\$118,507,013	11.2%
Harrison (T)	2,646	\$2,812,269,922	217	8.2%	\$1,071,231,981	38.1%	366	13.8%	\$1,477,174,316	52.5%
Hoboken (C)	14,289	\$6,922,849,652	10,062	70.4%	\$5,092,647,894	73.6%	11,862	83.0%	\$5,842,559,000	84.4%
Jersey City (C)	38,336	\$29,829,276,781	5,445	14.2%	\$8,118,476,100	27.2%	7,796	20.3%	\$12,722,594,832	42.7%
Kearny (T)	7,207	\$9,630,626,567	679	9.4%	\$5,861,291,044	60.9%	756	10.5%	\$6,011,791,207	62.4%
North Bergen (T)	6,002	\$9,906,706,329	138	2.3%	\$2,759,111,340	27.9%	196	3.3%	\$3,128,929,820	31.6%
Secaucus (T)	3,844	\$12,075,088,549	968	25.2%	\$7,109,209,274	58.9%	1,142	29.7%	\$7,726,223,145	64.0%
Union City (C)	1,729	\$4,009,712,429	0	0.0%	\$0	0.0%	0	0.0%	\$0	0.0%
Weehawken (T)	2,112	\$1,638,112,105	159	7.5%	\$551,145,081	33.6%	174	8.2%	\$582,429,832	35.6%
West New York (T)	4,594	\$3,076,856,343	18	0.4%	\$161,847,732	5.3%	32	0.7%	\$264,887,890	8.6%
Hudson County (Total)	93,031	\$92,543,948,444	19,099	20.5%	\$34,310,857,438	37.1%	24,372	26.2%	\$42,388,877,751	45.8%

Source: NJOIT 2024; Microsoft BING 2019; RS Means 2024; FEMA 2015,2018

**Table 9-15. Buildings in the 1 and 0.2- Percent Annual Chance Flood Hazard Areas, by General Occupancy Class**

	1 Percent Annual Chance Flood Event Hazard Area				0.2 Percent Annual Chance Flood Event Hazard Area			
	Residential	Commercial	Industrial	Other ^a	Residential	Commercial	Industrial	Other ^a
Bayonne (C)	516	29	713	79	811	65	834	87
East Newark (B)	1	0	7	0	7	2	16	0
Guttenberg (T)	62	0	0	6	214	0	0	12
Harrison (T)	154	20	35	8	258	32	49	27
Hoboken (C)	9,480	367	27	188	11,188	440	27	207
Jersey City (C)	4,362	480	260	343	6,277	697	348	474
Kearny (T)	193	42	341	103	230	60	352	114
North Bergen (T)	16	35	62	25	37	51	75	33
Secaucus (T)	717	90	86	75	857	112	95	78
Union City (C)	0	0	0	0	0	0	0	0
Weehawken (T)	113	20	8	18	117	23	10	24
West New York (T)	11	3	0	4	22	4	0	6
Hudson County (Total)	15,625	1,086	1,539	849	20,018	1,486	1,806	1,062

Source: NJOIT 2024; Microsoft BING 2019; FEMA 2015, 2018

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

**Table 9-16. General Building Stock Potential Loss to the 1 Percent Chance Flood Event**

Jurisdiction	Total Replacement Cost Value	1 Percent Annual Chance Flood Event Impact on Buildings				
		Estimated Loss for All Occupancies	Percent of Total	Estimated Loss for Residential Properties	Estimated Loss for Commercial Properties	Estimated Loss for All Other Occupancies
Bayonne (C)	\$11,278,964,959	\$657,353,608	5.8%	\$21,701,703	\$91,043,354	\$544,608,550
East Newark (B)	\$300,712,303	\$1,183,795	0.4%	\$113,992	\$0	\$1,069,803
Guttenberg (T)	\$1,062,772,505	\$2,876,408	0.3%	\$2,725,565	\$0	\$150,843
Harrison (T)	\$2,812,269,922	\$95,772,781	3.4%	\$12,985,761	\$1,993,398	\$80,793,621
Hoboken (C)	\$6,922,849,652	\$1,586,776,135	22.9%	\$1,084,632,529	\$173,634,944	\$328,508,662
Jersey City (C)	\$29,829,276,781	\$1,271,032,294	4.3%	\$254,282,402	\$220,138,789	\$796,611,103
Kearny (T)	\$9,630,626,567	\$847,639,139	8.8%	\$10,566,957	\$7,483,966	\$829,588,216
North Bergen (T)	\$9,906,706,329	\$171,637,138	1.7%	\$14,022,080	\$26,650,611	\$130,964,447
Secaucus (T)	\$12,075,088,549	\$100,115,856	0.8%	\$21,323,066	\$2,911,556	\$75,881,235
Union City (C)	\$4,009,712,429	\$0	0.0%	\$0	\$0	\$0
Weehawken (T)	\$1,638,112,105	\$145,935,985	8.9%	\$46,906,401	\$57,042,098	\$41,987,486
West New York (T)	\$3,076,856,343	\$9,725,935	0.3%	\$8,211,141	\$39,386	\$1,475,407
Hudson County (Total)	\$92,543,948,444	\$4,890,049,073	5.3%	\$1,477,471,596	\$580,938,102	\$2,831,639,375

Source: Hazus v6.1; NJOIT 2024; Microsoft BING 2019; RS Means 2024; FEMA 2015, 2018; Tetra Tech 2020



NFIP Statistics

Participating in the NFIP is voluntary. Communities that choose to participate agree to adopt and implement local floodplain management regulations that protect lives and reduce risk from future flooding. In return, the federal government makes flood insurance available to property owners throughout the community. To join, a community must complete an application; adopt a resolution of intent to participate and cooperate with FEMA; and adopt and submit a floodplain management ordinance that meets or exceeds the minimum NFIP criteria. The ordinance must adopt any FEMA-approved flood mapping for the community (FEMA 2020, FEMA 2022).

FEMA provided a list of residential properties with NFIP policies, past claims, and multiple claims. Properties with multiple claims are defined as repetitive loss (RL) properties or severe repetitive loss (SRL) properties, based on definitions from two FEMA programs as follows:

- The NFIP defines RL properties as structures that meet either of the following qualifiers:
 - Two or more claims of more than \$1,000 paid by NFIP within any rolling 10-year period since 1978
 - Two or more claims (building payments only) that, on average, equal or exceed 25 percent of the current value of the property
- FEMA's Flood Mitigation Assistance (FMA) grant program defines RL properties as structures covered by a contract for flood insurance made available under the NFIP that meet both of the following qualifiers:
 - Has incurred flood-related damage on two occasions, in which the cost of the repair, on average, equaled or exceeded 25 percent of the market value of the structure at the time of each flood event
 - At the time of the second incidence of flood-related damage, the contract for flood insurance contained increased cost of compliance coverage.
- The NFIP defines SRL properties as residential properties covered under an NFIP flood insurance policy that satisfies the third condition below and either of the first two:
 - Four or more separate claim payments for the property (including building and contents) over \$5,000 each have occurred, and the cumulative amount of such claim's payments exceeded \$20,000.
 - At least two separate claim payments for the property (building payments only) have occurred, and the cumulative amount of the building portion of such claims exceeded the current value of the property.
 - For either of the above, at least two of the referenced claims must have occurred within any 10-year- period and must have occurred more than 10 days apart.
- The FMA program defines SRL properties as structures covered by a contract for flood insurance that meets one of two qualifiers:
 - Four or separate claims payments (includes building and contents) have been made under flood insurance coverage with the amount of each such claim exceeding \$5,000, and with the cumulative amount of such claim payments exceeding \$20,000.
 - At least two separate claim payments (includes only building) have been made under such coverage, with the cumulative amount of such claims exceeding the market value of the insured structured.

Table 9-17 summarizes the NFIP policies, claims and repetitive loss statistics for Hudson County. Table 9-18 summarizes the occupancy classes of the repetitive loss and severe repetitive loss properties in the County.

**Table 9-17. NFIP Claims, Payments, and Repetitive Loss Statistics for Hudson County**

Jurisdiction	Total Claims	Total Payments	Number of NFIP RL Properties	Number of FMA RL Properties	Number of NFIP SRL Properties	Number of FMA SRL Properties
Bayonne (C)	166	\$3,921,678.99	16	—	—	—
East Newark (B)	1	\$22,487.84	—	—	—	—
Guttenberg (T)	4	\$68,572.50	—	—	—	—
Harrison (T)	39	\$5,473,793.49	3	—	—	—
Hoboken (C)	2,210	\$56,236,694.42	274	23	—	23
Jersey City (C)	1,808	\$54,583,071.35	220	21	1	21
Kearny (T)	277	\$30,527,497.26	12	3	—	3
North Bergen (T)	146	\$5,488,320.98	15	5	—	5
Secaucus (T)	85	\$888,793.45	7	—	—	—
Union City (C)	—	—	—	—	—	—
Weehawken (T)	110	\$7,537,473.53	4	—	—	—
West New York (T)	15	\$2,477,495.63	1	—	—	—
Hudson County (Total)	10,586	\$368,462,870.51	612	56	2	56

Source: FEMA NFIP 2024

Table 9-18. Summary of Repetitive Loss Properties by Jurisdiction

	Single Family	2-4 Family	Business	Other Residential	Other Non-Residential
Repetitive Loss Properties					
Bayonne (C)	8	5	2	1	1
East Newark (B)	0	0	0	0	0
Guttenberg (T)	0	0	0	0	0
Harrison (T)	0	3	0	0	0
Hoboken (C)	28	94	12	141	6
Jersey City (C)	62	131	5	26	8
Kearny (T)	2	0	8	0	5
New Jersey Meadowlands Commission	36	16	4	6	1
North Bergen (T)	6	3	1	0	5
Secaucus (T)	5	2	0	0	1
Union City (C)	0	0	0	0	0
Weehawken (T)	0	4	0	0	0
West New York (T)	0	0	0	0	1
Hudson County (Total)	147	258	32	174	28



	Single Family	2-4 Family	Business	Other Residential	Other Non-Residential
Severe Repetitive Loss Properties					
Bayonne (C)	0	0	0	0	1
East Newark (B)	0	0	0	0	0
Guttenberg (T)	0	0	0	0	0
Harrison (T)	0	0	0	0	0
Hoboken (C)	2	7	1	13	0
Jersey City (C)	5	13	0	0	3
Kearny (T)	0	0	1	0	2
New Jersey Meadowlands Commission	2	1	0	0	1
North Bergen (T)	1	0	0	0	5
Secaucus (T)	0	0	0	0	0
Union City (C)	0	0	0	0	0
Weehawken (T)	0	0	0	0	0
West New York (T)	0	0	0	0	0
Hudson County (Total)	10	21	2	13	12

Source: FEMA NFIP 2024

COASTAL EROSION

Coastal erosion can undermine the foundations of buildings and infrastructure, leading to structural failure and increased flooding risks. As shorelines retreat, structures previously considered safe may become exposed to these hazards. Sea level rise exacerbates this vulnerability by increasing the frequency and intensity of coastal flooding and storm surges.

The potential damage represents the modeled loss to the exposed inventory, measured by the structural and content replacement cost value. As shown in Table 9-19, there are 507 buildings in the coastal erosion hazard area, accounting for approximately 0.5 percent of the County's total general building stock. The replacement cost value for these buildings is an estimated \$841 million, which constitutes 0.9 percent of the County's total inventory replacement cost value. The City of Jersey City has the greatest amount of exposure, with approximately 162, or 4.0 percent, of all buildings within the jurisdictional total, which compromise 1.4 percent, or \$410 million, of total estimated building value, located in the coastal erosion hazard area.

Table 9-20 presents the buildings categorized by general occupancy class within the coastal erosion hazard area. Hudson County has a total of 350 residential buildings, 29 commercial buildings, 46 industrial buildings, and 82 buildings classified under government, religious, agricultural, and educational categories. The City of Jersey City has the highest number of residential (113), commercial (14), and buildings classified under government, religious, agricultural, and educational categories (27) in this hazard area. The City of Bayonne has the highest number of industrial buildings (23) in this hazard area.

**Table 9-19. Buildings in the Coastal Erosion Hazard Area**

Jurisdiction	Jurisdiction Total Buildings		Buildings in the Coastal Erosion Hazard Area			
			Number of Buildings		Replacement Cost Value	
	Count	Replacement Cost Value	Count	% of Jurisdiction Total	Value	% of Jurisdiction Total
Bayonne (C)	9,264	\$11,278,964,959	124	1.3%	\$88,224,248	0.8%
East Newark (B)	434	\$300,712,303	5	1.2%	\$4,126,221	1.4%
Guttenberg (T)	2,574	\$1,062,772,505	46	1.8%	\$34,863,446	3.3%
Harrison (T)	2,646	\$2,812,269,922	6	0.2%	\$14,415,680	0.5%
Hoboken (C)	14,289	\$6,922,849,652	42	0.3%	\$32,240,069	0.5%
Jersey City (C)	38,336	\$29,829,276,781	162	0.4%	\$409,691,419	1.4%
Kearny (T)	7,207	\$9,630,626,567	14	0.2%	\$34,753,579	0.4%
North Bergen (T)	6,002	\$9,906,706,329	10	0.2%	\$9,490,484	0.1%
Secaucus (T)	3,844	\$12,075,088,549	80	2.1%	\$102,828,107	0.9%
Union City (C)	1,729	\$4,009,712,429	0	0.0%	\$0	0.0%
Weehawken (T)	2,112	\$1,638,112,105	11	0.5%	\$88,393,934	5.4%
West New York (T)	4,594	\$3,076,856,343	7	0.2%	\$21,819,698	0.7%
Hudson County (Total)	93,031	\$92,543,948,444	507	0.5%	\$840,846,886	0.9%

Source: NJ Office of Information Technology, Office of GIS 2024; Microsoft BING 2019; RS Means 2024; NJDEP 2015

Table 9-20. Buildings in the Coastal Erosion Hazard Area by General Occupancy Class

Jurisdiction	Buildings in the Coastal Erosion Hazard Area by General Occupancy Class			
	Residential	Commercial	Industrial	Other ^a
Bayonne (C)	84	1	23	16
East Newark (B)	1	0	4	0
Guttenberg (T)	42	0	0	4
Harrison (T)	1	2	2	1
Hoboken (C)	28	1	2	11
Jersey City (C)	113	14	8	27
Kearny (T)	0	3	7	4
North Bergen (T)	2	1	0	7
Secaucus (T)	72	1	0	7
Union City (C)	0	0	0	0
Weehawken (T)	5	4	0	2
West New York (T)	2	2	0	3
Hudson County (Total)	350	29	46	82

Source: NJ Office of Information Technology, Office of GIS 2024; Microsoft BING 2019; NJDEP 2015

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



SEA LEVEL RISE

Table 9-21 and Table 9-22 summarize the exposed inventory and replacement cost value for the 1- and 3-foot sea level rise hazard areas. In the 1-foot sea level rise hazard area, there are 62 buildings, which represent about 0.1 percent of the County's total general building stock. The replacement cost value for these buildings is estimated at \$328 million, accounting for 0.4 percent of the County's total inventory replacement cost value. Jersey City has the highest exposure in this area, with approximately 34 buildings, or 0.1 percent of all buildings within the jurisdiction, valued at \$140 million, which constitutes 0.5 percent of the total estimated building value in this hazard area.

In the 3-foot sea level rise hazard area, there are 257 buildings, making up approximately 0.3 percent of the County's total general building stock. The replacement cost value for these buildings is estimated at \$2.3 billion, which is 2.5 percent of the County's total inventory replacement cost value. Kearny has the highest exposure in this area, with approximately 112 buildings, or 1.6 percent of all buildings within the jurisdiction, valued at \$1 billion, which constitutes 10.9 percent of the total estimated building value in this hazard area.

Table 9-23 summarizes the buildings categorized by general occupancy class within the 1- and 3-foot sea level rise hazard areas. In the 1-foot hazard area, Hudson County has a total of 26 residential buildings, five commercial buildings, 12 industrial buildings, and 19 buildings classified under government, religious, agricultural, and educational categories. The City of Jersey City has the highest number of residential (22), and buildings classified under government, religious, agricultural, and educational categories (eight) in this hazard area. The Town of Weehawken has the highest number of industrial buildings (four) in this hazard area. Lastly, the Town of Kearny leads in industrial buildings (seven) in this hazard area.

Table 9-21. Buildings in the 1-Foot Sea Level Rise Hazard Area

Jurisdiction	Jurisdiction Total Buildings		Buildings in the 1ft Sea Level Rise Hazard Area			
			Number of Buildings		Replacement Cost Value	
	Count	Replacement Cost Value	Count	% of Jurisdiction Total	Value	% of Jurisdiction Total
Bayonne (C)	9,264	\$11,278,964,959	5	0.1%	\$59,094,143	0.5%
East Newark (B)	434	\$300,712,303	0	0.0%	\$0	0.0%
Guttenberg (T)	2,574	\$1,062,772,505	0	0.0%	\$0	0.0%
Harrison (T)	2,646	\$2,812,269,922	0	0.0%	\$0	0.0%
Hoboken (C)	14,289	\$6,922,849,652	4	<0.1%	\$2,060,236	<0.1%
Jersey City (C)	38,336	\$29,829,276,781	34	0.1%	\$140,144,489	0.5%
Kearny (T)	7,207	\$9,630,626,567	9	0.1%	\$44,362,548	0.5%
North Bergen (T)	6,002	\$9,906,706,329	1	<0.1%	\$81,119	<0.1%
Secaucus (T)	3,844	\$12,075,088,549	0	0.0%	\$0	0.0%
Union City (C)	1,729	\$4,009,712,429	0	0.0%	\$0	0.0%
Weehawken (T)	2,112	\$1,638,112,105	8	0.4%	\$80,707,277	4.9%
West New York (T)	4,594	\$3,076,856,343	1	<0.1%	\$1,898,197	0.1%
Hudson County (Total)	93,031	\$92,543,948,444	62	0.1%	\$328,348,009	0.4%

Source: NJ Office of Information Technology, Office of GIS 2024; Microsoft BING 2019; RS Means 2024; NOAA 2022

**Table 9-22. Buildings in the 3-Foot Sea Level Rise Hazard Area**

Jurisdiction	Jurisdiction Total Buildings		Buildings in the 3ft Sea Level Rise Hazard Area			
			Number of Buildings		Replacement Cost Value	
	Count	Replacement Cost Value	Count	% of Jurisdiction Total	Value	% of Jurisdiction Total
Bayonne (C)	9,264	\$11,278,964,959	7	0.1%	\$59,855,481	0.5%
East Newark (B)	434	\$300,712,303	0	0.0%	\$0	0.0%
Guttenberg (T)	2,574	\$1,062,772,505	0	0.0%	\$0	0.0%
Harrison (T)	2,646	\$2,812,269,922	2	0.1%	\$7,111,706	0.3%
Hoboken (C)	14,289	\$6,922,849,652	7	<0.1%	\$238,858,943	3.5%
Jersey City (C)	38,336	\$29,829,276,781	45	0.1%	\$163,146,651	0.5%
Kearny (T)	7,207	\$9,630,626,567	112	1.6%	\$1,049,228,371	10.9%
North Bergen (T)	6,002	\$9,906,706,329	27	0.4%	\$436,117,207	4.4%
Secaucus (T)	3,844	\$12,075,088,549	48	1.2%	\$253,642,170	2.1%
Union City (C)	1,729	\$4,009,712,429	0	0.0%	\$0	0.0%
Weehawken (T)	2,112	\$1,638,112,105	8	0.4%	\$80,707,277	4.9%
West New York (T)	4,594	\$3,076,856,343	1	<0.1%	\$1,898,197	0.1%
Hudson County (Total)	93,031	\$92,543,948,444	257	0.3%	\$2,290,566,003	2.5%

Source: NJ Office of Information Technology, Office of GIS 2024; Microsoft BING 2019; RS Means 2024; NOAA 2022

Table 9-23. Buildings in the 1- and 3-Foot Sea Level Rise Hazard Area by General Occupancy Class

Jurisdiction	Buildings in the 1ft Sea Level Rise Hazard Area by General Occupancy Class			
	Residential	Commercial	Industrial	Government, Religion, Agricultural, and Education
1-Foot Sea Level Rise				
Bayonne (C)	0	0	2	3
East Newark (B)	0	0	0	0
Guttenberg (T)	0	0	0	0
Harrison (T)	0	0	0	0
Hoboken (C)	0	0	0	4
Jersey City (C)	22	1	3	8
Kearny (T)	0	0	7	2
North Bergen (T)	0	0	0	1
Secaucus (T)	0	0	0	0
Union City (C)	0	0	0	0
Weehawken (T)	4	4	0	0
West New York (T)	0	0	0	1
Hudson County (Total)	26	5	12	19



Jurisdiction	Buildings in the 1ft Sea Level Rise Hazard Area by General Occupancy Class			
	Residential	Commercial	Industrial	Government, Religion, Agricultural, and Education
3-Foot Sea Level Rise				
Bayonne (C)	0	0	2	5
East Newark (B)	0	0	0	0
Guttenberg (T)	0	0	0	0
Harrison (T)	0	0	2	0
Hoboken (C)	0	0	1	6
Jersey City (C)	22	1	5	17
Kearny (T)	15	7	69	21
North Bergen (T)	6	4	15	2
Secaucus (T)	33	1	6	8
Union City (C)	0	0	0	0
Weehawken (T)	4	4	0	0
West New York (T)	0	0	0	1
Hudson County (Total)	80	17	100	60

Source: NJ Office of Information Technology, Office of GIS 2024; Microsoft BING 2019; NOAA 2022

Within the 3-foot sea level rise hazard area, Hudson County has a total of 80 residential buildings, 17 commercial buildings, 100 industrial buildings, and 60 buildings classified under government, religious, agricultural, and educational categories. The Town of Secaucus has the highest number of residential buildings (33) in this hazard area. The Town of Kearny leads in commercial (seven), industrial (69), and buildings classified under government, religious, agricultural, and educational categories (21) in this hazard area.

9.2.3 Community Lifelines and Other Critical Facilities

Critical services during and after a flood may not be available if critical facilities are damaged or if transportation routes to access critical facilities are impacted. Roads that are blocked or damaged can isolate residents and prevent access throughout the planning area to many service providers who need to reach vulnerable populations or make repairs. Utilities such as overhead power, cable, and phone lines could also be vulnerable due to utility poles damaged by standing water, the surge of water from a dam failure event, or the effects of coastal erosion. Loss of these utilities could create additional isolation issues for the inundation zones (refer to Chapter 6 Dam Failure).

RIVERINE FLOOD

Community lifeline exposure to the 1 percent and 0.2 percent annual chance flood hazard event boundary was examined. Table 9-24 and Table 9-25 summarizes the number of community lifelines exposed to the 1 percent and 0.2 percent flood inundation areas by jurisdiction. Of the 393 community lifelines located in the 1 percent annual chance flood event boundary, Transportation has the majority of facilities (111). Out of the 461 community lifelines located in the 0.2 percent annual chance flood event boundary, Transportation has the majority of facilities (127).



Table 9-24. Number of Facilities in the 1 Percent Annual Chance Flood Hazard Area, by Lifeline Category

Jurisdiction	Number of Facilities in the 1 Percent Annual Chance Flood Hazard Area, by Lifeline Category									Total Facilities in Hazard Area	
	Communications	Energy	Food, Hydration, Shelter	Hazardous Materials	Health & Medical	Safety & Security	Transportation	Water Systems	Other Critical Facilities	Count	% of Jurisdiction Total
Bayonne (C)	0	6	0	3	0	3	6	8	2	28	24.1%
East Newark (B)	0	0	0	0	0	0	1	0	0	1	11.1%
Guttenberg (T)	0	0	0	0	0	0	0	0	0	0	0.0%
Harrison (T)	1	2	0	1	0	1	0	1	1	7	15.6%
Hoboken (C)	1	3	23	5	7	19	12	4	30	104	74.3%
Jersey City (C)	1	15	4	19	3	27	50	7	11	137	31.6%
Kearny (T)	3	10	0	7	0	5	20	6	0	51	47.7%
North Bergen (T)	0	3	0	1	2	0	5	5	2	18	18.0%
Secaucus (T)	3	1	1	2	3	4	9	4	5	32	38.1%
Union City (C)	0	0	0	0	0	0	1	0	0	1	1.1%
Weehawken (T)	0	0	1	0	0	1	7	2	2	13	28.3%
West New York (T)	0	0	0	0	0	0	0	1	0	1	2.1%
Hudson County (Total)	9	40	29	38	15	60	111	38	53	393	31.7%

Source: Hudson County 2024; HIFLD 2024; NJGIN 2024; FEMA 2015, 2018

**Table 9-25. Number of Facilities in the 0.2 Percent Annual Chance Flood Hazard Area, by Lifeline**

Jurisdiction	Number of Facilities in the 0.2 Percent Annual Chance Flood Hazard Area, by Lifeline Category									Total Facilities in Hazard Area	
	Communications	Energy	Food, Hydration, Shelter	Hazardous Materials	Health & Medical	Safety & Security	Transportation	Water Systems	Other Critical Facilities	Count	% of Jurisdiction Total
Bayonne (C)	0	9	0	3	0	3	11	8	3	37	31.9%
East Newark (B)	0	0	0	0	0	0	1	0	0	1	11.1%
Guttenberg (T)	0	0	0	0	0	0	0	0	0	0	0.0%
Harrison (T)	1	2	0	2	0	1	0	1	1	8	17.8%
Hoboken (C)	1	3	25	5	7	23	12	4	38	118	84.3%
Jersey City (C)	1	15	4	19	3	32	58	12	25	169	38.9%
Kearny (T)	3	10	0	7	0	5	20	7	0	52	48.6%
North Bergen (T)	0	3	0	1	2	0	7	10	2	25	25.0%
Secaucus (T)	3	1	1	2	4	4	9	4	6	34	40.5%
Union City (C)	0	0	0	0	0	0	1	0	0	1	1.1%
Weehawken (T)	0	0	1	0	0	1	8	3	2	15	32.6%
West New York (T)	0	0	0	0	0	0	0	1	0	1	2.1%
Hudson County (Total)	9	43	31	39	16	69	127	50	77	461	37.2%

Source: Hudson County 2024; HIFLD 2024; NJGIN 2024; FEMA 2015, 2018



COASTAL EROSION

Table 9-26 summarizes the number of community lifelines exposed to the coastal erosion hazard area by jurisdiction. Of the 44 community lifelines located in this hazard area, Transportation has the majority of facilities (36).

SEA LEVEL RISE

Table 9-27 and Table 9-28 summarizes the number of community lifelines exposed to the 1- and 3-foot sea level rise hazard areas by jurisdiction. Of the 29 community lifelines located in the 1-foot hazard area, Transportation has the majority of facilities (22). Out of the 44 community lifelines located in the 3-foot hazard area, Transportation has the majority of facilities (32).

9.2.4 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, business interruption, impacts on tourism, and impacts on the tax base to Hudson County. In areas that are directly flooded, renovations of commercial and industrial buildings may be necessary, disrupting associated services. Refer to the 'Impact on Buildings' subsection earlier which discusses direct impacts to buildings in Hudson County. Other economic components such as loss of facility use, functional downtime and socio-economic factors are less measurable with a high degree of certainty.

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

Debris management may also be a large expense after a flood event. HAZUS-MH estimates the amount of debris generated from the 1 percent annual chance event. The model breaks down debris into three categories: (1) finishes (dry wall, insulation, etc.); (2) structural (wood, brick, etc.) and (3) foundations (concrete slab and block, rebar, etc.). The distinction is made because of the different types of equipment needed to handle the debris. Table 9-29 summarizes the debris Hazus version 6.1 estimates for these events. As a result of the 1 percent annual chance event, Hazus v6.1 estimates approximately 69,255 tons of debris will be generated in total.

9.2.5 Natural, Historic and Cultural Resources

NATURAL

The environmental impacts of a flood can include significant water quality and debris-disposal issues. Floodwaters can back up sanitary sewer systems and inundate wastewater treatment plants, causing raw sewage to contaminate the flooded waterway. The contents of unsecured containers of oil, fertilizers, pesticides, and other chemicals get added to floodwaters. Hazardous materials may be released and distributed widely across the floodplain. After floodwaters subside, contaminated and flood-damaged building materials and contents must be properly disposed of. Contaminated sediment must be removed from buildings, yards, and properties. In addition, severe erosion caused by flooding can negatively impact local ecosystems. The erosion of sediment can deteriorate riverbanks, causing additional flooding into locations that may not otherwise have experienced flooding conditions.



Table 9-26. Number of Facilities in the Coastal Erosion Hazard Area, by Lifeline

Jurisdiction	Number of Facilities in Coastal Erosion Hazard Area, by Lifeline Category									Total Facilities in Hazard Area	
	Communications	Energy	Food, Hydration, Shelter	Hazardous Materials	Health & Medical	Safety & Security	Transportation	Water Systems	Other Critical Facilities	Count	% of Jurisdiction Total
Bayonne (C)	0	1	0	0	0	0	4	1	0	6	5.2%
East Newark (B)	0	0	0	0	0	0	1	0	0	1	11.1%
Guttenberg (T)	0	0	0	0	0	0	0	0	0	0	0.0%
Harrison (T)	0	0	0	0	0	0	0	1	0	1	2.2%
Hoboken (C)	0	0	0	0	0	0	7	0	1	8	5.7%
Jersey City (C)	0	0	0	0	0	0	10	1	0	11	2.5%
Kearny (T)	0	0	0	0	0	0	8	0	0	8	7.5%
North Bergen (T)	0	0	0	0	0	0	1	0	0	1	1.0%
Secaucus (T)	0	1	0	0	0	0	2	1	0	4	4.8%
Union City (C)	0	0	0	0	0	0	0	0	0	0	0.0%
Weehawken (T)	0	0	0	0	0	0	3	0	1	4	8.7%
West New York (T)	0	0	0	0	0	0	0	0	0	0	0.0%
Hudson County (Total)	0	2	0	0	0	0	36	4	2	44	3.6%

Source: Hudson County 2024; HIFLD 2024; NJGIN 2024; NJDEP 2015



Table 9-27. Number of Facilities in the 1-Foot Sea Level Rise Hazard Area, by Lifeline

Jurisdiction	Number of Facilities in 1ft Sea Level Rise Hazard Area, by Lifeline Category									Total Facilities in Hazard Area	
	Communications	Energy	Food, Hydration, Shelter	Hazardous Materials	Health & Medical	Safety & Security	Transportation	Water Systems	Other Critical Facilities	Count	% of Jurisdiction Total
Bayonne (C)	0	0	0	0	0	0	2	0	0	2	1.7%
East Newark (B)	0	0	0	0	0	0	1	0	0	1	11.1%
Guttenberg (T)	0	0	0	0	0	0	0	0	0	0	0.0%
Harrison (T)	0	0	0	0	0	0	0	0	0	0	0.0%
Hoboken (C)	0	0	0	0	0	0	3	0	0	3	2.1%
Jersey City (C)	0	0	0	0	0	0	5	0	0	5	1.2%
Kearny (T)	3	0	0	0	0	0	6	0	0	9	8.4%
North Bergen (T)	0	0	0	0	0	0	1	0	0	1	1.0%
Secaucus (T)	2	0	0	2	0	0	2	0	0	6	7.1%
Union City (C)	0	0	0	0	0	0	0	0	0	0	0.0%
Weehawken (T)	0	0	0	0	0	0	2	0	0	2	4.3%
West New York (T)	0	0	0	0	0	0	0	0	0	0	0.0%
Hudson County (Total)	5	0	0	2	0	0	22	0	0	29	2.3%

Source: Hudson County 2024; HIFLD 2024; NJGIN 2024; NOAA 2022



Table 9-28. Number of Facilities in the 3-Foot Sea Level Rise Hazard Area, by Lifeline

Jurisdiction	Number of Facilities in 3ft Sea Level Rise Hazard Area, by Lifeline Category									Total Facilities in Hazard Area	
	Communications	Energy	Food, Hydration, Shelter	Hazardous Materials	Health & Medical	Safety & Security	Transportation	Water Systems	Other Critical Facilities	Count	% of Jurisdiction Total
Bayonne (C)	0	0	0	0	0	0	2	0	0	2	1.7%
East Newark (B)	0	0	0	0	0	0	1	0	0	1	11.1%
Guttenberg (T)	0	0	0	0	0	0	0	0	0	0	0.0%
Harrison (T)	0	0	0	0	0	0	0	0	0	0	0.0%
Hoboken (C)	0	0	0	0	0	0	3	0	0	3	2.1%
Jersey City (C)	0	1	0	0	0	0	8	0	0	9	2.1%
Kearny (T)	3	1	0	0	0	0	10	3	0	17	15.9%
North Bergen (T)	0	0	0	0	0	0	3	0	0	3	3.0%
Secaucus (T)	2	0	0	2	0	0	3	0	0	7	8.3%
Union City (C)	0	0	0	0	0	0	0	0	0	0	0.0%
Weehawken (T)	0	0	0	0	0	0	2	0	0	2	4.3%
West New York (T)	0	0	0	0	0	0	0	0	0	0	0.0%
Hudson County (Total)	5	2	0	2	0	0	32	3	0	44	3.6%

Source: Hudson County 2024; HIFLD 2024; NJGIN 2024; NOAA 2022

**Table 9-29. Estimated Debris Generated from the 1 Percent Annual Chance Flood Event**

Jurisdiction	1 Percent Annual Chance Flood Event			
	Total (tons)	Finish (tons)	Structure (tons)	Foundation (tons)
Bayonne (C)	3,153	2,309	511	333
East Newark (B)	0	0	0	0
Guttenberg (T)	329	298	18	13
Harrison (T)	186	148	26	12
Hoboken (C)	30,127	25,058	3,196	1,873
Jersey City (C)	12,194	10,576	1,186	432
Kearny (T)	522	512	5	4
North Bergen (T)	2,518	1,797	468	254
Secaucus (T)	1,143	960	112	71
Union City (C)	3	3	0	0
Weehawken (T)	18,098	4,168	10,461	3,470
West New York (T)	982	795	108	79
Hudson County (Total)	69,255	46,623	16,090	6,542

Source: Hazus v6.1; NJOIT 2024; Microsoft BING 2019; RS Means 2024; FEMA 2015, 2018; Tetra Tech 2020

HISTORIC

Historic places, community facilities, and religious institutions are all vulnerable to impacts from flooding. Historic buildings face structural damage during flooding events. Restoration of flood-damaged historic buildings that are subject to landmark laws can pose significant challenges. These laws often require adherence to strict preservation standards, which can complicate and prolong the recovery process.

CULTURAL

Cultural resources, such as community facilities and religious institutions, face significant risks of damage because they are not easily replaceable. These facilities often serve multiple functions, acting as communal spaces for different groups, which makes their loss particularly impactful. Flood events can lead to closures of these vital community spaces.

Parks and recreational areas, although often designed with flooding in mind, are also vulnerable. Flood events can lead to closures of parks, recreation areas, and community spaces, disrupting residents' lives and hindering access to critical community services.

9.3 Future Changes That May Affect Risk

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



9.3.1 Potential or Planned Development

As Hudson County communities grow, flood events may increase in frequency and severity due to land use changes, the construction of more structures, and the expansion of impervious surfaces. Specific areas of recent and new development are indicated in the jurisdictional annexes in Volume II of this plan. The ability of new development to withstand flooding impacts can be enhanced through land use practices and consistent enforcement of codes and regulations for new construction. New development changes the landscape, where buildings, roads, and other infrastructure replace open land and vegetation. This transformation of pervious surfaces (including vegetation) to impervious surfaces increases runoff and the potential for flooding. Proper planning and implementation of green infrastructure can help mitigate these effects by promoting natural water absorption and reducing the risk of flood events.

9.3.2 Projected Changes in Population

If population growth occurs outside the SFHA, risk exposure remains the same. However, if it grows within the SFHA, risk exposure increases. Any changes in the density of population can create issues for local residents during evacuation of a flood event.

The New Jersey Department of Labor and Workforce Development produced populations projections by County from 2014 to 2019, 2024, 2029, and 2034. According to these projections, Hudson County is projected to have an increase in population in the upcoming years. These projection totals include a population of 747,400 by 2029, and 766,500 by 2034 (State of New Jersey 2017).

9.3.3 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 rainfall, which has the potential to increase the risk to flash flooding, riverine flooding, and can 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.

9.3.4 Other Identified Conditions

It is anticipated that Hudson County will continue to experience direct and indirect impacts of flooding events annually that may induce secondary hazards such as infrastructure deterioration or failure, utility failures, power outages, water quality and supply concerns, transportation delays, accidents, and inconveniences.



10. GEOLOGICAL HAZARDS

10.1 Hazard Profile

10.1.1 Hazard Description

For the purposes of this HMP update, the Geological Hazards profile discusses earthquakes, landslides, and land subsidence/sinkholes.

EARTHQUAKES

An earthquake is the sudden movement of the Earth's surface caused by the release of stress accumulated within or along the edge of tectonic plates, a volcanic eruption, or by a human-made explosion (FEMA 2001). Most earthquakes occur at the intersection of the Earth's tectonic plates, which are called faults. Less than 10 percent of earthquakes occur in tectonic plate interiors; however, these interior-related earthquakes have occurred in New Jersey in the past. Tectonic plates move slowly over time, sometimes towards or away, or even sliding past one another. These shifts weaken boundary regions, eventually becoming part of the plate interiors. 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 (USGS 2016).

The location of an earthquake is commonly described by its focal depth and epicenter. Focal depth refers to the depth from the Earth's surface to the region where an earthquake's energy originates, also called the focus or hypocenter. An epicenter is the point on the Earth's surface directly above the hypocenter (USGS n.d.). Earthquakes usually occur without warning and their effects can impact areas of great distance from the epicenter (FEMA 2001).

According to the U.S. Geological Survey (USGS) Earthquake Hazards Program, an earthquake hazard is any disruption associated with an earthquake that may affect residents' normal activities. USGS identifies six types of disruptions, defined as the following, although not all these events affect Hudson County (USGS n.d., NOAA 2023):

- **Surface faulting** results in displacement that reaches the Earth's surface during a slip along a fault. This disruption commonly occurs with "shallow" earthquakes with an epicenter less than 20 kilometers (roughly 12.5 miles).
- **Ground motion** (shaking) is 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** is the movement of surface material down a slope. This type of disruption is examined in more detail later in this section.
- **Liquefaction** is 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** refers to a change in the original shape of a material caused by stress and strain.





- **Tsunami** is 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** is the sloshing of a closed body of water, such as a lake or bay, from earthquake shaking.

LANDSLIDES

The term “landslide” includes a wide range of ground movement, such as rock falls, deep failure of slopes, and shallow debris flows. Gravity acting on an over-steepened slope is the primary reason for a landslide. Contributing factors include the following (USGS n.d.):

- Erosion by rivers, glaciers, or ocean waves, which creates over-steepened slopes
- Rock and soil slopes weakened by saturation due to snowmelt or heavy rains
- Earthquakes, which generate energy that makes weak slopes fail
- Excess weight from rain/snow accumulation, rock/ore stockpiling, waste piles, or man-made structures.

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 (NJDEP 2009).
- 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 (NPS 2023).

SUBSIDENCE/SINKHOLES

Land subsidence is 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 (USGS 2018). Subsidence often occurs through the loss of subsurface support in karst terrain, which may result from a number of natural or human-caused occurrences. Karst is a landscape characterized by 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 streams, enlarged bedrock fractures, caves, and underground streams (NJOEM 2019).

Sinkholes, the type of subsidence most frequently seen in New Jersey, are a common geologic feature in areas with underlying limestone, carbonate rock, salt beds, or other rocks that are soluble in water. They can result from natural or human causes:

- Natural sinkholes result when, over thousands of years, carbonate bedrock is dissolved by acidic rainwater moving in fractures or cracks in the bedrock. This creates larger openings in the rock through which water and overlying soil materials travel. Over time the voids enlarge until the roof over the void is unable to support the land above, at which time it collapses, forming a sinkhole.



- Human-caused sinkholes involve changes to the water balance of an area such as over-withdrawing 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. These actions can accelerate the natural processes of creation of soil voids, which can have a direct impact on sinkhole creation (NJOEM 2019).

Both natural and human-made sinkholes can occur without warning. Slumping or falling fence posts, trees, or foundations, sudden formation of small ponds, wilting vegetation, discolored well water, and/or structural cracks in walls and floors are signs that a sinkhole may be forming. Sinkholes can range from steep-walled holes to bowl or cone-shaped depressions. When sinkholes occur in developed areas, they can cause severe property damage, disruption of utilities, damage to roadways, injury, and loss of life (NJOEM 2019).

10.1.2 Location

EARTHQUAKES

Faults

Earthquakes in New Jersey are most likely to occur in the northern parts of the state, which includes Hudson County, where significant faults are concentrated; however, low-magnitude events can and do occur in many other areas of the State (NJDEP 2024). 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, do not now occur on known faults. The faults in these areas are from tectonic activity more than 200 million years ago (NJDEP 2024).

There are many faults in New Jersey; however, the Ramapo Fault, which separates the Piedmont and Highlands Physiographic Provinces, is best known. 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 (NJDEP 2024). Figure 10-1 illustrates the proximity of the Ramapo fault line to Hudson County.

Soils Susceptible to Shaking

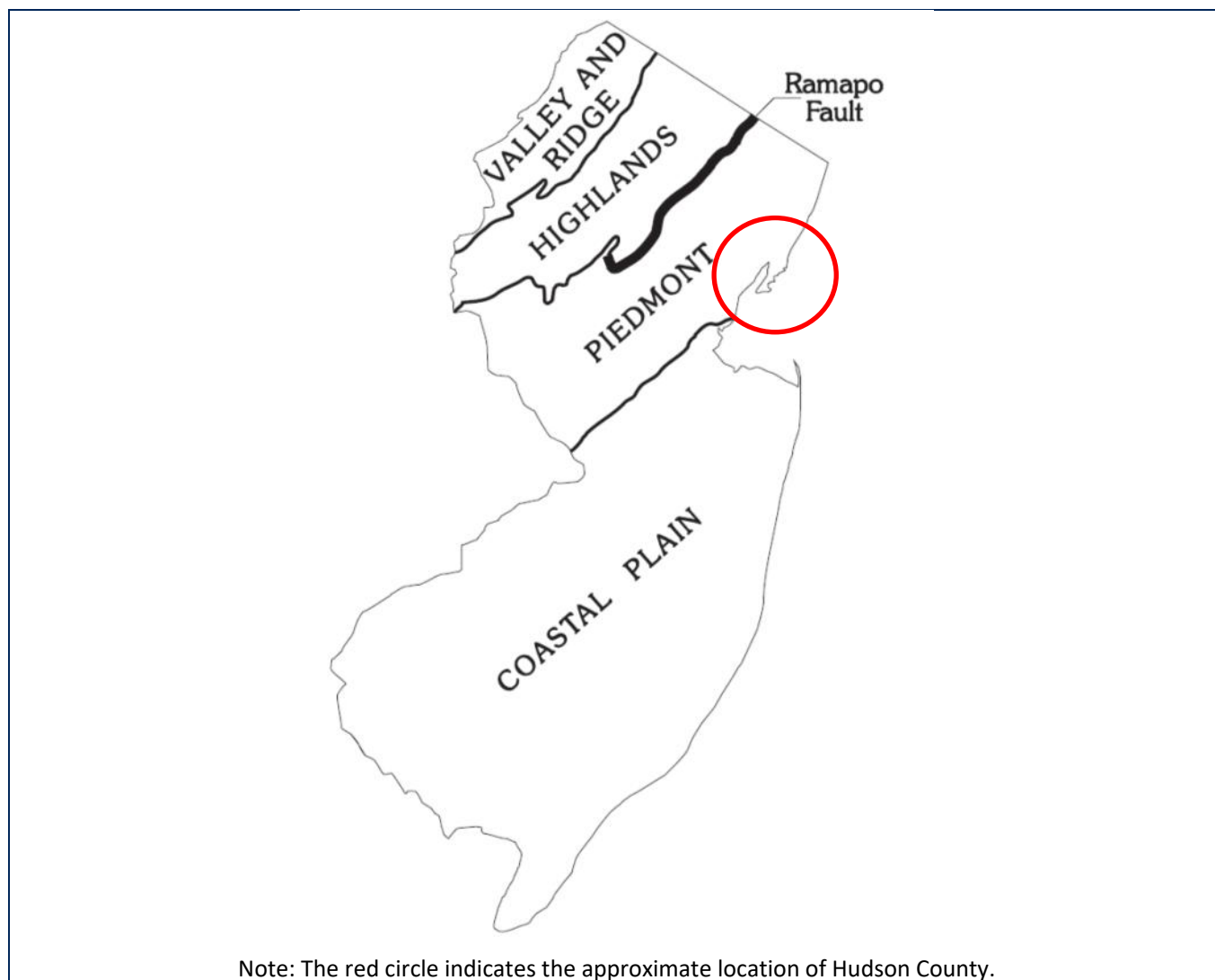
The National Earthquake Hazard Reduction Program (NEHRP) developed five soil classifications that impact the severity of an earthquake. The soil classification system ranges from A to E, as noted in Table 10-1, where A represents hard rock that reduces ground motions from an earthquake and E represents soft soils that amplify and magnify ground shaking and increase building damage and losses. Figure 10-2 illustrates the most seismically sensitive NEHRP soils (Classes D and E) in Hudson County.

A New Jersey Department of Transportation (NJDOT) report on seismic design for bridges in the state (Anil Agrawal 2012) classifies soils according to the American Association of State Highway and Transportation Officials Guide Specifications for Bridge Seismic Design. Sites are classified into Soil Classes A, B, C, D, E and F, ranging from hard rock to soft soil and special soils (similar to the NEHRP soil classifications); refer to Table 10-2.

NJDOT also developed a Geotechnical Database Management System that contains soil boring data across the state. The soil boring logs were then used to classify soil sites. Through this analysis, NJDOT developed a map of soil site classes according to ZIP codes in New Jersey where each ZIP code was assigned a class based on its predominant soil condition. In Hudson County, most ZIP codes were rated as Category C (Anil Agrawal 2012).



Figure 10-1. Physiographic Provinces of New Jersey and Ramapo Fault Line



Source: Dombroski 1998 (Revised in 2005)

Table 10-1. NEHRP Soil Classifications

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

Source: FEMA n.d.



Figure 10-2. NEHRP Soils in Hudson County

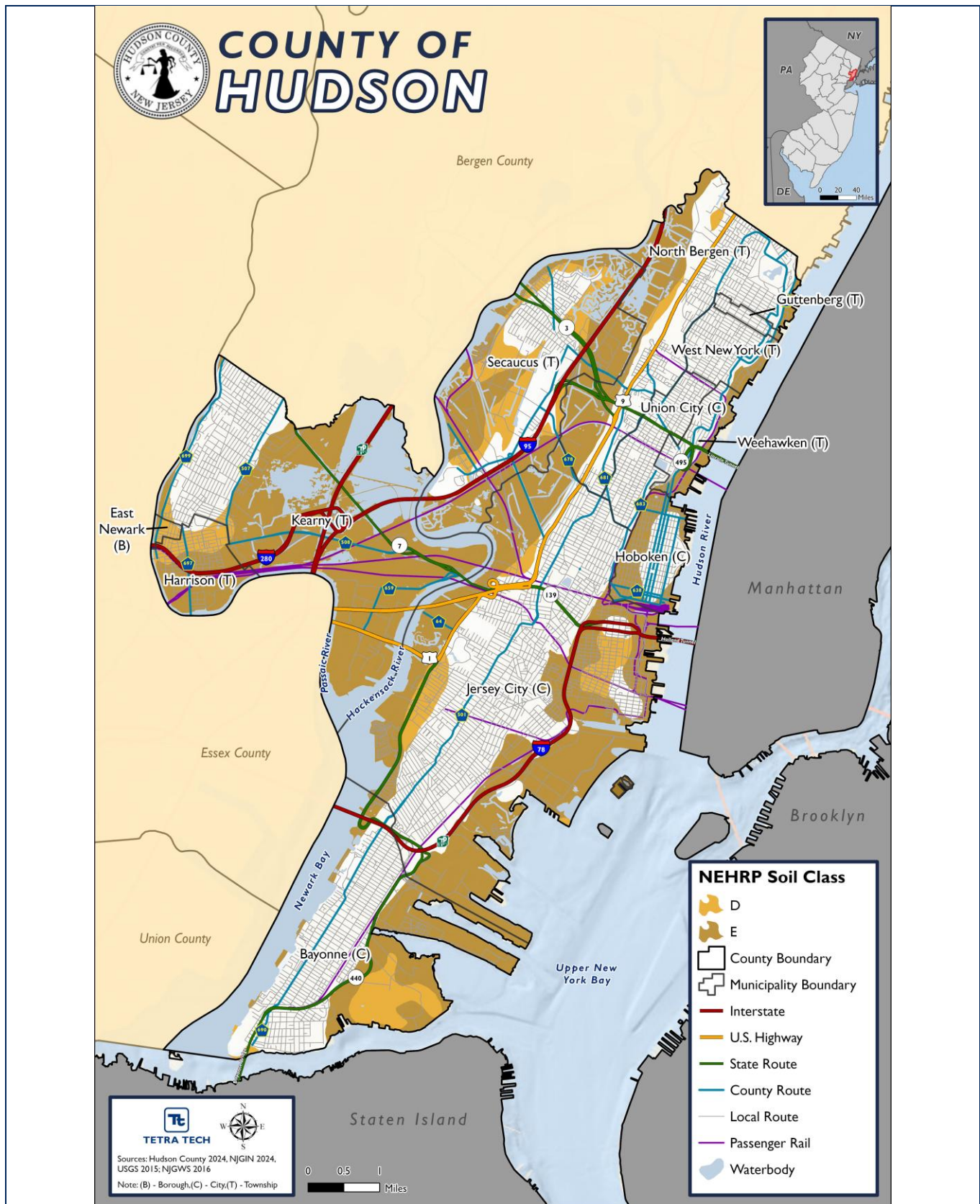




Table 10-2. NJDOT Soil Classifications

Soil Classification	Description
A-B	Rock sites
C	Very dense soil
D	Dense soil
E	Soft soil
F	Special soil requiring site-specific analysis

Source: NJDOT 2012

LANDSLIDES

Landslides are common in New Jersey, primarily in the northern region of the state. The state has an extensive history of landslides, and the landslides occur for a variety of reasons. Figure 10-3 illustrates the historic landslides in Hudson County. According to this figure, most of the landslide events have occurred in the northeastern section of the County.

The New Jersey Geologic Survey (currently known as the NJGWS) determined landslide susceptibility for the following nine counties in New Jersey: Bergen, Essex, Hudson, Middlesex, Monmouth, Morris, Passaic, Somerset, and Union (NJOEM 2024). Areas within these counties are classified into Class A, B, and C landslide susceptible classes based on soil types, with subclasses within these main classifications based on slope. Class A areas consist of strongly cemented rock. Class B consists of weakly cemented rock. Class C includes shale and clayey soil (FEMA 2020). Figure 10-4 shows the landslide susceptibility in Hudson County. There are small areas throughout the County with Class A and Class B landslide susceptibility and no areas of Class C.

Surficial materials in Hudson County include glacial till, glacial-lake sand and gravel deposits, glacial-lake silt and clay deposits, postglacial river sand, peat and organic silt deposited in estuaries and salt marshes, and outcropping bedrock. Areas of potential landsliding in Hudson County include cliffs and steep slopes in diabase bedrock on the east slope of the Palisades Ridge north of Jersey City, several small areas of steep slope on the west slope of the Palisades Ridge, bluffs in serpentinite bedrock at Stevens Point in Hoboken, and the cliffs in diabase on Snake Hill in Secaucus (NJGS 1999). Figure 10-5 illustrates the geological features of Hudson County.

According to the New Jersey Geological Survey (NJGS), the Palisades are the most active area for landslides in New Jersey (refer to Figure 10-6). The Palisades are cliffs that line the western margin of the Hudson River, from Jersey City to the south, to northward of the Tappan Zee Bridge. The cliffs and forested talus slopes rise more than 600 feet above the river (NJ Palisades Interstate Park Commission 2024). In this region, large rockfalls and rockslides occur along the high cliffs bordering the Hudson River. These landslides are most common in the winter and spring months after freeze-thaw cycles occur and loosen pieces of rock along joints and fractures. Surface water also seeps into joints and cracks along the rock, increasing the weight of the rocks and causing the expansion of joints when it freezes, thus prying blocks away from the main cliff (NJGS 2009).



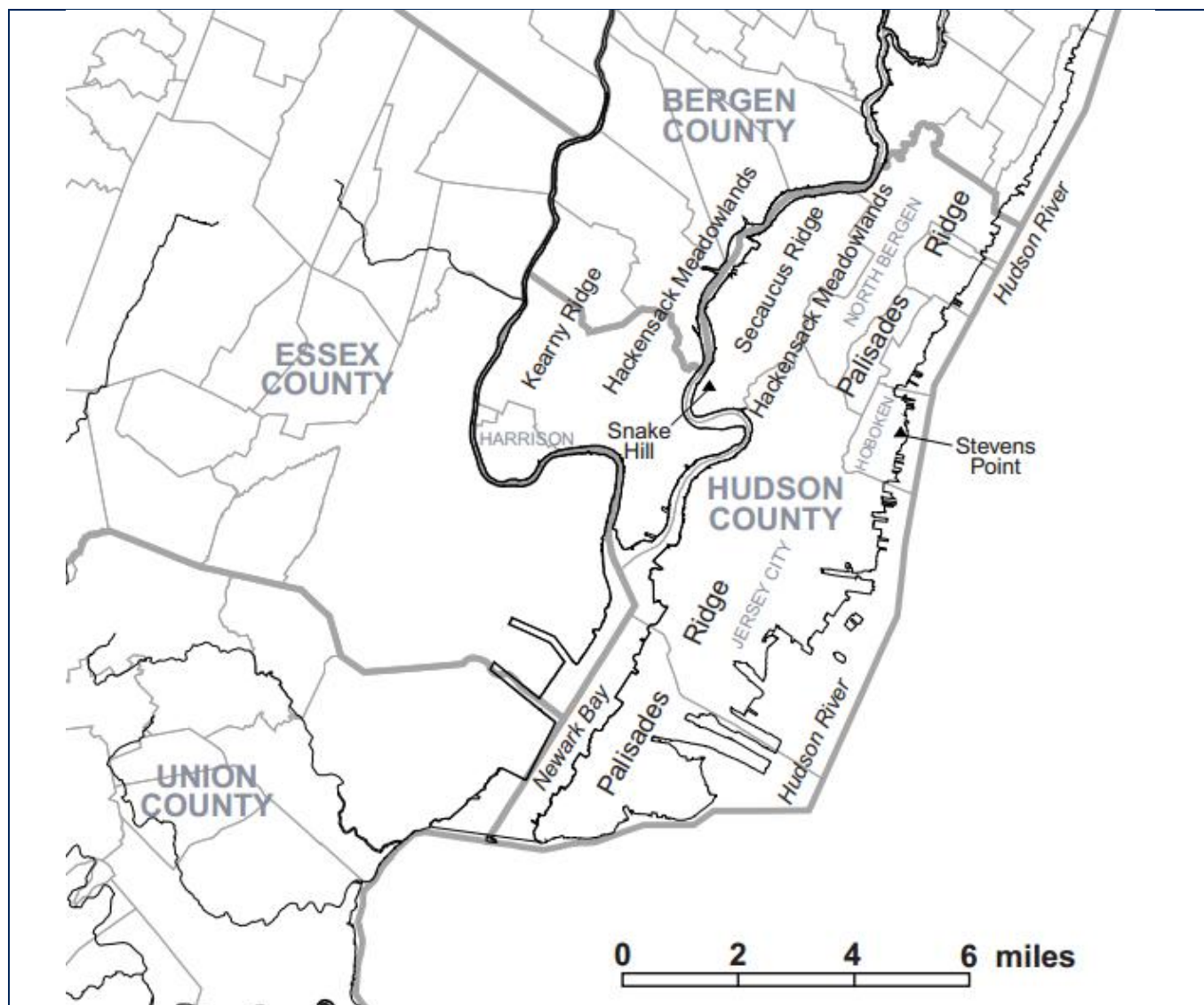


Figure 10-4. Landslide Susceptibility in Hudson County





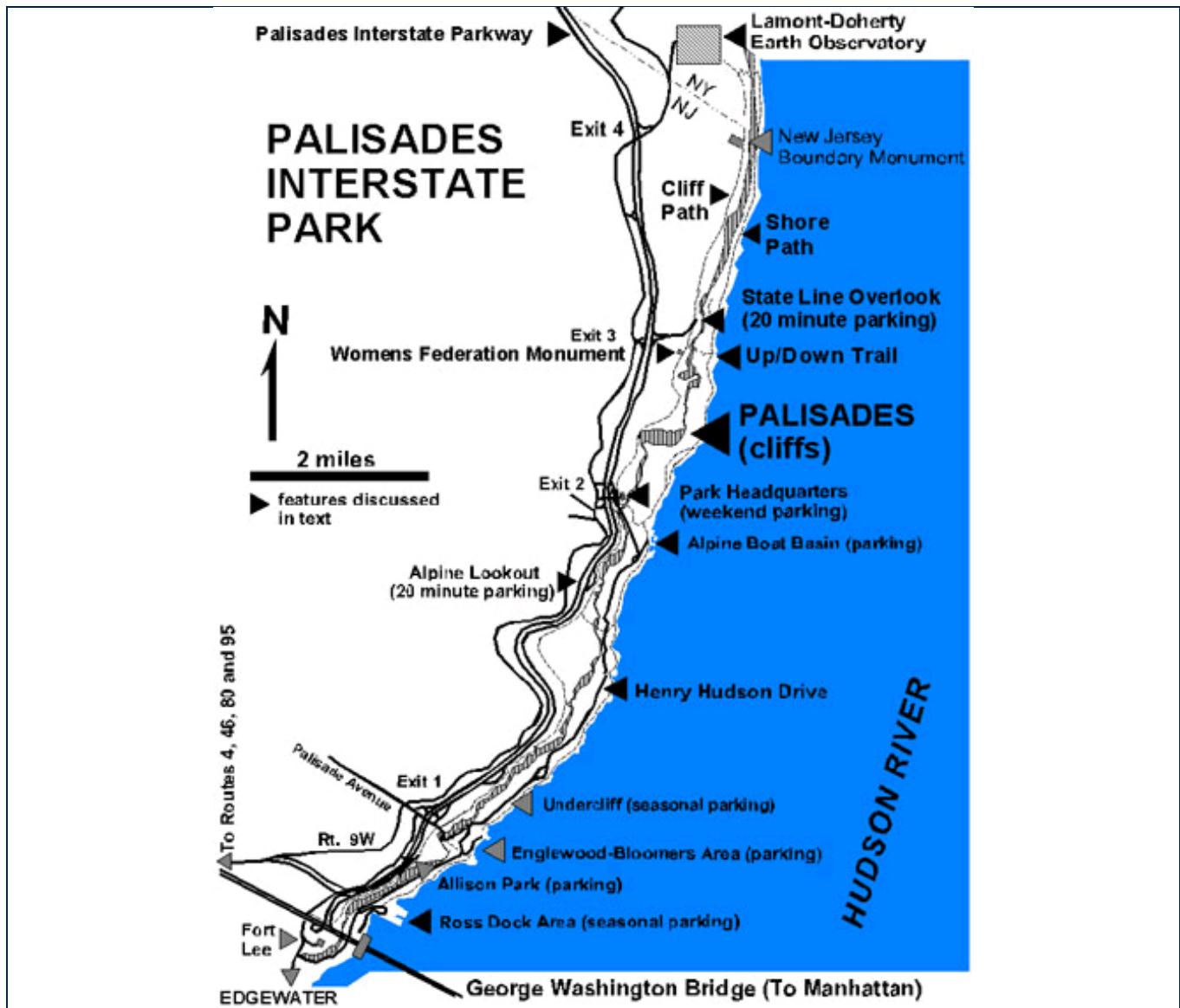
Figure 10-5. Geological Features in Hudson County



Source: NJGS 1999



Figure 10-6. New Jersey Palisades



Source: USGS n.d.

SUBSIDENCE/SINKHOLES

New Jersey is susceptible to the effects of subsidence and sinkholes, primarily in the northern region of the state. Land subsidence and sinkholes have been known to occur as a result of natural geologic phenomenon or as a result of human alteration of surface and underground geology. Naturally occurring subsidence and sinkholes in the State 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. In some areas, no sinkholes have appeared, while in others, sinkholes are common. Sinkholes in New Jersey are generally concentrated in the northwestern part of the state.

Areas underlain by carbonate rock may contain surface depressions and open drainage passages making such areas unstable and susceptible to subsidence and surface collapse. As a result, the alteration of drainage patterns, placement



of impervious coverage, grade changes or increased loads can result in land subsidence and sinkhole formation (AGI 2001). These formations are areas of potential natural subsidence. These geologic units contain a high enough percentage of carbonate minerals such as calcite and/or dolomite for karst features such as sinkholes to form. Some of these units are more prone to sinkhole development than others due to a greater carbonate content in the rock. Although not every unit listed has documented sinkholes, all are susceptible to dissolution by groundwater so various karst features, including sinkholes, may be found on any of these units. Hudson County does not contain carbonate rock formations.

The region's susceptibility to subsidence is also due in part to the number of abandoned mines throughout the State of New Jersey. There are approximately 450 underground mines in New Jersey, all of which are now abandoned. Although these mines have closed, continued development in the northern part of the State has been problematic because of the extensive mining there which has caused widespread subsidence. One problem is that the mapped locations of some of the abandoned mines are not accurate. Another issue is that many of the surface openings were improperly filled in, and roads and structures have been built adjacent to or on top of these former mine sites. Hudson County does not have any abandoned mines (NJOEM 2019).

10.1.3 Extent

EARTHQUAKES

Event Magnitude

An earthquake's magnitude describes the size at the focal point of an earthquake. Magnitude is most commonly expressed using the moment magnitude (M_w) 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) (USGS 2012).

Intensity, Shaking, and Peak Ground Acceleration

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.

The most used intensity scale is the modified Mercalli intensity scale (MMI). Ratings of the scale, as well as the perceived shaking and damage potential for structures, are shown in Table 10-3. The modified Mercalli intensity scale is generally represented visually using maps that show the expected ground shaking at any given location produced by an earthquake with a specified magnitude and epicenter.

The ground experiences acceleration as it shakes during an earthquake. The peak ground acceleration (PGA) is the largest acceleration that occurs 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 (UNDRR n.d.). Table 10-4 displays the MMI scale and its relationship to PGA. Damage levels experienced in an earthquake vary with the intensity of ground shaking and with the seismic capacity of structures, as noted in Table 10-5.

**Table 10-3. Modified Mercalli Intensity Scale**

Mercalli Intensity	Description
a	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 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 2021

Table 10-4. Modified Mercalli Intensity and PGA Equivalents

Modified Mercalli Intensity	Peak Ground Acceleration (%g)	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: USGS 2021

Table 10-5. Damage Levels Experienced in Earthquakes

Ground Motion	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 and more damage in poorly designed buildings. Only unusually poor buildings would be subject to potential collapse.
20 - 50%g	May cause significant damage in some modern buildings and very high levels of damage (including collapse) in poorly designed buildings.
≥50%g	May causes higher levels of damage in many buildings, even those designed to resist seismic forces.

Source: NJOEM 2011

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



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 2023 for all 50 states using new science on seismicity, fault ruptures, ground motions, and probabilistic techniques to produce a standard of practice for public policy and other engineering applications (USGS 2023).

A probabilistic assessment was conducted for the 500- and 2,500-year mean return period (MRP) in Hazus 6.1 to analyze the earthquake hazard for Hudson County. In summary, 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. The Hazus analysis evaluates the statistical likelihood that a specific event will occur and what consequences will occur. Figure 10-7 and Figure 10-8 show the geographic distribution of PGA for the 500- and 2,500-year MRP events.

Liquefaction

Liquefaction occurs in saturated soils and when it occurs, the strength of the soil decreases and the ability of a soil deposit to support foundations for buildings and bridges is reduced. 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 Hudson County, NJGWS classified soils into the Hazus categories using Standard Penetration Test data, which were acquired during the drilling of test borings. Approximately 300 borings in the Hudson County-Newark area contained engineering data usable for Hazus soil classification. The boring logs also reported the water table depth, which marks the upper limit of saturation. This information, along with the grain size and compaction of the soil, was used to map liquefaction susceptibility in Hudson County. The coverage shows the liquefaction susceptibility of natural soils. Man-made fill overlies these soils, particularly those in Category 4, in some areas. Typically, fill has a low liquefaction susceptibility, uncompacted sand, and silt fills may liquefy. The behavior of fill during seismic shaking should be addressed on a site-specific basis. The categories are as follows:

- Category 1 – Very Low
- Category 2 – Low
- Category 3 – Moderate
- Category 4 – High

As shown in Figure 10-9, liquefaction susceptibility varies throughout Hudson County. A central band of the County, from the Town of Guttenberg to the City of Bayonne is shown as having a very low susceptibility. Areas along the Newark Bay and Upper New York Bay and Hudson River are shown as having high liquefaction susceptibility, as shown in Figure 10-10. Parts of Secaucus, East Newark, Hoboken, and Jersey City have areas of low to moderate susceptibility.



Figure 10-7. Peak Ground Acceleration 500-Year Mean Return Period for Hudson County

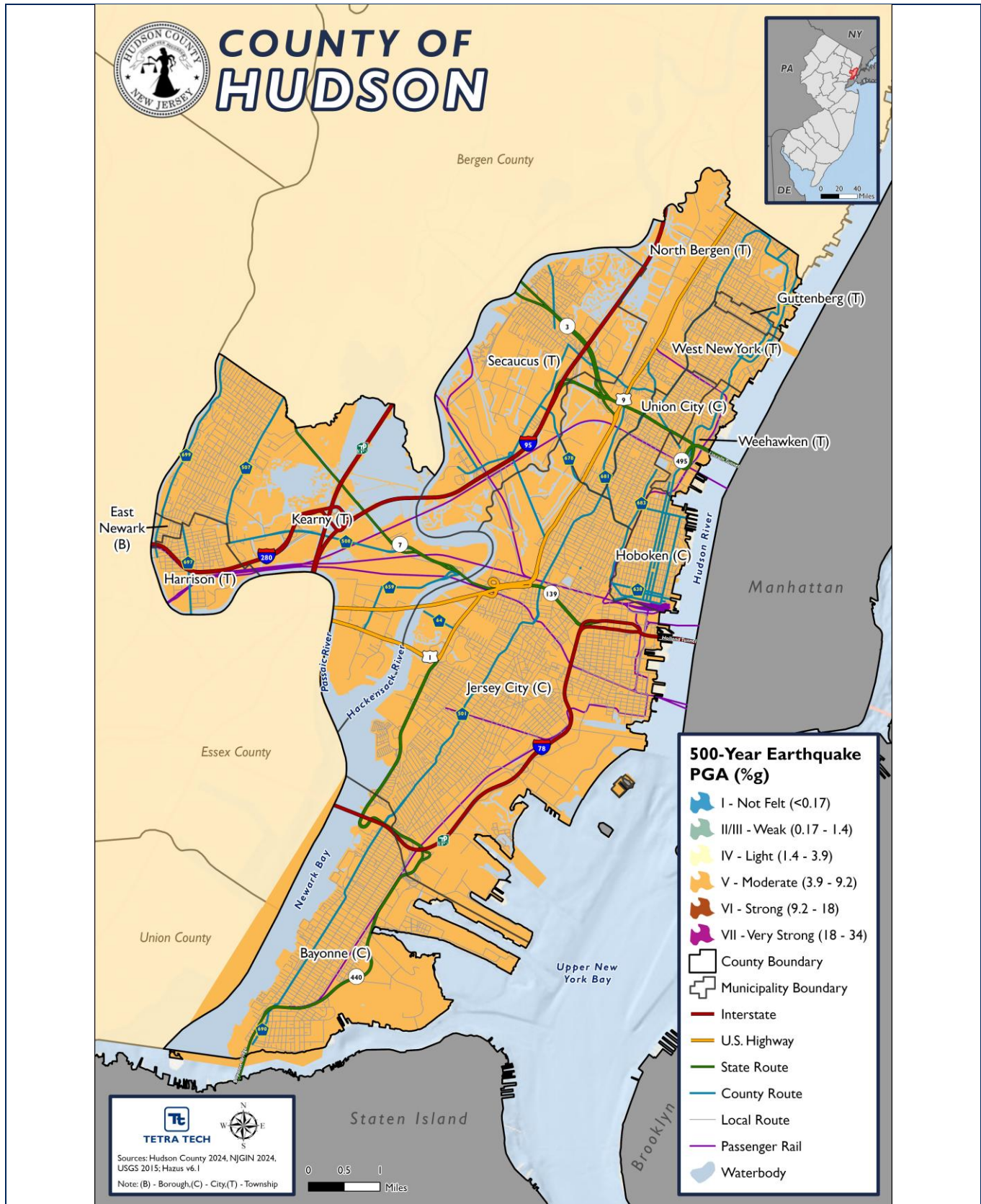




Figure 10-8. Peak Ground Acceleration 2,500-Year Mean Return Period for Hudson County

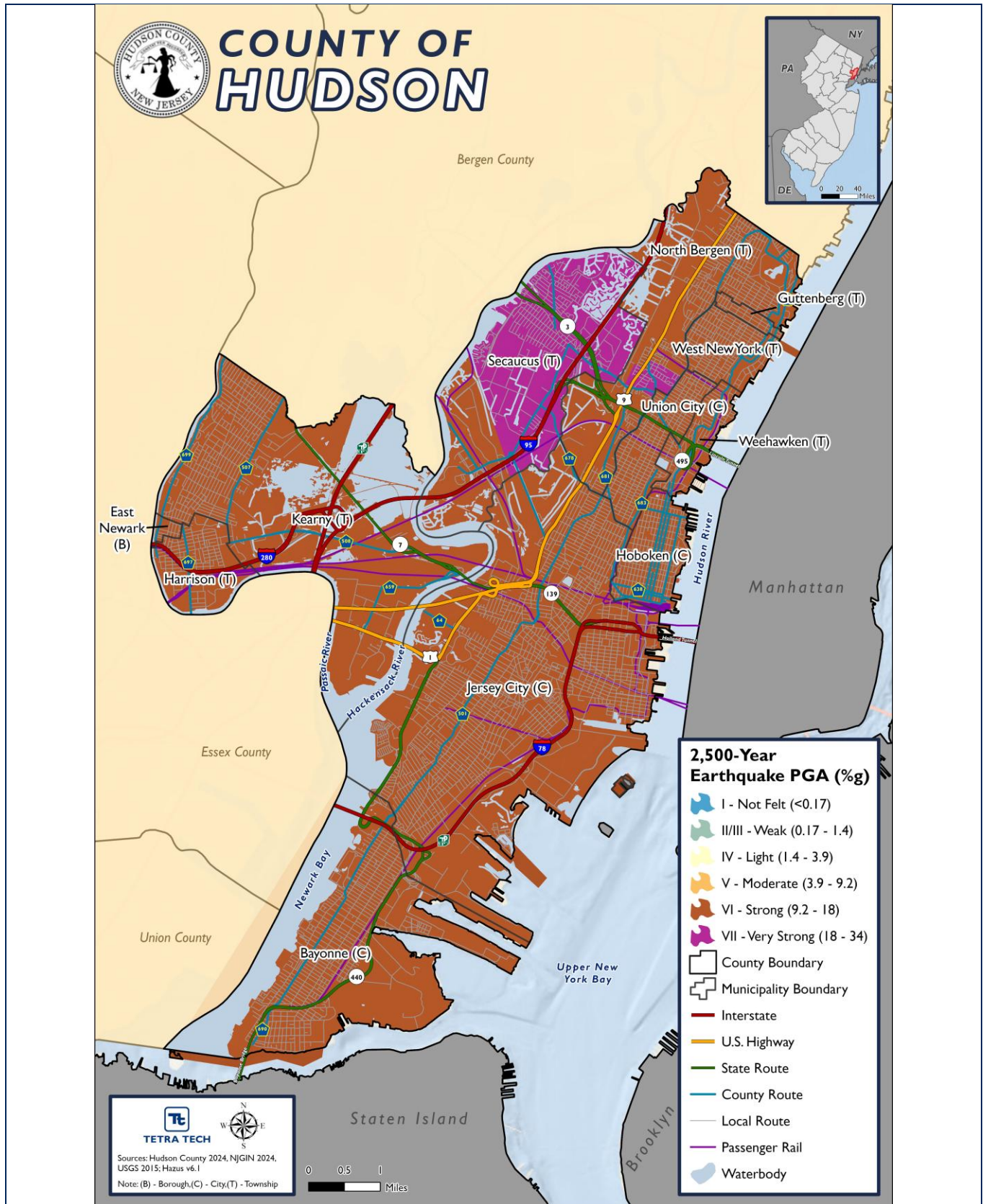
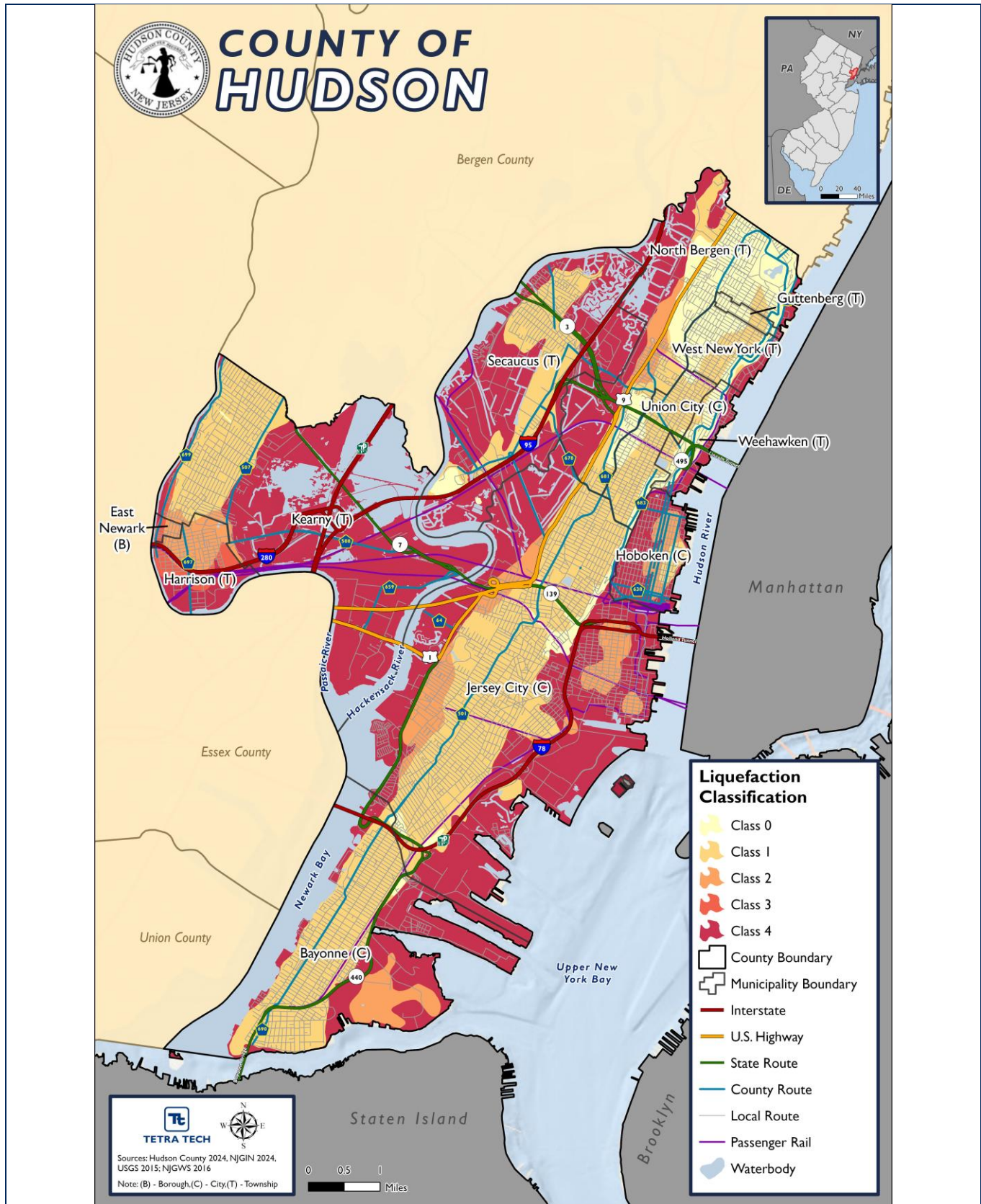




Figure 10-9. Liquefaction Classes in Hudson County





COUNTY OF HUDSON

Bergen County

North Bergen (T)

Guttenberg (T)

West New York (T)

Union City (C)

Weehawken (T)

Hoboken (C)

Jersey City (C)

Bayonne (C)

Harrison (T)

Kearny (T)

East Newark (B)

Essex County

Union County

Staten Island

Manhattan

Brooklyn

Upper New York Bay

Newark Bay

Hackensack River

Passaic River

Hudson River

Liquefaction Classification

- Class 4
- County Boundary
- Municipality Boundary
- Interstate
- U.S. Highway
- State Route
- County Route
- Local Route
- Passenger Rail
- Waterbody

0 0.5 1 Miles

Sources: Hudson County 2024, NJGIN 2024, USGS 2015, NJGWS 2016

Note: (B) - Borough, (C) - City, (T) - Township





LANDSLIDES

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 an area include soil properties, topographic position and slope, and historical incidence. The landslide hazard is often represented by landslide incidence and/or susceptibility, as defined below (NJGWS 2013):

- Landslide incidence is the number of landslides that have occurred in a given geographic area. High incidence means greater than 15 percent of a given area has been involved in landsliding; medium incidence means that 1.5 to 15 percent of an area has been involved; and low incidence means that less than 1.5 percent of an area has been involved.
- Landslide susceptibility is 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. Landslide susceptibility depends on slope angle and the geologic material underlying the slope. High, medium, and low susceptibility are delimited by the same percentages used for classifying the incidence of landsliding.

SUBSIDENCE/SINKHOLES

Subsidence in the U.S. has directly affected more than 17,000 square miles in 45 states, and associated annual costs are estimated to be \$125 million. Global positioning systems (GPS) are used to monitor subsidence on a regional scale. Benchmarks are commonly spaced approximately 4 miles apart (USGS 2013).

Another method to monitor subsidence is Interferometric Synthetic Aperture Radar (InSAR). InSAR is a remote sensing technique that uses radar signals to interpolate land surface elevation changes. It is a cost-effective solution for measuring land surface deformation for a region while offering a high degree of spatial detail and resolution (USGS 2013).

10.1.4 Previous Occurrences

FEMA MAJOR DISASTER AND EMERGENCY DECLARATIONS

Between 1954 and 2023, Hudson County was not included in any DR or EM declarations for geological hazard-related events (FEMA 2023).

USDA DECLARATIONS

The Secretary of Agriculture from the U.S. Department of Agriculture (USDA) is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in contiguous counties. Between 2019 and 2023, Hudson County was not included in any USDA geological hazard-related agricultural disaster declarations (USDA 2024).



PREVIOUS EVENTS

There have been two rockslide events that impacted Hudson County between August 2019 and December 2023, as shown below in Table 10-6. No events prior to 2019 have been recorded in past Hudson County HMP updates.

Table 10-6. Geological Hazard Events in Hudson County (2019 to 2023)

Date	Hazard Type	FEMA Declaration Number	Hudson County Included in Declaration?	Location Impacted	Description
September 2023	Rockslide	N/A	N/A	North Bergen	Minor rockslide reported on the cliffs in back of the Duchess, 7601 River Road.
December 2023	Rockslide	N/A	N/A	North Bergen	Dozens of vehicles parked behind a North Bergen high-rise at the foot of the Palisades were badly damaged in a rockslide at The Duchess at 7601 River Rd. The falling rock even causing some damage to the parking garage.

(NJDEP Bureau of GIS 2024)

10.1.5 Probability of Future Occurrences

PROBABILITY BASED ON PREVIOUS OCCURRENCES

Historically, New Jersey and Hudson County have not experienced a major geological hazard event. However, there have been a number of earthquakes of relatively low intensity. The majority of earthquakes that have occurred in New Jersey have occurred along faults in the central and eastern Highlands, with the Ramapo fault being the most seismically active fault in the region (Volkert 2015). Small earthquakes may occur several times a year and generally do not cause significant damage. Based on historical records, as summarized in Table 10-7, and input from the Steering Committee, the probability of occurrence for Hazard in the County is considered “occasional.”

Table 10-7. Probability of Future Geological Hazards

Hazard Type	Number of Occurrences Between 1939 and 2024	Percent Chance of Occurring in Any Given Year
Earthquakes	6	7.0 %
Landslides	0	0 %
Rockslides/Rockfalls	11	12.8 %
Debris Flow	10	11.6 %
Subsidence/Sinkholes	0	0 %
Total	27	31.4 %

Source: (NJDEP Bureau of GIS 2024); (Hudson County 2020); (NOAA NCEI 2024)



EFFECT OF CLIMATE CHANGE ON FUTURE PROBABILITY

Earthquakes

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. The National Aeronautics and Space Administration (NASA) and USGS scientists found that retreating glaciers in southern Alaska might be opening the way for future earthquakes (NJOEM 2019). The lack of glaciers in New Jersey and the surrounding area makes it unlikely that glacier retreat will increase the occurrence of earthquake in Hudson County.

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 (NJOEM 2019).

Landslides

Increase in global temperature could affect the snowpack and its ability to hold and store water, resulting in an increase in the occurrence and duration of droughts. This in turn could increase the probability of wildfire, leading to the reduction in vegetation growth that helps to support steep slopes. Climate change may impact storm patterns, increasing the probability of more frequent, intense storms that could loosen unprotected soils. All these factors would increase the probability for landslide occurrences.

Subsidence/Sinkholes

One of the triggers for subsidence and sinkholes is an abundance of moisture which has the potential to permeate the bedrock causing an event. Climatologists expect an increase in annual precipitation amounts. This increase will coincide with an increased risk in subsidence and sinkholes in vulnerable areas.

Recently, sinkholes have been correlated to land use practices, especially from groundwater pumping and from construction and development practices. Sinkholes may form when the land surface is changed, such as when industrial and runoff-storage ponds are created. The weight of new material can trigger an underground collapse of supporting material, causing a sinkhole. Additionally, the overburden sediments that cover buried cavities in the aquifer systems are balanced by groundwater fluid pressure. Groundwater is helping keep the surface soil in place. Pumping groundwater for urban water supply and irrigation can produce new sinkholes. If pumping results in a lowering of groundwater levels, then underground structural failure, sinkholes may occur as well (USGS 2018).

10.1.6 Cascading Impacts on Other Hazards

Geological hazards can elevate the risk of a dam failure. Seismic activity can cause slumping or settling of earth-filled dams, especially if the fill is not properly 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.



10.2 Vulnerability and Impact Assessment

To estimate the County's risk to the geologic hazard, the following hazard datasets were analyzed:

- NEHRP Class D and E Soils (earthquake risk)
- Liquefaction Class 4 (earthquake risk)
- Geological Class A (landslide, sinkhole, subsidence risk)

These datasets were overlaid on the updated asset inventory maps (population, building stock, critical facilities, and new development). Assets with their centroid located in the hazard area were totaled to estimate the totals and values at risk from the impacts of a geologic event.

The risk assessment for earthquake also included a Level 2 probabilistic assessment in Hazus for the 500- and 2,500-year MRP events to estimate injuries and structure damage. The probabilistic method uses information from historic earthquakes and inferred faults, locations and magnitudes, and computes the probable ground shaking levels that may be experienced during a recurrence period.

10.2.1 Life, Health, and Safety

OVERALL POPULATION

Earthquakes

The entire County may experience the impacts of an earthquake. The degree of impact on people is dependent on the age and type of construction people live in, the soil type that homes are located on, and the intensity of the earthquake. Overall, risk to public safety and loss of life from an earthquake in the County is minimal for low magnitude events. However, there is a higher risk to public safety for those inside buildings due to structural damage or people walking below building ornamentations and chimneys that may be shaken loose and fall because of an earthquake.

NEHRP Soil Classes D and E amplify ground shaking to damaging levels even during a moderate earthquake and thus increase risk to the population. As shown in Table 10-8, 115,322 persons live within the NEHRP Soils Class D and E hazard areas. The City of Jersey City has the greatest population in the hazard area with 52,524 persons.

Table 10-9 shows that 81,622 persons live in the Liquefaction Class 4 hazard area. The City of Hoboken has the greatest population in the hazard area with 38,311 persons.

Hazus estimated the number of people who might be injured or killed by an earthquake,. The analysis provided casualty estimates for three times of day to reflect peak occupancy in different community sectors. The 2:00 AM estimate represents maximum residential occupancy, the 2:00 PM estimate represents peak occupancy in educational, commercial, and industrial sectors, and the 5:00 PM estimate represents peak commute time. The Hazus analysis was conducted for the 500- and 2,500-year MRP events; results for each are shown in Table 10-10.

**Table 10-8. Estimated Population Living in the NEHRP Soils Class D and E Hazard Areas**

Jurisdiction	Total Population (2020 Decennial)	Population in the NEHRP Soils (D&E) Hazard Area	
		Number of Persons	% of Jurisdiction Total
Bayonne (C)	71,686	845	1.2%
East Newark (B)	2,594	2,465	95.0%
Guttenberg (T)	12,017	905	7.5%
Harrison (T)	19,450	18,888	97.1%
Hoboken (C)	60,419	33,451	55.4%
Jersey City (C)	292,449	52,524	18.0%
Kearny (T)	41,999	2,234	5.3%
North Bergen (T)	63,361	136	0.2%
Secaucus (T)	22,181	2,792	12.6%
Union City (C)	68,589	0	0.0%
Weehawken (T)	17,197	625	3.6%
West New York (T)	52,912	457	0.9%
Hudson County (Total)	724,854	115,322	15.9%

Source: U.S. Census Bureau 2020; NJGWS 2016

Table 10-9. Population in the Liquefaction Class 4 Hazard Area

Jurisdiction	Total Population (2020 Decennial)	Population in the Liquefaction Class 4 Hazard Area	
		Number of Persons	% of Jurisdiction Total
Bayonne (C)	71,686	2,855	4.0%
East Newark (B)	2,594	0	0.0%
Guttenberg (T)	12,017	611	5.1%
Harrison (T)	19,450	62	0.3%
Hoboken (C)	60,419	38,311	63.4%
Jersey City (C)	292,449	34,337	11.7%
Kearny (T)	41,999	1,662	4.0%
North Bergen (T)	63,361	136	0.2%
Secaucus (T)	22,181	2,941	13.3%
Union City (C)	68,589	0	0.0%
Weehawken (T)	17,197	250	1.5%
West New York (T)	52,912	457	0.9%
Hudson County (Total)	724,854	81,622	11.3%

Source: U.S. Census Bureau 2020; NJGWS 2016

**Table 10-10. Estimated Casualties from 500- and 2,500-Year Mean Return Period Earthquake Events**

Time of Day Event Occurs	Non-Hospitalized Injuries	Hospitalizations	Casualties
500-Year Mean Return Period			
2:00 a.m.	4	0	0
2:00 p.m.	13	1	0
5:00 p.m.	4	0	0
2,500-Year Mean Return Period			
2:00 a.m.	64	5	0
2:00 p.m.	153	27	5
5:00 p.m.	65	9	1

Source: Hazus v6.1

Residents may be displaced or require temporary to long-term sheltering as a result of the event. The number of people requiring shelter is generally less than the number displaced, as some displaced persons use hotels or stay with family or friends after a disaster event. After running Hazus v6.1 it is estimated that there will be eight displaced households and three persons requiring sheltering for Hudson County for any earthquake event with a 500-Year Mean Return Period and for the 2,500-Year Mean Return Period there will be 400 displaced households, and 171 persons who would require sheltering needs as shown in Table 10-11.

Table 10-11. Person Seeking Sheltering, 500- and 2,500-Year Mean Return Period Earthquake Event

Jurisdiction	500-Year Mean Return Period Earthquake Event		2,500-Year Mean Return Period Earthquake Event	
	Displaced Households	Persons Seeking Short-Term Sheltering	Displaced Households	Persons Seeking Short-Term Sheltering
Bayonne (C)	0	0	17	9
East Newark (B)	0	0	0	0
Guttenberg (T)	0	0	1	0
Harrison (T)	0	0	4	2
Hoboken (C)	0	0	14	5
Jersey City (C)	8	3	318	132
Kearny (T)	0	0	10	5
North Bergen (T)	0	0	10	5
Secaucus (T)	0	0	7	3
Union City (C)	0	0	11	7
Weehawken (T)	0	0	2	0
West New York (T)	0	0	6	3
Hudson County (Total)	8	3	400	171

Source: Hazus v6.1, US Census Bureau 2020



Landslides and Subsidence/Sinkholes

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

Table 10-12 summarizes the population living in the geological class A hazard area. Overall, 7,109 persons are living in this hazard area. The Township of Guttenberg has the highest number of persons, 3,249 (27.0-percent of the jurisdictions total) exposed to the class A hazard area.

Table 10-12. Estimated Population in the Geological Class A Hazard Areas

Jurisdiction	Total Population (2020 Decennial)	Population in the Class A Hazard Area	
		Number of Persons	% of Jurisdiction Total
Bayonne (C)	7,726	0	0.0%
East Newark (B)	89,451	0	0.0%
Guttenberg (T)	8,945	3,249	27.0%
Harrison (T)	19,456	0	0.0%
Hoboken (C)	14,229	917	1.5%
Jersey City (C)	8,801	53	<0.1%
Kearny (T)	70,048	0	0.0%
North Bergen (T)	157,864	754	1.2%
Secaucus (T)	11,052	0	0.0%
Union City (C)	6,299	1,095	1.6%
Weehawken (T)	11,692	982	5.7%
West New York (T)	10,975	59	0.1%
Hudson County (Total)	11,217	7,109	1.0%

Source: U.S. Census Bureau 2020; NJGWS 2016

SOCIALLY VULNERABLE POPULATION

Populations most vulnerable to geological hazards such as earthquakes, landslides, and subsidence are those living in or near built environments, especially near unreinforced masonry construction. Among these, socially vulnerable groups, including the elderly (over age 65) and individuals living below the poverty threshold, are particularly susceptible. This increased vulnerability is due to factors like decreased mobility, limited financial resources to respond to hazards, and the quality and location of their housing. Research indicates that while some populations may not face higher hazard exposure, they can experience more severe impacts and longer recovery times if affected. For instance, the elderly and those living in poverty are at greater risk during geological events due to potential limited access to mobilization or medical resources.



Earthquakes

Table 10-13 presents the estimated socially vulnerable populations located within the NEHRP Soils Class D and E hazard areas. There are 11,402 persons over the age of 65 years, 7,655 persons under the age of 5 years, 12,061 non-English speakers, 8,021 persons with a disability, and 14,248 living in poverty located in these hazard areas. Table 10-14 presents the estimated socially vulnerable populations located within the Liquefaction Class 4 hazard area. There are 7,534 persons over the age of 65 years, 5,538 persons under the age of 5 years, 6,069 non-English speakers, 5,385 persons with a disability, and 8,803 living in poverty located in this hazard area.

Landslides and Subsidence/Sinkholes

Table 10-15 presents the estimated socially vulnerable populations living in the geological class A hazard areas. There are 878 persons over the age of 65 years, 453 persons under the age of 5 years, 1,070 non-English speakers, 671 persons with a disability, and 967 living in poverty located in this hazard area.

10.2.2 General Building Stock

EARTHQUAKE

Location on Susceptible Soils

There are 21,061 buildings with a replacement cost value of approximately \$43 billion built on lands in the NEHRP D and E soils hazard area. The City of Hoboken has the greatest number of buildings built in the NEHRP D and E Soils hazard area; 7,720 buildings (54.0-percent of its total building stock) with an estimated replacement cost of \$4.2 billion. Table 10-16 summarizes the number of buildings built on the NEHRP D and E Soils hazard area and the total replacement cost of these buildings by jurisdiction. Table 10-17 displays the buildings by general occupancy located within the NEHRP D and E hazard area. The exposure analysis estimates that the residential occupancy is the most exposed to this hazard area with 16,816 total buildings. The City of Hoboken holds the highest number of resident buildings (7,331) in the hazard area.

There are 16,419 buildings with a replacement cost value of approximately \$39 billion built on lands in the Liquefaction Class 4 hazard area. The City of Hoboken has the greatest number of buildings built in the Liquefaction Class 4 hazard area; 8,881 buildings (62.2-percent of its total building stock) with an estimated replacement cost of \$4.8 billion. Table 10-18 summarizes the number of buildings built on the Liquefaction Class A hazard area and the total replacement cost of these buildings by jurisdiction. Table 10-19 displays the buildings by general occupancy located in the Liquefaction Class 4 hazard area. The exposure analysis estimates that the residential occupancy is the most exposed to this hazard with a total of 13,420 residential buildings. The City of Hoboken has the highest number of residential buildings (8,396) in this hazard area.

**Table 10-13. Estimated Vulnerable Persons Located in the NEHRP D & E Soils Hazard Area**

Jurisdiction	Estimated Number of Vulnerable Persons Located in the NEHRP D & E Soils Hazard Area									
	Persons Over 65	Percent of Total	Persons Under 5	Percent of Total	Non-English Speaking Persons	Percent of Total	Persons with a Disability	Percent of Total	Persons in Poverty	Percent of Total
Bayonne (C)	117	1.2%	60	1.2%	66	1.2%	80	1.2%	99	1.2%
East Newark (B)	292	94.8%	100	94.3%	450	95.0%	198	94.7%	606	95.0%
Guttenberg (T)	121	7.5%	61	7.5%	151	7.5%	100	7.5%	141	7.5%
Harrison (T)	2,004	97.1%	1,148	97.0%	3,978	97.1%	1,403	97.1%	2,639	97.1%
Hoboken (C)	2,136	55.4%	2,270	55.4%	1,446	55.4%	1,702	55.3%	2,497	55.4%
Jersey City (C)	5,867	18.0%	3,677	18.0%	5,221	18.0%	4,022	18.0%	7,747	18.0%
Kearny (T)	290	5.3%	143	5.3%	299	5.3%	170	5.3%	226	5.3%
North Bergen (T)	22	0.2%	8	0.2%	23	0.2%	13	0.2%	15	0.2%
Secaucus (T)	422	12.6%	132	12.5%	270	12.6%	245	12.6%	141	12.6%
Union City (C)	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Weehawken (T)	74	3.6%	36	3.6%	45	3.6%	38	3.6%	45	3.6%
West New York (T)	57	0.9%	20	0.8%	112	0.9%	50	0.9%	92	0.9%
Hudson County (Total)	11,402	13.2%	7,655	16.3%	12,061	12.9%	8,021	13.1%	14,248	14.3%

Source: US Census Bureau, ACS 5-Year Estimates; NJGWS 2016

**Table 10-14. Estimated Vulnerable Persons Located in the Liquefaction Class 4 Hazard Area**

Jurisdiction	Estimated Number of Vulnerable Persons Located in the Liquefaction Class 4 Hazard Area									
	Persons Over 65	Percent of Total	Persons Under 5	Percent of Total	Non-English Speaking Persons	Percent of Total	Persons with a Disability	Percent of Total	Persons in Poverty	Percent of Total
Bayonne (C)	396	4.0%	203	4.0%	225	4.0%	273	4.0%	335	4.0%
East Newark (B)	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Guttenberg (T)	82	5.1%	41	5.1%	102	5.1%	68	5.1%	95	5.1%
Harrison (T)	6	0.3%	3	0.3%	13	0.3%	4	0.3%	8	0.3%
Hoboken (C)	2,446	63.4%	2,599	63.4%	1,656	63.4%	1,949	63.4%	2,860	63.4%
Jersey City (C)	3,836	11.7%	2,404	11.7%	3,413	11.7%	2,629	11.7%	5,064	11.7%
Kearny (T)	216	3.9%	106	3.9%	222	3.9%	126	3.9%	168	3.9%
North Bergen (T)	22	0.2%	8	0.2%	23	0.2%	13	0.2%	15	0.2%
Secaucus (T)	444	13.2%	140	13.3%	285	13.3%	258	13.2%	148	13.2%
Union City (C)	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Weehawken (T)	29	1.4%	14	1.4%	18	1.4%	15	1.4%	18	1.4%
West New York (T)	57	0.9%	20	0.8%	112	0.9%	50	0.9%	92	0.9%
Hudson County (Total)	7,534	8.7%	5,538	11.8%	6,069	6.5%	5,385	8.8%	8,803	8.8%

Source: US Census Bureau, ACS 5-Year Estimates; NJGWS 2016

**Table 10-15. Estimated Number of Vulnerable Persons Located in the Geological Class A Hazard Area**

Jurisdiction	Estimated Number of Vulnerable Persons Located in the Geological Class A Hazard Area									
	Persons Over 65	Percent of Total	Persons Under 5	Percent of Total	Non-English Speaking Persons	Percent of Total	Persons with a Disability	Percent of Total	Persons in Poverty	Percent of Total
Bayonne (C)	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
East Newark (B)	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Guttenberg (T)	437	27.0%	219	27.0%	545	27.0%	361	27.0%	507	27.0%
Harrison (T)	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Hoboken (C)	58	1.5%	62	1.5%	39	1.5%	46	1.5%	68	1.5%
Jersey City (C)	5	<0.1%	3	<0.1%	5	<0.1%	4	<0.1%	7	<0.1%
Kearny (T)	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
North Bergen (T)	125	1.2%	45	1.2%	130	1.2%	72	1.2%	87	1.2%
Secaucus (T)	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Union City (C)	130	1.6%	65	1.6%	265	1.6%	122	1.6%	216	1.6%
Weehawken (T)	116	5.7%	57	5.7%	72	5.7%	60	5.6%	71	5.7%
West New York (T)	7	0.1%	2	0.1%	14	0.1%	6	0.1%	11	0.1%
Hudson County (Total)	878	1.0%	453	1.0%	1,070	1.1%	671	1.1%	967	1.0%

Source: US Census Bureau, ACS 5-Year Estimates; NJGWS 2016

**Table 10-16. Replacement Cost Values of Buildings in the NEHRP D & E Soils Hazard Area**

Jurisdiction	Jurisdiction Total Buildings		Buildings in the NEHRP D&E Soils Hazard Area			
			Number of Buildings		Replacement Cost Value	
	Count	Replacement Cost Value	Count	% of Jurisdiction Total	Value	% of Jurisdiction Total
Bayonne (C)	9,264	\$11,278,964,959	1,084	11.7%	\$4,056,799,464	36.0%
East Newark (B)	434	\$300,712,303	413	95.2%	\$291,565,176	97.0%
Guttenberg (T)	2,574	\$1,062,772,505	188	7.3%	\$97,070,195	9.1%
Harrison (T)	2,646	\$2,812,269,922	2,566	97.0%	\$2,773,660,855	98.6%
Hoboken (C)	14,289	\$6,922,849,652	7,720	54.0%	\$4,231,207,516	61.1%
Jersey City (C)	38,336	\$29,829,276,781	7,229	18.9%	\$13,187,265,915	44.2%
Kearny (T)	7,207	\$9,630,626,567	885	12.3%	\$6,244,169,746	64.8%
North Bergen (T)	6,002	\$9,906,706,329	112	1.9%	\$2,905,836,187	29.3%
Secaucus (T)	3,844	\$12,075,088,549	694	18.1%	\$8,435,759,036	69.9%
Union City (C)	1,729	\$4,009,712,429	0	0.0%	\$0	0.0%
Weehawken (T)	2,112	\$1,638,112,105	122	5.8%	\$643,984,158	39.3%
West New York (T)	4,594	\$3,076,856,343	48	1.0%	\$298,648,955	9.7%
Hudson County (Total)	93,031	\$92,543,948,444	21,061	22.6%	\$43,165,967,204	46.6%

Source: NJOIT 2024; Microsoft BING 2019; RS Means 2024; NJGWS 2016

Table 10-17. Buildings in the NEHRP D&E Soils Hazard Area by General Occupancy Class

Jurisdiction	Buildings in the NEHRP D&E Soils Hazard Area by General Occupancy Class			
	Residential	Commercial	Industrial	Other ^a
Bayonne (C)	90	29	907	58
East Newark (B)	364	22	19	8
Guttenberg (T)	176	0	0	12
Harrison (T)	2,121	257	69	119
Hoboken (C)	7,331	227	21	141
Jersey City (C)	5,877	637	315	400
Kearny (T)	332	65	360	128
North Bergen (T)	11	34	41	26
Secaucus (T)	413	100	115	66
Union City (C)	0	0	0	0
Weehawken (T)	70	22	6	24
West New York (T)	31	4	0	13
Hudson County (Total)	16,816	1,397	1,853	995

Source: NJOIT 2024; Microsoft BING 2019; NJGWS 2016

a. Other = Government, Religion, Agricultural, Education

**Table 10-18. Replacement Cost Values of Buildings in the Liquefaction Class 4 Hazard Area**

Jurisdiction	Jurisdiction Total Buildings		Buildings in the Liquefaction Class 4 Hazard Area			
			Number of Buildings		Replacement Cost Value	
	Count	Replacement Cost Value	Count	% of Jurisdiction Total	Value	% of Jurisdiction Total
Bayonne (C)	9,264	\$11,278,964,959	741	8.0%	\$3,031,197,238	26.9%
East Newark (B)	434	\$300,712,303	2	0.5%	\$3,089,311	1.0%
Guttenberg (T)	2,574	\$1,062,772,505	131	5.1%	\$85,310,463	8.0%
Harrison (T)	2,646	\$2,812,269,922	48	1.8%	\$788,213,286	28.0%
Hoboken (C)	14,289	\$6,922,849,652	8,881	62.2%	\$4,795,091,918	69.3%
Jersey City (C)	38,336	\$29,829,276,781	4,883	12.7%	\$11,861,372,086	39.8%
Kearny (T)	7,207	\$9,630,626,567	769	10.7%	\$6,118,825,987	63.5%
North Bergen (T)	6,002	\$9,906,706,329	137	2.3%	\$3,172,230,337	32.0%
Secaucus (T)	3,844	\$12,075,088,549	712	18.5%	\$8,477,481,795	70.2%
Union City (C)	1,729	\$4,009,712,429	0	0.0%	\$0	0.0%
Weehawken (T)	2,112	\$1,638,112,105	67	3.2%	\$513,800,802	31.4%
West New York (T)	4,594	\$3,076,856,343	48	1.0%	\$298,648,955	9.7%
Hudson County (Total)	93,031	\$92,543,948,444	16,419	17.6%	\$39,145,262,176	42.3%

Source: NJOIT 2024; Microsoft BING 2019; RS Means 2024; NJGWS 2016

Table 10-19. Buildings in the Liquefaction Class 4 Hazard Area by General Occupancy Class

Jurisdiction	Buildings in the Liquefaction Class 4 Hazard Area by General Occupancy Class			
	Residential	Commercial	Industrial	Other ^a
Bayonne (C)	304	27	351	59
East Newark (B)	0	0	2	0
Guttenberg (T)	119	0	0	12
Harrison (T)	7	5	26	10
Hoboken (C)	8,396	303	26	156
Jersey City (C)	3,842	391	286	364
Kearny (T)	247	40	353	129
North Bergen (T)	11	38	61	27
Secaucus (T)	435	96	115	66
Union City (C)	0	0	0	0
Weehawken (T)	28	15	3	21
West New York (T)	31	4	0	13
Hudson County (Total)	13,420	919	1,223	857

Source: NJOIT 2024; Microsoft BING 2019; NJGWS 2016

a. Other = Government, Religion, Agricultural, Education



Level of Damage by Occupancy Class

The entire general building stock of the county is exposed to the earthquake hazard. Table 10-20 provides an analysis of the expected damage to various building types during earthquakes with 500-year and 2,500-year Mean Return Periods. For residential buildings, the majority are expected to sustain no damage, with 99.3 percent undamaged in the 500-year period and 91.1 percent in the 2,500-year period. Minor damage is expected in a small percentage, increasing from 0.7 percent to 7.6 percent as the return period lengthens. Moderate to severe damage and destruction are rare across all building types, with slightly higher percentages in the 2,500-year period. Commercial, industrial, and other buildings show similar trends, with most buildings remaining undamaged, and minor damage percentages increasing with longer return periods. Severe damage and destruction remain minimal across all categories. Another key factor in degree of vulnerability is age of facilities and infrastructure, which correlates with building standards in place at times of construction.

Table 10-20. Damage Severity by Occupancy Class

Total Number of Buildings in Occupancy	Severity of Expected Damage	500-Year Mean Return Period		2,500-Year Mean Return Period	
		Building Count	% Buildings in Occupancy Class	Building Count	% Buildings in Occupancy Class
Residential Exposure (Single and Multi-Family Dwellings)					
79,906	NONE	79,328	99.3%	72,769	91.1%
	MINOR	532	0.7%	6,036	7.6%
	MODERATE	46	0.1%	1,039	1.3%
	SEVERE	0	0.0%	61	0.1%
	DESTRUCTION	0	0.0%	1	<0.1%
Commercial Buildings					
7,174	NONE	7,129	99.4%	6,593	91.9%
	MINOR	36	0.5%	402	5.6%
	MODERATE	8	0.1%	165	2.3%
	SEVERE	0	0.0%	12	0.2%
	DESTRUCTION	0	0.0%	2	<0.1%
Industrial Buildings					
2,746	NONE	2,566	93.5%	1,993	72.6%
	MINOR	124	4.5%	423	15.4%
	MODERATE	48	1.8%	255	9.3%
	SEVERE	7	0.3%	65	2.4%
	DESTRUCTION	0	0.0%	11	0.4%
Other Buildings ^a					
3,205	NONE	3,162	98.7%	2,856	89.1%
	MINOR	33	1.0%	239	7.5%
	MODERATE	9	0.3%	95	3.0%
	SEVERE	1	<0.1%	13	0.4%
	DESTRUCTION	0	0.0%	2	0.1%

Source: Hazus v6.1; NJOIT 2024; Microsoft BING 2019

a. Other = Government, Religion, Agricultural, Education



Estimated Cost of Damage

Table 10-21 and Table 10-22 provide an overview of the estimated damage to structures and contents in various jurisdictions within Hudson County during earthquakes with a 500-Year and 2,500-Year Mean Return Period.

Table 10-21. Estimated Damage Costs Due to the 500-Year Mean Return Period Earthquake Events

Jurisdiction	Total Replacement Cost Value (RCV)	Estimated Damage to Structure and Contents				
		Residential	Commercial	Other ^a	Total	
					Damage	% of RCV
Bayonne (C)	\$11,278,964,959	\$1,090,766	\$505,581	\$3,333,091	\$4,929,438	<0.1%
East Newark (B)	\$300,712,303	\$30,519	\$3,917	\$108,406	\$142,842	<0.1%
Guttenberg (T)	\$1,062,772,505	\$85,370	\$7,687	\$36,272	\$129,329	<0.1%
Harrison (T)	\$2,812,269,922	\$268,502	\$52,069	\$508,383	\$828,954	<0.1%
Hoboken (C)	\$6,922,849,652	\$1,034,154	\$210,553	\$551,707	\$1,796,415	<0.1%
Jersey City (C)	\$29,829,276,781	\$3,573,671	\$1,177,206	\$7,659,348	\$12,410,224	<0.1%
Kearny (T)	\$9,630,626,567	\$607,385	\$161,245	\$5,160,319	\$5,928,950	0.1%
North Bergen (T)	\$9,906,706,329	\$508,472	\$418,476	\$2,440,644	\$3,367,591	<0.1%
Secaucus (T)	\$12,075,088,549	\$753,402	\$724,500	\$5,009,883	\$6,487,784	0.1%
Union City (C)	\$4,009,712,429	\$473,860	\$219,519	\$494,003	\$1,187,382	<0.1%
Weehawken (T)	\$1,638,112,105	\$168,695	\$59,873	\$123,232	\$351,800	<0.1%
West New York (T)	\$3,076,856,343	\$173,556	\$63,926	\$201,533	\$439,015	<0.1%
Hudson County (Total)	\$92,543,948,444	\$8,768,352	\$3,604,551	\$25,626,820	\$37,999,723	<0.1%

Source: Hazus v6.1; NJOIT 2024; Microsoft BING 2019; RS Means 2024

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

Table 10-22. Estimated Damage Costs Due to 2,500-Year Mean Return Period Earthquake Events

Jurisdiction	Total Replacement Cost Value (RCV)	Estimated Damage to Structure and Contents				
		Residential	Commercial	Other ^a	Total	
					Damage	% of RCV
Bayonne (C)	\$11,278,964,959	\$28,800,121	\$12,255,351	\$58,149,892	\$99,205,363	0.9%
East Newark (B)	\$300,712,303	\$783,309	\$111,350	\$1,999,788	\$2,894,447	1.0%
Guttenberg (T)	\$1,062,772,505	\$3,463,684	\$439,203	\$1,031,316	\$4,934,203	0.5%
Harrison (T)	\$2,812,269,922	\$6,935,384	\$1,505,189	\$13,401,278	\$21,841,851	0.8%
Hoboken (C)	\$6,922,849,652	\$28,709,556	\$6,180,246	\$11,758,655	\$46,648,457	0.7%
Jersey City (C)	\$29,829,276,781	\$84,583,264	\$29,825,141	\$133,977,061	\$248,385,466	0.8%
Kearny (T)	\$9,630,626,567	\$15,278,578	\$4,366,027	\$81,127,459	\$100,772,064	1.0%
North Bergen (T)	\$9,906,706,329	\$15,556,628	\$12,112,857	\$51,441,033	\$79,110,518	0.8%
Secaucus (T)	\$12,075,088,549	\$14,617,925	\$14,467,785	\$97,507,511	\$126,593,220	1.0%
Union City (C)	\$4,009,712,429	\$13,839,922	\$6,291,474	\$9,244,695	\$29,376,090	0.7%
Weehawken (T)	\$1,638,112,105	\$5,346,251	\$2,039,053	\$2,679,033	\$10,064,337	0.6%
West New York (T)	\$3,076,856,343	\$7,280,262	\$3,078,407	\$5,101,244	\$15,459,913	0.5%
Hudson County (Total)	\$92,543,948,444	\$225,194,882	\$92,672,082	\$467,418,964	\$785,285,928	0.8%

Source: Hazus v6.1; NJOIT 2024; Microsoft BING 2019; RS Means 2024

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



The first table shows that the total replacement cost value (RCV) for the County is approximately \$93 billion, with estimated damages to residential, commercial, and other buildings totaling around \$38 million, which is less than 0.1 percent of the RCV. The second table presents details indicating that the total estimated damage for the 2,500-Year period is about \$785 million, or 0.8 percent of the RCV. This includes significant damages across residential, commercial, and other buildings, with the City of Jersey City experiencing the highest total damage at approximately \$248 million.

LANDSLIDES AND SUBSIDENCE/SINKHOLES

In general, the built environment is vulnerable to the geological hazard if built on soils/geology susceptible to land sliding or sinkholes. Geological hazard areas may destabilize the foundation of structures resulting in monetary losses to businesses and residents. There are 1,072 buildings with a replacement cost value of approximately \$574 million built on lands within the Geological Class hazard area. The Township of Guttenberg has the greatest number of buildings built in this area; 632 buildings (24.6-percent of its total building stock) with an estimated replacement cost of \$216 million. Table 10-23 summarizes the number of buildings built on the Geological Class A hazard area and the total replacement cost of these buildings by jurisdiction.

Table 10-23. Replacement Cost Value of Buildings in the Geological Class A Hazard Area

Jurisdiction	Jurisdiction Total Buildings		Buildings in the Geological Class A Hazard Area			
			Number of Buildings		Replacement Cost Value	
	Count	Replacement Cost Value	Count	% of Jurisdiction Total	Value	% of Jurisdiction Total
Bayonne (C)	9,264	\$11,278,964,959	0	0.0%	\$0	0.0%
East Newark (B)	434	\$300,712,303	0	0.0%	\$0	0.0%
Guttenberg (T)	2,574	\$1,062,772,505	632	24.6%	\$215,716,005	20.3%
Harrison (T)	2,646	\$2,812,269,922	0	0.0%	\$0	0.0%
Hoboken (C)	14,289	\$6,922,849,652	204	1.4%	\$87,308,478	1.3%
Jersey City (C)	38,336	\$29,829,276,781	10	<0.1%	\$41,898,680	0.1%
Kearny (T)	7,207	\$9,630,626,567	0	0.0%	\$0	0.0%
North Bergen (T)	6,002	\$9,906,706,329	73	1.2%	\$68,165,601	0.7%
Secaucus (T)	3,844	\$12,075,088,549	0	0.0%	\$0	0.0%
Union City (C)	1,729	\$4,009,712,429	22	1.3%	\$63,307,034	1.6%
Weehawken (T)	2,112	\$1,638,112,105	120	5.7%	\$55,654,929	3.4%
West New York (T)	4,594	\$3,076,856,343	11	0.2%	\$41,653,796	1.4%
Hudson County (Total)	93,031	\$92,543,948,444	1,072	1.2%	\$573,704,523	0.6%

Source: NJOIT 2024; Microsoft BING 2019; RS Means 2024; NJGWS 2016

Table 10-24 displays the buildings by general occupancy located within the Geological Class A hazard area. The exposure analysis estimates that across all subsidence hazard areas, the residential occupancy is the most exposed to the this hazard area with 1,034 total buildings. The Township of Guttenberg holds the highest number of resident buildings (632) in the hazard area.

**Table 10-24. Buildings in the Geological Class A Hazard Area by General Occupancy Class**

Jurisdiction	Buildings in the Geological Class A Hazard Area by General Occupancy Class			
	Residential	Commercial	Industrial	Other ^a
Bayonne (C)	0	0	0	0
East Newark (B)	0	0	0	0
Guttenberg (T)	632	0	0	0
Harrison (T)	0	0	0	0
Hoboken (C)	201	0	2	1
Jersey City (C)	6	1	2	1
Kearny (T)	0	0	0	0
North Bergen (T)	61	2	0	10
Secaucus (T)	0	0	0	0
Union City (C)	20	0	0	2
Weehawken (T)	110	3	4	3
West New York (T)	4	1	6	0
Hudson County (Total)	1,034	7	14	17

a. Other = Government, Religion, Agricultural, Education

10.2.3 Community Lifelines and Other Critical Facilities

EARTHQUAKE

All critical facilities in Hudson County are considered exposed to the earthquake hazard. The Hazus earthquake model was used to assign the range or average probability of each damage state category to the critical facilities in the County for the 500-Year and 2,500-Year Mean Return Period events. In addition, Hazus estimates the time to restore critical facilities to fully functional use. Results are presented as a probability of being functional at specified time increments (days after the event). For example, Hazus might estimate that a facility has 5-percent chance of being fully functional at Day 3, and a 95-percent chance of being fully functional at Day 90. For percent probability of sustaining damage, the minimum and maximum damage estimated value for that facility type is presented.

Table 10-25 provides an analysis of the average percent probability of sustaining damage and the average percent functionality of various lifeline systems during a 500-year MRP earthquake. The lifelines assessed include communications, energy, food, hydration, shelter, hazardous materials, health and medical, safety and security, transportation, and water systems.

For most lifelines, the probability of sustaining no damage is very high, ranging from 97.0 percent to 99.8 percent. Slight damage is expected in a small percentage of cases, while moderate, extensive, and complete damage are rare. For instance, the transportation and health and medical systems have over 99 percent chance of sustaining no damage and less than a 0.1 percent chance of moderate damage.

**Table 10-25. Average Percent Probability of Sustaining Damage, 500-Year MRP**

Name	Average Percent Probability of Sustaining Damage 500-Year Mean Return Period					Average Percent Functionality			
	None	Slight	Moderate	Extensive	Complete	Day 1	Day 7	Day 30	Day 90
Communications	97.0%	2.9%	<0.1%	<0.1%	0.0%	99.9%	99.9%	99.9%	99.9%
Energy	97.4%	1.5%	0.9%	0.1%	0.0%	98.2%	99.9%	99.9%	99.9%
Food, Hydration, Shelter	97.2%	2.1%	0.6%	0.1%	0.0%	97.1%	99.2%	99.9%	99.9%
Hazardous Materials	97.0%	2.3%	0.7%	0.1%	0.0%	96.9%	99.2%	99.9%	99.9%
Health and Medical	99.4%	0.6%	<0.1%	0.0%	0.0%	99.4%	99.9%	99.9%	99.9%
Safety and Security	97.1%	2.2%	0.6%	0.1%	0.0%	97.1%	99.2%	99.9%	99.9%
Transportation	99.8%	0.2%	<0.1%	0.0%	0.0%	100.0%	100.0%	100.0%	100.0%
Water Systems	97.7%	1.3%	0.8%	0.1%	0.0%	98.2%	99.7%	99.8%	99.9%

Source: Hazus v6.1; Hudson County; HIFLD; NJGIN 2024

In terms of functionality, most lifelines are expected to recover quickly. By Day 1, functionality ranges from 96.9 percent to 100.0 percent, and by Day 7, it improves to between 99.2 percent and 100.0 percent. By Day 30 and Day 90, nearly all lifelines are expected to be fully functional, with percentages close to or at 100 percent.

Table 10-26 provides an analysis of the average percent probability of sustaining damage and the average percent functionality of various lifeline systems during a 2,500-year MRP earthquake. The lifelines assessed include communications, energy, food, hydration, shelter, hazardous materials, health and medical, safety and security, transportation, and water systems.

Table 10-26. Average Percent Probability of Sustaining Damage, 2,500-Year MRP

Name	Average Percent Probability of Sustaining Damage 2,500-Year Mean Return Period					Average Percent Functionality			
	None	Slight	Moderate	Extensive	Complete	Day 1	Day 7	Day 30	Day 90
Communications	58.6%	29.2%	8.9%	3.2%	0.1%	92.7%	98.2%	99.9%	99.9%
Energy	82.5%	8.5%	7.1%	1.9%	<0.1%	87.4%	98.9%	99.9%	99.9%
Food, Hydration, Shelter	80.9%	12.1%	5.8%	1.1%	0.1%	80.9%	93.0%	98.8%	99.8%
Hazardous Materials	80.2%	12.5%	6.1%	1.1%	0.1%	80.1%	92.6%	98.7%	99.8%
Health and Medical	92.8%	6.5%	0.7%	<0.1%	<0.1%	92.7%	99.1%	99.9%	99.9%
Safety and Security	80.9%	12.1%	5.8%	1.1%	0.1%	80.8%	92.7%	98.7%	99.4%
Transportation	97.8%	2.0%	0.2%	<0.1%	<0.1%	99.7%	99.9%	99.9%	99.9%
Water Systems	83.9%	7.9%	6.4%	1.7%	0.0%	87.3%	97.7%	98.5%	99.8%

Source: Hazus v6.1; Hudson County; HIFLD; NJGIN 2024

For most lifelines, the probability of sustaining no damage is relatively high, ranging from 80.2 percent to 97.8 percent, with the exception of communications showing a probability of 58.6 percent of sustaining no damage. Slight damage ranges from 2.0 percent to 29.2 percent, moderate damage ranges from 0.2 percent to 8.9 percent, extensive damage



ranges from less than 0.1 percent to 3.2 percent, and complete damage is generally very low, ranging from less than 0.1 percent to 0.1 percent. This indicates that while slight and moderate damage are more common, extensive and complete damage are rare.

In terms of functionality, most lifelines are expected to recover significantly within the first week. By Day 1, functionality ranges from 80.1 percent to 99.7 percent, improving to between 92.6 percent and 99.9 percent by Day 7. By Day 30 and Day 90, nearly all lifelines are expected to be fully functional, with percentages close to 100 percent.

Table 10-27 shows the number of critical facilities located in the NEHRP D and E soils hazard area for Hudson County. There is a total of 455 facilities located in this hazard area with the highest number among the Transportation lifeline (143). The City of Jersey City has the highest number of critical facilities (156) located in the NEHRP D and E soils hazard area.

Table 10-28 outlines the number of critical facilities in the Liquefaction Class 4 Hazard Area across various jurisdictions in Hudson County, categorized by lifeline sectors. Again, the City of Jersey City has the highest number of facilities in this hazard area (145), followed by the City of Hoboken (90). Overall, Hudson County has 405 facilities in the Liquefaction Class 4 hazard area, accounting for 32.7 percent of the jurisdictional total.

LANDSLIDES AND SUBSIDENCE/SINKHOLES

In addition to critical facilities, a significant amount of infrastructure can be exposed to mass movements of geological material (USGS 2023):

- *Roads*—Access to major roads is crucial to life-safety after a disaster event and to response and recovery operations. Landslides and sinkholes 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. Sinkholes can swallow utility lines and cause impacts to underground pipes. Power and communication failures due to landslides and sinkholes 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 New York City, and a landslide event could prevent travel to and from work.

**Table 10-27. Number of Facilities in the NEHRP D & E Soils Hazard Area, by Lifeline Category**

Jurisdiction	Number of Facilities in the NEHRP D & E Soils Hazard Area, by Lifeline Category									Total Facilities in Hazard Area	
	Communications	Energy	Food, Hydration, Shelter	Hazardous Materials	Health & Medical	Safety & Security	Transportation	Water Systems	Other Critical Facilities	Count	% of Jurisdiction Total
Bayonne (C)	0	8	0	3	0	2	7	7	2	29	25.0%
East Newark (B)	0	0	2	0	1	2	1	0	0	6	66.7%
Guttenberg (T)	0	0	0	0	0	0	0	0	0	0	0.0%
Harrison (T)	1	4	2	2	2	14	9	1	9	44	97.8%
Hoboken (C)	0	3	15	5	2	12	12	3	27	79	56.4%
Jersey City (C)	1	16	4	20	3	31	52	10	19	156	35.9%
Kearny (T)	3	10	0	7	0	5	25	11	0	61	57.0%
North Bergen (T)	0	3	0	0	2	0	9	3	1	18	18.0%
Secaucus (T)	5	3	1	2	4	1	17	6	2	41	48.8%
Union City (C)	0	0	0	0	0	0	0	0	0	0	0.0%
Weehawken (T)	0	0	1	0	0	1	11	3	2	18	39.1%
West New York (T)	0	0	0	0	0	1	0	2	0	3	6.3%
Hudson County (Total)	10	47	25	39	14	69	143	46	62	455	36.7%

Source: Hudson County 2024; HIFLD 2024; NJGIN 2024; NJGWS 2016



Table 10-28. Number of Facilities in the Liquefaction Class 4 Hazard Area, by Lifeline Category

Jurisdiction	Number of Facilities in the Liquefaction Class 4 Hazard Area, by Lifeline Category									Total Facilities in Hazard Area	
	Communications	Energy	Food, Hydration, Shelter	Hazardous Materials	Health & Medical	Safety & Security	Transportation	Water Systems	Other Critical Facilities	Count	% of Jurisdiction Total
Bayonne (C)	0	4	0	3	0	0	7	8	2	24	20.7%
East Newark (B)	0	0	0	0	0	0	0	0	0	0	0.0%
Guttenberg (T)	0	0	0	0	0	0	0	0	0	0	0.0%
Harrison (T)	0	1	0	1	0	0	1	0	1	4	8.9%
Hoboken (C)	0	3	17	5	7	14	12	3	29	90	64.3%
Jersey City (C)	1	16	4	18	3	26	54	10	13	145	33.4%
Kearny (T)	3	10	0	7	0	5	25	11	0	61	57.0%
North Bergen (T)	0	3	0	0	2	0	9	4	2	20	20.0%
Secaucus (T)	5	3	1	2	4	2	18	6	3	44	52.4%
Union City (C)	0	0	0	0	0	0	0	0	0	0	0.0%
Weehawken (T)	0	0	1	0	0	0	8	3	2	14	30.4%
West New York (T)	0	0	0	0	0	0	0	3	0	3	6.3%
Hudson County (Total)	9	40	23	36	16	47	134	48	52	405	32.7%

Source: Hudson County 2024; HIFLD 2024; NJGIN 2024; NJGWS 2016



Several other types of infrastructure may also be exposed to the geological hazards, including water and sewer infrastructure. In addition to impacting buildings and facilities, subsidence can severely impact roads and roadway infrastructure, which are included in the transportation lifeline. Depending upon the size, events can block egress and ingress on roads, causing isolation for residents and potentially neighborhoods, traffic problems and delays for transportation. This can result in economic losses for businesses. Furthermore, mass movements can knock out bridge abutments or significantly weaken the soil supporting them, making them hazardous for use.

For Hudson County, there are 12 critical facilities located in the Geological Class A hazard area, as show in Table 10-29.

10.2.4 Economy

Geological hazards can impose direct and indirect impacts on society. Direct costs include the actual damage sustained by buildings, property, and infrastructure due to ground failure, which also threatens transportation corridors, fuel and energy conduits, and communication lines (USGS 2020). Indirect costs, such as clean-up costs, business interruption, loss of tax revenues, reduced property values, and loss of productivity may also occur, but are difficult to measure. Earthquake impacts on the economy include loss of business function, damage to inventory, relocation costs, wage loss, and rental loss due to the repair/replacement of buildings. Buildings susceptible to landslide events were summarized earlier in this section. Losses to these structures will impact the local tax base and economy. Subsidence and sinkholes can cause several types of secondary effects, such as blocking access to roads, which can isolate residents and businesses and delay commercial, public, and private transportation.

ESTIMATED DEBRIS GENERATED

Table 10-30 outlines the estimated debris generated in various jurisdictions within Hudson County during earthquakes with 500- and 2,500-Year Mean Return Periods. For the 500-Year period, the total debris includes 19,463 tons of brick/wood and 3,168 tons of concrete/steel. In the 2,500-Year period, these amounts significantly increase to 130,406 tons of brick/wood and 40,257 tons of concrete/steel.

10.2.5 Natural, Historic and Cultural Resources

NATURAL

According to the USGS, earthquakes can cause damage to the surface of the Earth in various forms depending on the magnitude and distribution of the event. Ground failure as a result of soil liquefaction can significantly impact soil pores and water retention. The greater the seismic activity and the liquefaction properties of the soil, the more likely it is that groundwater drainage will occur, depleting groundwater resources. In areas with higher groundwater pressure, the soil pores can build up more pressure, causing the soil to behave more like a fluid rather than a solid, increasing the risk of localized flooding and the deposition or accumulation of silt. (USGS n.d.).

Disturbance of areas with unstable soil can trigger erosion and sedimentation, resulting in the loss of topsoil. Silting of wetlands, lakes, ponds, and streams can damage and degrade wetland and aquatic habitats, which are found throughout the region and receive the state's highest water quality protections. Soil liquefaction and erosion can also result in the loss of habitat quality, degradation of surface water quality, and alteration of drainage patterns.

**Table 10-29. Number of Facilities in Geological Class A Hazard Area, by Lifeline Category**

Jurisdiction	Number of Facilities in the Geological Class A Hazard Area, by Lifeline Category									Total Facilities in Hazard Area	
	Communications	Energy	Food, Hydration, Shelter	Hazardous Materials	Health & Medical	Safety & Security	Transportation	Water Systems	Other Critical Facilities	Count	% of Jurisdiction Total
Bayonne (C)	0	0	0	0	0	0	0	0	0	0	0.0%
East Newark (B)	0	0	0	0	0	0	0	0	0	0	0.0%
Guttenberg (T)	0	0	0	0	0	0	1	0	0	1	5.3%
Harrison (T)	0	0	0	0	0	0	0	0	0	0	0.0%
Hoboken (C)	0	0	0	0	0	0	0	1	0	1	0.7%
Jersey City (C)	0	0	0	0	0	0	4	1	0	5	1.2%
Kearny (T)	0	0	0	0	0	0	0	0	0	0	0.0%
North Bergen (T)	0	0	0	0	0	0	0	0	0	0	0.0%
Secaucus (T)	0	0	0	0	0	0	0	0	0	0	0.0%
Union City (C)	0	0	1	0	0	0	2	0	1	4	4.4%
Weehawken (T)	0	1	0	0	0	0	0	0	0	1	2.2%
West New York (T)	0	0	0	0	0	0	0	0	0	0	0.0%
Hudson County (Total)	0	1	1	0	0	0	7	2	1	12	1.0%

Source: Hudson County 2024; HIFLD 2024; NJGIN 2024; NJGWS 2016

**Table 10-30. 500- and 2,500-Year Mean Return Period Earthquake Event Debris**

Jurisdiction	Debris Generated (tons)			
	500-Year Mean Return Period		2,500-Year Mean Return Period	
	Brick/Wood	Concrete/Steel	Brick/Wood	Concrete/Steel
Bayonne (C)	3,038	532	18,247	5,950
East Newark (B)	114	19	704	209
Guttenberg (T)	38	5	326	74
Harrison (T)	278	33	2,903	666
Hoboken (C)	366	57	3,074	948
Jersey City (C)	5,806	980	38,526	13,670
Kearny (T)	4,210	738	23,806	7,217
North Bergen (T)	1,958	295	14,400	3,814
Secaucus (T)	3,008	413	23,465	6,259
Union City (C)	349	57	2,595	831
Weehawken (T)	101	17	746	244
West New York (T)	199	23	1,614	374
Hudson County (Total)	19,463	3,168	130,406	40,257

Source: Hazus v6.1; NJOIT 2024; Microsoft BING 2019; RS Means 2024

HISTORIC

In Hudson County, the primary concern for historic resources in the event of an earthquake is the potential damage from ground shaking and soil liquefaction. The County's historic landmarks and older buildings, many of which may not be built to modern seismic standards, are particularly vulnerable to earthquake damage. These structures are more susceptible to damage compared to newer infrastructure designed to withstand seismic activity.

While landslides are not a significant risk in the County due to its relatively flat terrain, the effects of earthquakes can still pose a threat to the integrity of historical buildings. Ground shaking can cause structural damage, and soil liquefaction can undermine foundations, leading to potential collapse or severe damage. Protecting these historic resources requires careful planning and retrofitting to enhance their resilience against seismic events.

CULTURAL

Earthquake impacts on cultural resources within Hudson County are primarily related to ground shaking and soil liquefaction. Cultural landmarks in the county, many of which are older structures not built to modern seismic standards, are particularly vulnerable to these effects. Depending on the magnitude, earthquake events could cause significant damage to properties in and around cultural landmarks, undermining foundations and leading to structural damage.



10.3 Future Changes That May Affect Risk

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

10.3.1 Potential or Planned Development

As discussed in Chapter 3 (County Profile), areas targeted for future growth and development have been identified across Hudson County. Development in areas with softer NEHRP soil classes and liquefaction-susceptible zones may experience shifting or cracking in the foundation during earthquakes due to the loose soil characteristics. However, current building codes require seismic provisions that should render new construction less vulnerable to seismic impacts than older, existing structures that may have been built to lower standards.

Any areas of growth could potentially be impacted by geological hazards if located within the identified hazard zones. In general, development on slopes is not recommended due to the increased risk of erosion, stormwater runoff, and flooding potential. Additional runoff can result in sedimentation of downstream surface waters, which damages habitats and has the potential to damage property. Geological make-up should also be considered for future development; certain soils, such as those prone to liquefaction, require careful planning and mitigation measures.

10.3.2 Projected Changes in Population

The New Jersey Department of Labor and Workforce Development produced populations projections by County from 2014 to 2019, 2024, 2029, and 2034. According to these projections, Hudson County is projected to have an increase in population in the upcoming years. These projection totals include a population of 747,400 by 2029, and 766,500 by 2034 (State of New Jersey 2017). An increase in population density can impact the number of persons exposed to geological hazard areas. Changes in density can not only create issues for local residents during evacuation of a landslide or ground failure event but can also have an effect on commuters that travel into and out of the County for work, particularly during a geologic event (such as a sinkhole) that breaches major transportation corridors, which are also major commuter roads.

10.3.3 Climate Change

The County is expected to experience an increase in average annual temperatures and precipitation due to climate change. Severe storms and heavy rainfall events may elevate the likelihood of landslides in steep sloped areas, as precipitation may exceed the soil's absorption capacity. These changes depend on the development of steep slopes and other climate trends, such as seasonal precipitation and drought, which affect vegetation growth.

Higher temperatures and potentially more intense, less frequent summer rainfall may alter water resource availability and increase the frequency of droughts. Drought periods can intensify sinkhole activity in some karst areas, potentially increasing the number of sinkholes. Changes to the water balance, including over-withdrawal of groundwater, diverting



surface water, creating artificial ponds, and drilling new wells, can accelerate bedrock degradation and sinkhole formation.

The impacts of climate change on earthquakes are not well understood, making it difficult to determine changes in the County's vulnerability. However, climate change may magnify secondary impacts of earthquakes. Consequently, the County's assets located on saturated soils and at the base of steep slopes are at higher risk of landslides and mudslides due to seismic activity.

10.3.4 Other Identified Conditions

The impacts of climate change on earthquakes are not well understood, making it difficult to determine changes in the County's vulnerability. However, climate change has the potential to magnify secondary impacts of earthquakes. As a result, the County's assets located on saturated soils and at the base of steep slopes are at higher risk of landslides and mudslides due to seismic activity.

The County is expected to experience an increase in average annual temperatures and precipitation due to climate change. Severe storms and heavy rainfall events may elevate the likelihood of landslides in steep sloped areas, as precipitation may exceed the soil's absorption capacity. These changes depend on the development of steep slopes and other climate trends, such as seasonal precipitation and drought, which affect vegetation growth.



11. SEVERE WEATHER

11.1 Hazard Profile

11.1.1 Hazard Description

The severe weather hazard for this HMP update includes thunderstorms and lightning, high winds, hailstorms, tornadoes, and hurricanes (including storm surge).

THUNDERSTORMS AND LIGHTNING

A thunderstorm is a local storm accompanied by lightning and thunder (NWS 2021). It forms from a combination of moisture, rapidly rising warm air, and a force capable of lifting air, such as a warm and cold front, a sea breeze, or a mountain. Although thunderstorms generally affect a small area when they occur, they have the potential to become dangerous due to their ability in generating tornadoes, hailstorms, strong winds, flash flooding, and lightning. The National Weather Service (NWS) considers a thunderstorm severe only if it produces damaging wind gusts of at least 58 miles per hour (mph), hail of at least one-inch diameter, or tornadoes. Typical thunderstorms are 15 miles in diameter and last an average of 30 minutes. An estimated 100,000 thunderstorms occur each year in the United States, with approximately 10 percent of them classified as severe (NWS 2016).

Lightning is a bright flash of electrical energy produced by a thunderstorm. The resulting clap of thunder is the result of a shock wave created by the rapid heating and cooling of the air in the lightning channel. Lightning can damage homes and injure people. In the United States, an average of 300 people are injured and 80 people are killed by lightning each year. Lightning can occur anywhere there is a thunderstorm and can travel via cloud-to-air, cloud-to-cloud (i.e., “intra-cloud”), and cloud-to-ground (NOAA 2014).

HIGH WINDS

Wind is horizontal movement of air caused by uneven heating of the earth’s surface. It occurs at all scales, from local breezes lasting a few minutes to global winds resulting from solar heating of the earth. High winds are often associated by other severe weather events such as thunderstorms, tornadoes, hurricanes, and tropical storms (NWS 2012). Straight-line wind is a term used to define any thunderstorm wind that is not associated with rotation and is used mainly to differentiate from tornadic winds. It includes the following (NOAA 2023):

- A **microburst** is a small, concentrated downburst that produces an outward burst of strong winds at or near the surface. Microbursts are typically less than 2.5 miles across and short-lived, lasting only five to 10 minutes, with maximum windspeeds sometimes exceeding 100 mph. There are two kinds of microbursts: wet and dry. A wet microburst is accompanied by heavy precipitation at the surface. Dry microbursts, common in places like the high plains and the intermountain west, occur with little or no precipitation reaching the ground.
- A **derecho** is a widespread, long-lived windstorm that is associated with a band of rapidly moving showers or thunderstorms. A derecho is defined as an event with a wind damage swath extending more than 240 miles that includes wind gusts of at least 58 mph or greater along most of its length. A typical derecho consists of numerous microbursts, downbursts, and downburst clusters.





HAILSTORMS

Hail forms inside a thunderstorm where there are strong updrafts of warm air and downdrafts of cold water. If a water droplet is picked up by the updrafts, it can be carried well above the freezing level. Water droplets freeze when temperatures reach 32 degrees Fahrenheit (°F) or colder. As the frozen droplet begins to fall, it might thaw as it moves into warmer air toward the bottom of the thunderstorm, or the droplet might be picked up again by another updraft and carried back into the cold air to re-freeze. With each trip above and below the freezing level, the frozen droplet adds another layer of ice. The frozen droplet, with many layers of ice, falls to the ground as hail (NSSL 2021).

TORNADOES

A tornado is a violently rotating column of air that extends from a thunderstorm to the ground with an average forward speed of 30 mph. Tornadoes typically develop from either a severe thunderstorm or hurricane as cool air rapidly overrides a layer of warm air. Tornadoes can occur at any time of the year, with peak seasons at different times for different states (NWS 2010).

HURRICANES

A hurricane is a tropical cyclone that attains hurricane status when its wind speed reaches at least 74 mph. A tropical cyclone is a rotating, organized system of clouds and thunderstorms that originates over tropical or sub-tropical waters and has a closed low-level circulation. Tropical depressions, tropical storms, and hurricanes are all considered tropical cyclones. These storms rotate counterclockwise around the center in the northern hemisphere and are accompanied by heavy rain and strong winds (NOAA 2023). Almost all tropical storms and hurricanes in the Atlantic Basin (which includes the Gulf of Mexico and Caribbean Sea) form between June and November, officially referred to as hurricane season. August and September are peak months for hurricane development in the North Atlantic Basin (NHC 2020).

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. They are fueled by a different heat mechanism than other cyclonic windstorms, such as nor'easters and polar lows. The characteristic that separates tropical cyclones from other cyclonic systems is that at any height in the atmosphere, the center of a tropical cyclone will be warmer than its surroundings, which is called a "warm core" storm system (NOAA 2023).

During hurricanes, storm surge causes backwater flooding by causing rising water elevations at coastal river mouths. Strong winds can increase tide levels and water-surface elevations in the connected bodies of water. Storm systems generate large waves that run up and can push high amounts of water inland along waterways opposite the direction of their typical flow, which can overtop banks and impact adjacent low-lying floodplains.

11.1.2 Location

THUNDERSTORMS AND LIGHTNING, HIGH WINDS, HAILSTORMS, AND TORNADOES

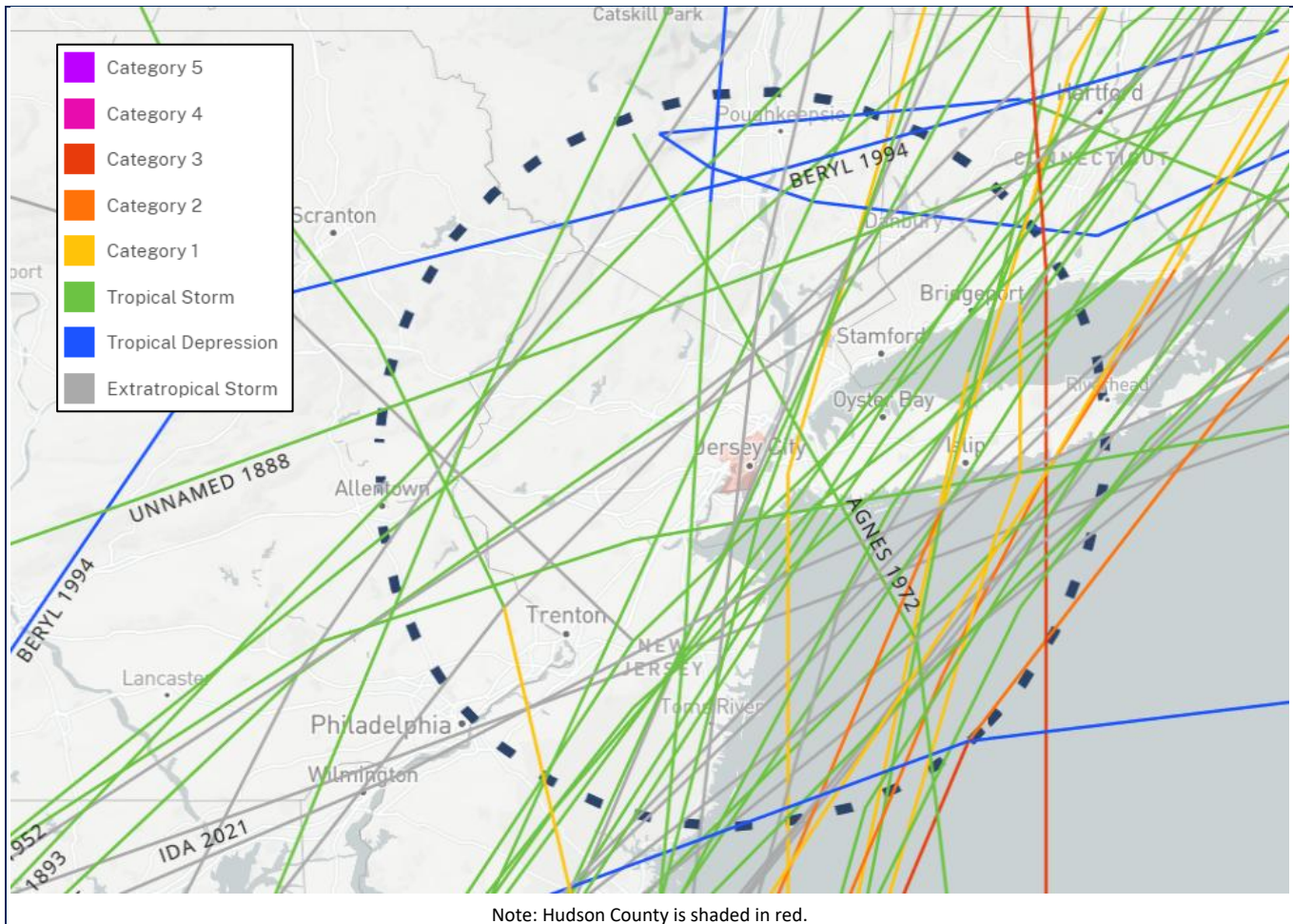
All of Hudson County is exposed to the elements of severe weather.



HURRICANES

Tropical systems develop in the Atlantic Ocean or in the warm waters of the Caribbean and Gulf of Mexico. They may move up the Atlantic coast or through the the Gulf Coast states, bringing wind and rain as far north as New England before moving offshore. Figure 11-1 displays tropical cyclones that tracked within 60 nautical miles of Hudson County (an approximate distance from the center of rotation where significant impacts could be felt) between 1861 and 2023.

Figure 11-1. Historical Tropical Storm and Hurricane Tracks 1861 to 2023

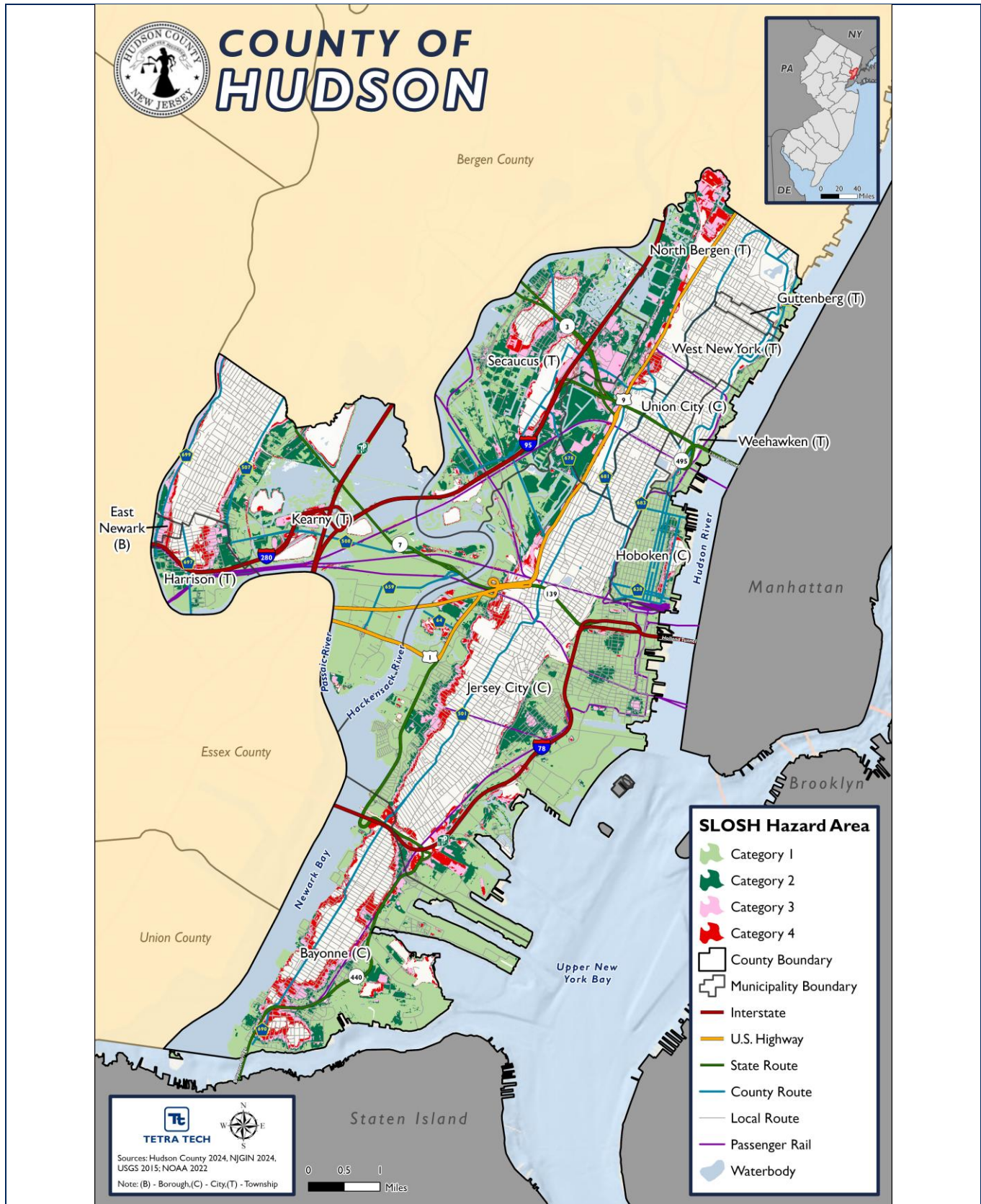


Source: NOAA 2023

Inundation from hurricane-caused storm surge has devastating impacts on the state's coastal communities. USACE in cooperation with FEMA, initially prepared SLOSH (Sea, Lake, and Overland Surges from Hurricanes) inundation maps (refer to Figure 11-2). SLOSH maps represent potential flooding from worst-case combinations of hurricane direction, forward speed, landfall point, and high astronomical tide. The SLOSH maps do not include riverine flooding caused by hurricane surge or inland freshwater flooding. The mapping was developed for the coastal communities in the State of New Jersey using the computer model to forecast surges that occur from wind and pressure forces of hurricanes coastline topography. In the State, hurricane category is the predominant factor in worst-case hurricane surges. The resulting inundation areas are grouped into Category 1 and 2 (dangerous), Category 3 (devastating), and Category 4 (catastrophic) classifications. The hurricane category refers to the Saffir/Simpson Hurricane Intensity Scale.



Figure 11-2. SLOSH Model (Categories 1 to 4) in Hudson County





11.1.3 Extent

THUNDERSTORMS AND LIGHTNING

Severe thunderstorm statements, watches, and warnings are issued by the local NWS office and the Storm Prediction Center (SPC). The NWS and SPC will update the watches and warnings and notify the public when they are no longer in effect. NWS issues the following statements, watches, and warnings for thunderstorms (NWS 2023):

- A **Special Weather Statement** is issued for strong storms that are below severe levels but may have impacts. It is usually reserved for the threat of wind gust of 40 to 57 mph or hail between a half and one inch in diameter.
- A **Severe Thunderstorm Watches** is issued when severe thunderstorms are possible in and near watch areas.
- A **Severe Thunderstorm Warning** is imminent or occurring that is either detected by weather radar or reported by storm spotters. A severe thunderstorm is one that produces winds 58 mph or stronger or hail that is at least one inch in diameter. A warning means to take shelter.

As depicted in Figure 11-3, the NWS has five categories for severe thunderstorm risk: marginal, slight, enhanced, moderate, and high. The probabilistic forecast expresses the best estimate of a severe weather event occurring within 25 miles of a point (NWS 2019).

Figure 11-3. Thunderstorm Risk

THUNDERSTORMS (no label)	1 - MARGINAL (MRGL)	2 - SLIGHT (SLGT)	3 - ENHANCED (ENH)	4 - MODERATE (MDT)	5 - HIGH (HIGH)
No severe* thunderstorms expected	Isolated severe thunderstorms possible	Scattered severe storms possible	Numerous severe storms possible	Widespread severe storms likely	Widespread severe storms expected
Lightning/flooding threats exist with <u>all</u> thunderstorms	Limited in duration and/or coverage and/or intensity	Short-lived and/or not widespread, isolated intense storms possible	More persistent and/or widespread, a few intense	Long-lived, widespread and intense	Long-lived, very widespread and particularly intense
					

* NWS defines a severe thunderstorm as measured wind gusts to at least 58 mph, and/or hail to at least one inch in diameter, and/or a tornado. All thunderstorm categories imply lightning and the potential for flooding. Categories are also tied to the probability of a severe weather event within 25 miles of your location.

Source: NWS 2019

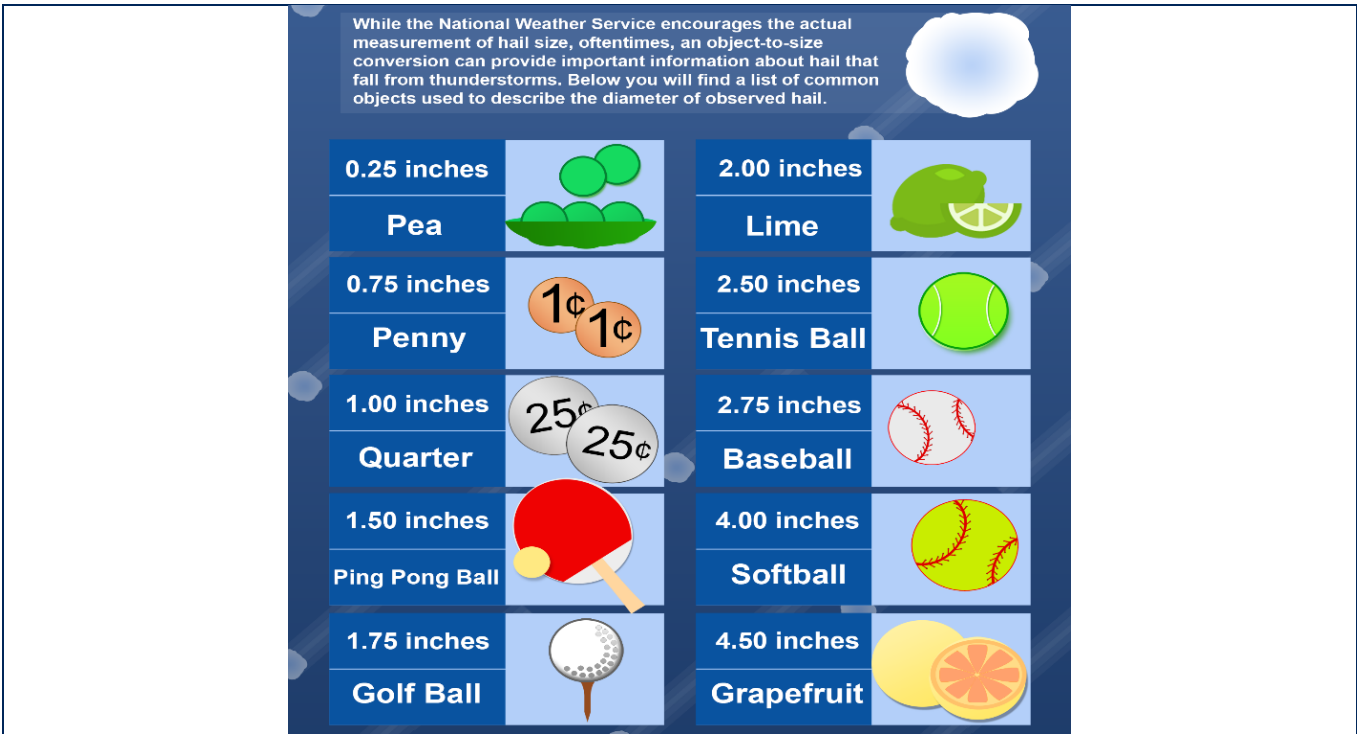
Currently, cloud-to-ground and intra-cloud lightning flashes are detected and mapped in real-time by two different networks: National Lightning Detection Network and the Earth Networks Total Lightning Network. These systems work by detecting radio atmospheric signals (sferics or spherics) emitted by fast electric currents (strokes) in lightning channels. A stroke can be a fast current within the cloud, or a return stroke in a channel to ground (NOAA n.d.).



HAILSTORMS

The severity of hail is measured by duration, hail size, and geographic extent. Hail can exhibit a variety of sizes, often estimated by comparing the hail to a known object (Figure 11-4). Most hailstorms are made up of a mix of different sizes, and only the very largest hail stones pose serious risk to people caught in the open (NSSL 2021).

Figure 11-4. Hail Size Reference Chart



Source: NWS 2023

HIGH WINDS

Table 11-1 provides the descriptions of wind events and their associated sustained speed used by the NWS. Another scale used to classify wind conditions is the Beaufort wind scale, which is provided in [Appendix H \(Supplementary Data\)](#).

Table 11-1. NWS Wind Descriptions

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

Source: NWS n.d.





The NWS issues advisories and warnings for winds that are typically site-specific. The NWS issues high wind advisories, watches, and warnings when wind speeds can pose a hazard or are life threatening. The criterion for each of these varies from state to state. Wind warnings and advisories are defined as the following (NWS 2012):

- **Wind Advisories** are issues when sustained winds of 30 to 39 mph are forecast for one hour or longer, or wind gusts of 46 to 57 mph for any duration.
- **High Wind Watches** are issued when there is the possibility that High Wind Warning Criteria may be met at longer ranges (24 to 48 hours out).
- **High Wind Warnings** are issued when sustained wind speeds of 40 mph or greater lasting for one hour or longer or for winds of 58 mph or greater for any duration or widespread damage are possible.

TORNADOES

The magnitude or severity of a tornado is categorized using the Enhanced Fujita (EF) Tornado Intensity Scale. This scale determines tornado ratings by comparing wind speed and actual damage. Figure 11-5 illustrates the relationship between EF ratings, wind speed, and expected tornado damage.

Figure 11-5 EF Scale Rating Descriptions

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

Source: NWS n.d)



Tornado watches and warning are issued by the local NWS office. A tornado watch is released when tornadoes are possible in an area. A tornado warning means a tornado has been sighted or indicated by weather radar. The current average lead time for tornado warnings is 13 minutes. Occasionally, tornadoes develop so rapidly that little, if any, advance warning is possible (NOAA 2011).

HURRICANES

Hurricane magnitude is measured using the Saffir-Simpson Hurricane Scale. The Saffir-Simpson Hurricane Wind Scale rates storms from Categories 1 to 5 (from least to most severe) based on a hurricane's sustained wind speed. This scale estimates potential property damage. Hurricanes reaching Category 3 and higher are considered major hurricanes because of their potential for significant loss of life and damage. Category 1 and 2 storms are still dangerous and require preventative measures (NOAA 2023). Table 11-2 presents this scale, which is used to estimate the potential property damage and flooding expected when a hurricane makes landfall.

Table 11-2. The Saffir-Simpson Hurricane Scale

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

Source: NOAA 2023

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 tropical cyclone watches and warnings (NOAA 2023):

- 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. The warning is issued 36 hours in advance of the anticipated onset of winds. It can remain in effect when dangerously high water or combination of dangerously high water and waves continue, even if winds are 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.

Hurricane Winds

In evaluating the potential for hazard events of a given magnitude, a mean return period (MRP) is often used. The MRP provides an estimate of the magnitude of an event that may occur within any given year based on past recorded events. MRP is the average period of time, in years, between occurrences of a particular hazard event, equal to the inverse of the annual frequency of exceedance (Dinicola 2009).

Hurricane return periods are the frequency at which a certain intensity of hurricane can be expected within a given distance of a given location. For example, a return period of 20 years for a major hurricane means that on average during the previous 100 years, a Category 3 or greater hurricane passed within 58 miles of a specific location approximately 5 times. According to the NHC, the return period of hurricanes for Hudson County was not calculated. However, the return period for surrounding counties is 18 to 19 years for a hurricane (greater than 64 mph winds) and 74 to 76 years for a major hurricane (greater than 110 mph winds) (NHC 2020).

Figure 11-6 and Figure 11-7 show the estimated maximum three-second gust wind speeds that can be anticipated in the study area associated with the 100- and 500-year MRP events. These peak wind speed projections were generated using HAZUS-MH model runs. The estimated hurricane track used for the 100- and 500-year event is also shown. The maximum three-second gust wind speeds for Hudson County is Category 1 hurricane speeds for the 100-year MRP event. The maximum three-second gust wind speeds for Hudson County is Category 2 hurricane speeds for the 500-year MRP event. The associated impacts and losses from these 100-year and 500-year MRP hurricane event model runs are reported in the Vulnerability Assessment.

Storm Surge

Storm surge is estimated by subtracting the regular/astrological tide level from the observed storm tide. Typical storm surge heights range from several feet to more than 25 feet. The exact height of the storm surge and which coastal areas will be flooded depends on many factors: strength, intensity, and speed of the hurricane or storm; the direction it is moving relative to the shoreline; how rapidly the sea floor is sloping along the shore; the shape and elevation of the shoreline; and the astronomical tide. Storm surge is most damaging when it occurs along a shallow sloped shoreline, during high tide, and in a highly populated and developed area.

Typically, storm surge is estimated by subtracting the regular/astrological tide level from the observed storm tide. Storm surge does not include flooding caused by precipitation. Figure 11-8 illustrates water level differences for storm surge, storm tide, and a normal (predicted) high tide as compared to sea level.



Figure 11-6. Wind Speeds for the 100-Year Mean Return Period Event

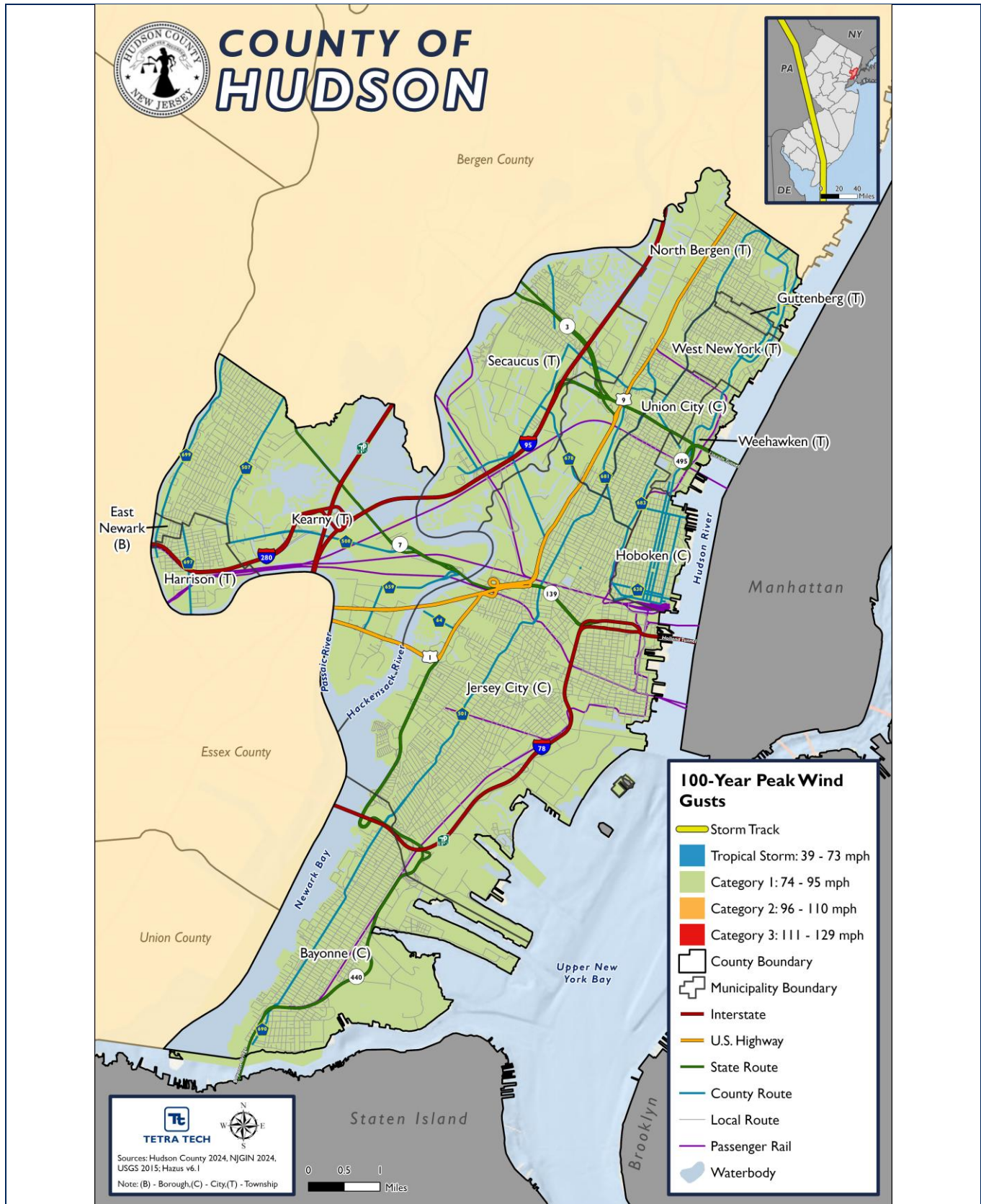




Figure 11-7. Wind Speeds for the 500-Year Mean Return Period Event

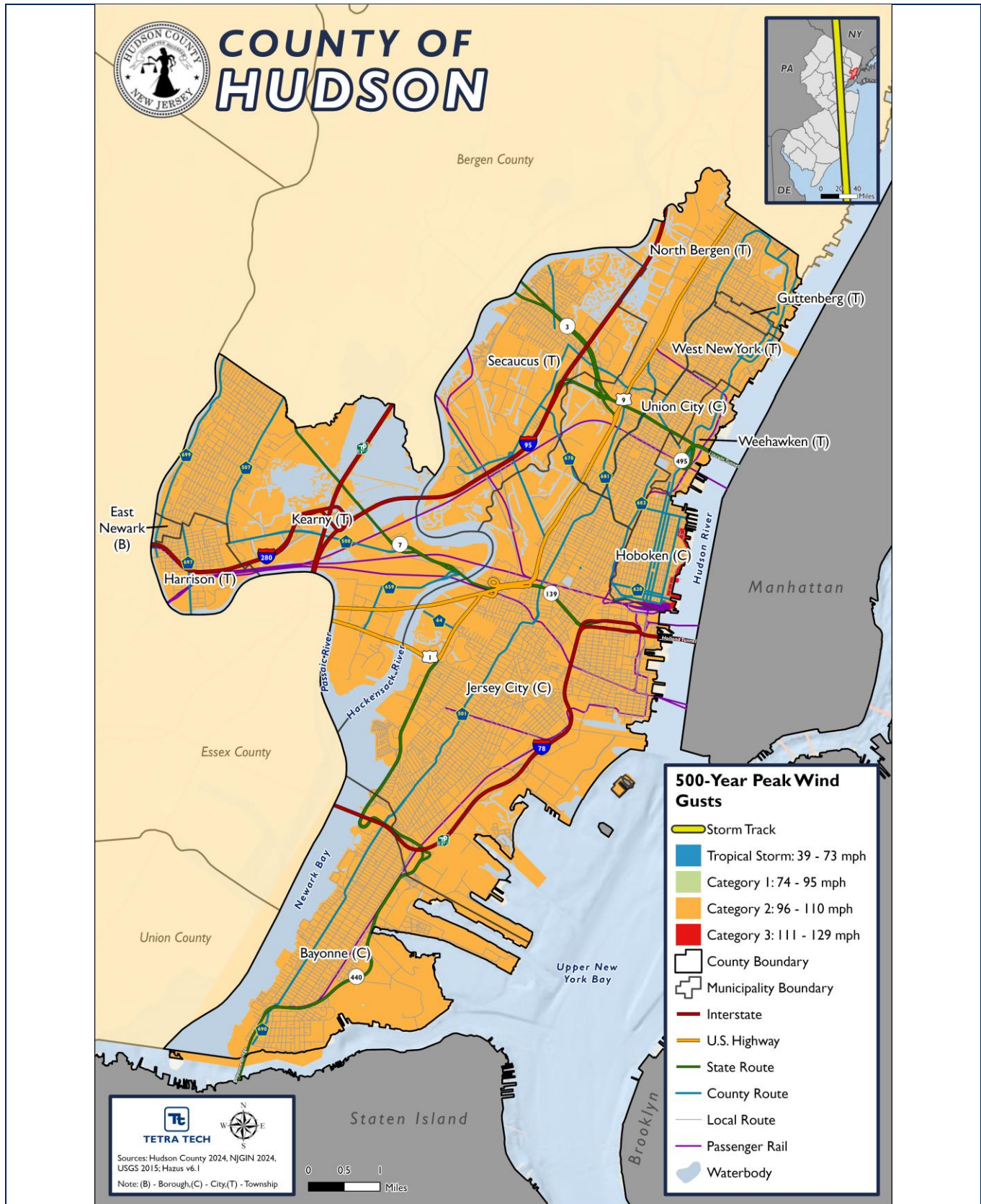
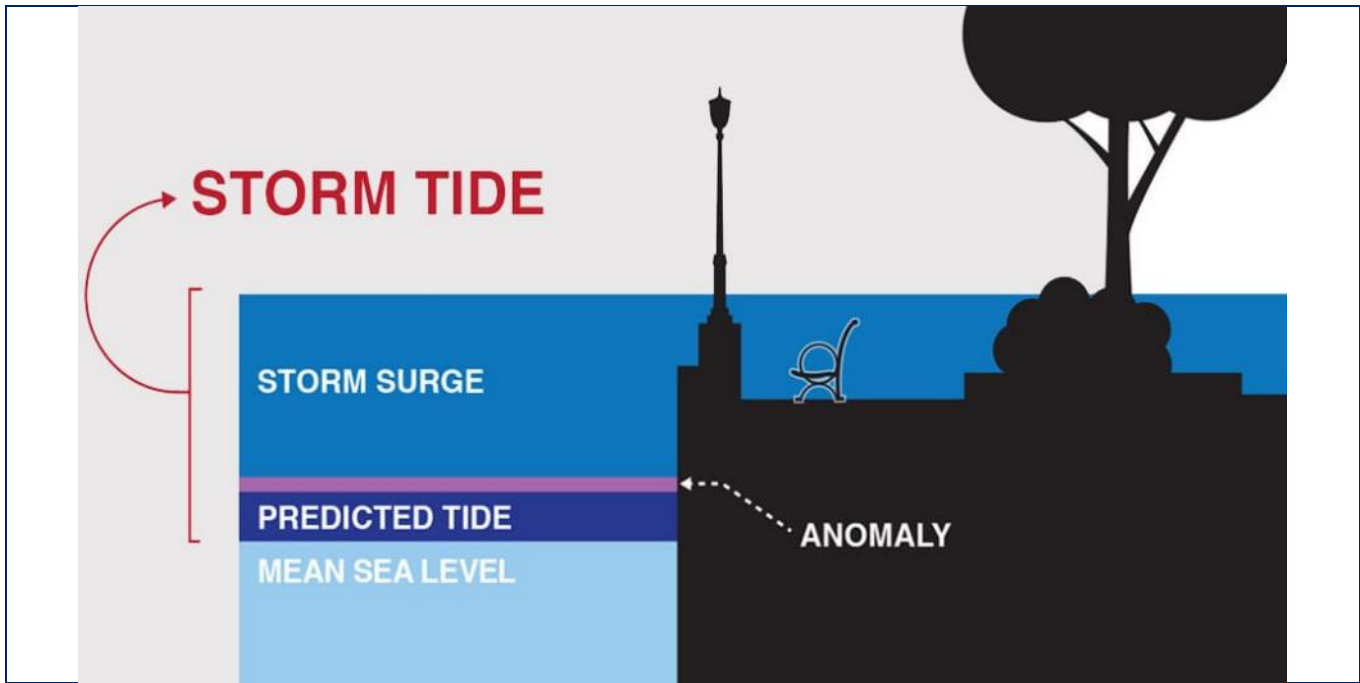




Figure 11-8. Storm Tide Diagram



Source: NOAA 2024

11.1.4 Previous Occurrences

FEMA MAJOR DISASTER AND EMERGENCY DECLARATIONS

Between 1954 and 2023, Hudson County was included in 10 major disaster (DR) or emergency (EM) declarations for severe weather-related events (FEMA 2024). Table 11-3 lists these declarations.

Table 11-3. FEMA Declarations for Severe Weather Events in Hudson County (1954 to 2023)

Event Date	Declaration Date	Declaration Number	Description
August 20, 1955	August 20, 1955	DR-41-NJ	Hurricane & Floods
October 18, 1996	November 19, 1996	DR-1145-NJ	Severe Storms and Flooding
September 16, 1999	September 17, 1999	EM-3148-NJ	Hurricane Floyd
August 29, 2005	September 19, 2005	EM-3257-NJ	Hurricane Katrina Evacuation
April 14, 2007	April 26, 2007	DR-1694-NJ	Severe Storms and Inland/Coastal Flooding
August 26, 2011	August 27, 2011	EM-3332-NJ	Hurricane Irene
August 27, 2011	August 31, 2011	DR-4021-NJ	Hurricane Irene
October 26, 2012	October 28, 2012	EM-3354-NJ	Hurricane Sandy
October 26, 2012	October 30, 2012	DR-4086-NJ	Hurricane Sandy
September 1, 2021	September 2, 2021	EM-3573-NJ	Remnants of Hurricane Ida
September 1, 2021	September 5, 2021	DR-4614-NJ	Remnants of Hurricane Ida

Sources: FEMA 2024



USDA DECLARATIONS

The Secretary of Agriculture from the U.S. Department of Agriculture (USDA) is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in contiguous counties. Between 2019 and 2023, Hudson County has not been included in any USDA Severe Weather-related agricultural disaster declarations.

PREVIOUS EVENTS

Known hazard events that impacted Hudson County between August 2019 and December 2023 are discussed in Table 11-4. For events prior to 2019, refer to the 2020 Hudson County HMP.

Table 11-4. Severe Weather Events in Hudson County (2019 to 2023)

Event Date	FEMA or State Declaration Number	Hudson County included in declaration?	Location Impacted	Description
October 31, 2019	N/A	N/A	Communipaw (Jersey City)	An unseasonably humid air mass ahead of a cold front triggered a severe thunderstorm that impacted Northeastern New Jersey. Thunderstorm winds of 60 mph recorded.
February 7, 2020	N/A	N/A	County-wide	Strong winds of 53 mph recorded in Bayonne.
April 13, 2020	N/A	N/A	County-wide	Deep low pressure passed to the west of the area resulting in high winds. Law enforcement reported a tree down on 33rd Street, blocking the road in Union City.
August 4, 2020	N/A	N/A	County-wide	Hurricane Isaias passed through the New York City area on August 4, 2020. Northeastern NJ recorded sustained wind speeds of 35 to 50 mph and gusts of 60 to 70, resulting in widespread wind damage, power outages, and mass transit disruptions.
November 15, 2020	N/A	N/A	Granton Junction (North Bergen), Babbitt (North Bergen), Communipaw (Jersey City)	A strong cold front triggered convective showers and thunderstorms across northeastern New Jersey. In Jersey City, wind gusts of 68 mph were recorded. Winds resulted in downed trees and power outages in North Bergen.
December 25, 2020	N/A	N/A	County-wide	A cold front with high winds ahead of it passed through during the early morning hours. A sustained wind of 42 mph was measured at a mesonet station located in Weehawken. A sustained wind of 40 mph was measured at a mesonet station located in Harrison. Additionally, Law Enforcement reported a partial collapse of the roof, fire escape, and cornice at 1st Street and Willow Avenue in Hoboken. At Robbins Reef lighthouse, a measured sustained wind of 54 mph, and a wind gust of 78 mph. Robbins Reef winds are measured at an elevation of 69 feet.



Event Date	FEMA or State Declaration Number	Hudson County included in declaration?	Location Impacted	Description
January 29, 2021	N/A	N/A	County-wide	High winds occurred over the region as high pressure built in from the west behind a strengthening coastal low-pressure system heading northeast after passing well to the south. A measured sustained wind of 45 mph occurred at nearby Robbins Reef Lighthouse at an elevation of 69 feet above ground.
March 26, 2021	N/A	N/A	County-wide	A low-pressure center moved across the Northeast, dragging a cold front across northeastern New Jersey with high winds. A wind gust of 62 mph occurred at Robbins Reef Lighthouse at an elevation of 69 feet above ground level.
April 30, 2021	N/A	N/A	County-wide	After a cold front passage during the predawn hours, an associated low pressure system strengthened along the New England Coast, tightening the pressure gradient and causing high winds across parts of Northeastern New Jersey. A wind gust of 65 mph occurred at a mesonet station in Jersey City.
September 2, 2021	EM-3573-NJ DR-4614-NJ	Yes	County-wide	Extremely heavy rainfall associated with the remnants of Hurricane Ida resulted in numerous road closures and water rescues throughout the County. Rainfall totals ranged from five to eight inches.
December 6, 2021	N/A	N/A	Greenville	A cold front triggered quasi-convective shower across northeastern New Jersey. Thunderstorm wind gusts of 58 were recorded at Honorable William Wall station near Jersey City.
November 30, 2022	N/A	N/A	County-wide	The pressure gradient tightened as a cold front approached from the west. This produced high winds over Southeastern New Jersey in the late afternoon to early evening hours. A measured wind gust of 60 mph was recorded at a mesonet station located in Jersey City, NJ
December 23, 2022	N/A	N/A	County-wide	A strong low-pressure system centered near the eastern Great Lakes Region continued to strengthen as it moved northeast. It brought high winds over northeastern New Jersey that morning as the pressure gradient tightened over the area. A trained spotter reported a downed tree across Davis Avenue in Harrison, NJ.
February 3, 2023	N/A	N/A	County-wide	An arctic cold front passed through the region during the morning of February 3, 2023. Strong cold air advection along with a tightening pressure gradient produced high winds over Northeastern New Jersey during the late afternoon into early evening hours of this day. A measured wind gust of 62 mph was recorded at a mesonet station located at Robbins Reef, NJ at an elevation of 70 feet.

Sources: FEMA 2024; NOAA NCEI 2024



11.1.5 Probability of Future Occurrences

PROBABILITY BASED ON PREVIOUS OCCURRENCES

Information on previous severe weather occurrences in the county was used to calculate the probability of future occurrence of such events, as summarized in Table 11-5. Based on historical records and input from the Steering Committee, the probability of occurrence for severe weather in the County is considered “occasional.”

Table 11-5. Probability of Future Severe Weather Events in Hudson County

Hazard Type	Number of Occurrences Between 1996 and 2023	Percent Chance of Occurring in Any Given Year
Hailstorms	15	54%
Heavy Rain	16	57%
High Winds	33	100%
Lightning	5	18%
Storm Surge	0	0%
Strong Winds	15	54%
Thunderstorm Winds	60	100%
Hurricanes	4	14%
Total	148	100%

Sources: NOAA NCEI 2024

Notes: Due to limitations in data, not all Severe Weather events occurring between 1954 and 1996 are accounted for in the tally of occurrences. As a result, the number of hazard occurrences is calculated using the number of occurrences between 1996 and 2023. Hurricanes include tropical storms.

EFFECT OF CLIMATE CHANGE ON FUTURE PROBABILITY

A warmer atmosphere means storms have the potential to be more intense and occur more often. In the State of New Jersey, extreme storms typically include coastal nor'easters, snowstorms, spring and summer thunderstorms, tropical storms, and on rare occasions hurricanes. Most of these events occur in the warmer months between April and October, with nor'easters occurring between September and April. Over the last 50 years, in the State of New Jersey, storms that resulted in extreme rain increased by 71 percent which is a faster rate than anywhere else in the United States (NJDEP 2020).

11.1.6 Cascading Impacts on Other Hazards

Severe weather may exacerbate flooding and dam failures. As discussed, the heavy precipitation associated with these events can create major flooding issues in the County. Strong winds can be destructive to the functionality of utilities by breaching power lines and disconnecting the utility systems, as well as result in falling trees and branches. Fallen trees and branches increases available fuel for wildfires. For more information on the wildfire hazard, refer to Chapter 13 (Wildfire) for more information about this hazard of concern.



11.2 Vulnerability and Impact Assessment

To understand risk, a community must evaluate what assets are exposed or vulnerable in the hazard area identified. The entire County has been identified as exposed for severe storms. Therefore, all assets in the County (population, structures, critical facilities, and lifelines), as described in the County Profile (Chapter 3), are exposed and vulnerable to severe storm events.

11.2.1 Life, Health, and Safety

The impact of severe weather events 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.

OVERALL POPULATION

The entire population of Hudson County (724,854) is exposed to this hazard; however, the impact of these events can have on life, health, and safety are dependent upon several factors, including the severity of the event and whether adequate warning time was provided to residents.

Outdoor workers are vulnerable to severe weather events. Employers should prepare for the hazards associated with adverse weather conditions that may require special facilities and safety equipment being provided to employees, or in some instances, work stoppage to ensure the safety and health of workers. Wet weather and high wind conditions can pose a greater threat to employees working in the construction and shipbuilding industries. For instance, workers in the construction industry are bound to work in open spaces, at heights, with electrical equipment and metals, in excavation areas and trenches, and may handle hazardous materials as a work task, thereby causing exposure to a myriad of safety hazards (Hazardous OSHA 2020).

Storm Surge

Table 11-6 presents the distribution of people residing in different SLOSH category hazard areas across jurisdictions in Hudson County. The City of Hoboken has the highest percentage of its population in all four SLOSH hazard areas, with nearly 99 percent in Category 4. In contrast, the City of Union City has no population in any SLOSH hazard area. The City of Jersey City has the largest number of people at risk in all four SLOSH hazard areas, with 52,480 in Category 1, 70,435 in Category 2, 78,550 in Category 3, and lastly, 91,849 in Category 4. Overall, 30.4 percent of Hudson County's population is in the Category 4 hazard area.

Hurricane and Other High Winds

As a result of a significant hurricane event, residents may be displaced or require temporary to long-term sheltering. The number of people requiring shelter is generally less than the number displaced as some displaced persons use hotels or stay with family or friends following a disaster event. Hazus estimates that there will be 95 displaced households and 64 persons seeking short-term shelter from the 100-year MRP event. Further, Hazus estimates that there will be 3,259 households displaced and 2,526 persons seeking short-term sheltering caused by the 500-year MRP event (Table 11-7).



Table 11-6. Population in the SLOSH Hazard Areas

Jurisdiction	Total Population	Population in the Category 1 SLOSH Hazard Area		Population in the Category 2 SLOSH Hazard Area		Population in the Category 3 SLOSH Hazard Area		Population in the Category 4 SLOSH Hazard Area	
		Number of People	Percent Total	Number of People	Percent Total	Number of People	Percent Total	Number of People	Percent Total
Bayonne (C)	71,686	8,574	12.0%	13,467	18.8%	20,576	28.7%	34,175	47.7%
East Newark (B)	2,594	0	0.0%	13	0.5%	589	22.7%	1,435	55.3%
Guttenberg (T)	12,017	709	5.9%	1,002	8.3%	1,383	11.5%	1,846	15.4%
Harrison (T)	19,450	276	1.4%	2,538	13.0%	5,904	30.4%	10,455	53.8%
Hoboken (C)	60,419	51,037	84.5%	57,457	95.1%	58,949	97.6%	59,638	98.7%
Jersey City (C)	292,449	52,480	17.9%	70,435	24.1%	78,550	26.9%	91,849	31.4%
Kearny (T)	41,999	861	2.1%	2,139	5.1%	3,317	7.9%	4,300	10.2%
North Bergen (T)	63,361	160	0.3%	222	0.4%	915	1.4%	2,930	4.6%
Secaucus (T)	22,181	1,190	5.4%	5,727	25.8%	9,264	41.8%	11,895	53.6%
Union City (C)	68,589	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Weehawken (T)	17,197	1,026	6.0%	1,053	6.1%	1,053	6.1%	1,053	6.1%
West New York (T)	52,912	310	0.6%	443	0.8%	457	0.9%	457	0.9%
Hudson County (Total)	724,854	116,623	16.1%	154,496	21.3%	180,957	25.0%	220,033	30.4%

Source: NJOIT, GIS 2024; Microsoft BING 2019; NOAA 2022



Table 11-7. Estimated Displaced Households and Persons Seeking Shelter Caused by the 100- and 500- Year MRP Hurricane Events

Jurisdiction	100-Year MRP Hurricane		500-Year MRP Hurricane	
	Displaced Households	Persons Seeking Short-Term Sheltering	Displaced Households	Persons Seeking Short-Term Sheltering
Bayonne (C)	25	20	363	297
East Newark (B)	0	0	4	5
Guttenberg (T)	0	0	56	51
Harrison (T)	3	2	44	37
Hoboken (C)	13	3	516	194
Jersey City (C)	40	25	1343	787
Kearny (T)	3	3	71	92
North Bergen (T)	1	1	199	284
Secaucus (T)	3	3	57	34
Union City (C)	2	3	285	437
Weehawken (T)	3	2	135	74
West New York (T)	2	2	186	234
Hudson County (Total)	95	64	3,259	2,526

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

SOCIALLY VULNERABLE POPULATION

Research has shown that some populations, while they may not have more hazard exposure, may experience exacerbated impacts and prolonged recovery if/when impacted. This is due to many factors, including their physical and financial ability to react or respond during a hazard. Of the population exposed, the most vulnerable include the economically disadvantaged and the population over age 65. Economically disadvantaged populations may be more vulnerable because they are likely to evaluate their risk and make decisions to evacuate based on net economic impacts on their families. The population over the age of 65 is more vulnerable because they are more likely to need medical attention, which may not be available due to isolation during a flood event, and they may have more difficulty evacuating.

Table 11-8 through Table 11-11 highlight the distribution of socially vulnerable populations residing in different SLOSH hazard categories. In the Category 1 SLOSH hazard area, the City of Jersey City has the highest number of vulnerable individuals, to include 5,862 persons over the age of 65, 3,674 persons under the age of 5 years, 5,216 non-English speakers, 4,018 persons with a disability, and 7,740 persons living in poverty. The Borough of East Newark and The City of Union City have no vulnerable populations in this category. The City of Jersey City leads again for the highest number of vulnerable persons located in the Category 2 hazard area, with 7,868 persons over the age of 65, 4,931 persons under the age of 5 years, 7,001 non-English speakers, 5,394 persons with a disability, and 10,388 persons living in poverty. The City of Union City has no vulnerable populations in this category. The City of Jersey City also leads in the highest number of vulnerable populations for Category 3 and Category 4 SLOSH hazard areas.



Table 11-8. Estimated Vulnerable Person Located in the Category 1 SLOSH Hazard Area

Jurisdiction	Estimated Number of Vulnerable Persons Located in the Category 1 SLOSH Hazard Area									
	Over 65	Percent of Jurisdiction Total	Under 5	Percent of Jurisdiction Total	Non-English Speaking	Percent of Jurisdiction Total	Disability	Percent of Jurisdiction Total	Poverty Level	Percent of Jurisdiction Total
Bayonne (C)	1,191	12.0%	611	12.0%	676	11.9%	820	12.0%	1,006	12.0%
East Newark (B)	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Guttenberg (T)	95	5.9%	47	5.8%	119	5.9%	78	5.8%	110	5.9%
Harrison (T)	29	1.4%	16	1.4%	58	1.4%	20	1.4%	38	1.4%
Hoboken (C)	3,259	84.5%	3,463	84.5%	2,206	84.4%	2,597	84.5%	3,810	84.5%
Jersey City (C)	5,862	17.9%	3,674	17.9%	5,216	17.9%	4,018	17.9%	7,740	17.9%
Kearny (T)	112	2.0%	55	2.0%	115	2.0%	65	2.0%	87	2.0%
North Bergen (T)	26	0.2%	9	0.2%	27	0.2%	15	0.2%	18	0.2%
Secaucus (T)	179	5.3%	56	5.3%	115	5.3%	104	5.3%	60	5.3%
Union City (C)	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Weehawken (T)	122	6.0%	59	5.9%	75	5.9%	63	5.9%	74	5.9%
West New York (T)	39	0.6%	13	0.5%	75	0.6%	34	0.6%	62	0.6%
Hudson County (Total)	10,914	12.6%	8,003	17.1%	8,682	9.3%	7,814	12.8%	13,005	13.1%

Source: US Census Bureau, ACS 5-Year Estimates; NOAA 2022

**Table 11-9. Estimated Vulnerable Person Located in the Category 2 SLOSH Hazard Area**

Jurisdiction	Estimated Number of Vulnerable Persons Located in the Category 2 SLOSH Hazard Area									
	Over 65	Percent of Jurisdiction Total	Under 5	Percent of Jurisdiction Total	Non-English Speaking	Percent of Jurisdiction Total	Disability	Percent of Jurisdiction Total	Poverty Level	Percent of Jurisdiction Total
Bayonne (C)	1,871	18.8%	959	18.8%	1,063	18.8%	1,288	18.8%	1,581	18.8%
East Newark (B)	1	0.3%	0	0.0%	2	0.4%	1	0.5%	3	0.5%
Guttenberg (T)	135	8.3%	67	8.3%	168	8.3%	111	8.3%	156	8.3%
Harrison (T)	269	13.0%	154	13.0%	534	13.0%	188	13.0%	354	13.0%
Hoboken (C)	3,669	95.1%	3,899	95.1%	2,483	95.1%	2,924	95.1%	4,289	95.1%
Jersey City (C)	7,868	24.1%	4,931	24.1%	7,001	24.1%	5,394	24.1%	10,388	24.1%
Kearny (T)	278	5.1%	137	5.1%	286	5.1%	162	5.1%	217	5.1%
North Bergen (T)	36	0.3%	13	0.3%	38	0.3%	21	0.3%	25	0.3%
Secaucus (T)	866	25.8%	272	25.8%	555	25.8%	503	25.8%	289	25.8%
Union City (C)	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Weehawken (T)	125	6.1%	61	6.1%	77	6.1%	65	6.1%	76	6.1%
West New York (T)	55	0.8%	19	0.8%	108	0.8%	48	0.8%	89	0.8%
Hudson County (Total)	15,173	17.5%	10,512	22.4%	12,315	13.2%	10,705	17.5%	17,467	17.5%

Source: US Census Bureau, ACS 5-Year Estimates; NOAA 2022



Table 11-10. Estimated Vulnerable Person Located in the Category 3 SLOSH Hazard Area

Jurisdiction	Estimated Number of Vulnerable Persons Located in the Category 3 SLOSH Hazard Area									
	Over 65	Percent of Jurisdiction Total	Under 5	Percent of Jurisdiction Total	Non-English Speaking	Percent of Jurisdiction Total	Disability	Percent of Jurisdiction Total	Poverty Level	Percent of Jurisdiction Total
Bayonne (C)	2,859	28.7%	1,466	28.7%	1,624	28.7%	1,969	28.7%	2,416	28.7%
East Newark (B)	69	22.4%	24	22.6%	107	22.6%	47	22.5%	144	22.6%
Guttenberg (T)	186	11.5%	93	11.5%	232	11.5%	153	11.4%	215	11.5%
Harrison (T)	626	30.3%	359	30.3%	1,243	30.3%	438	30.3%	825	30.4%
Hoboken (C)	3,765	97.6%	4,000	97.6%	2,548	97.5%	3,000	97.6%	4,401	97.6%
Jersey City (C)	8,775	26.9%	5,499	26.9%	7,808	26.9%	6,015	26.9%	11,585	26.9%
Kearny (T)	432	7.9%	213	7.9%	444	7.9%	252	7.9%	336	7.9%
North Bergen (T)	151	1.4%	55	1.4%	158	1.4%	88	1.4%	106	1.4%
Secaucus (T)	1,400	41.7%	441	41.8%	898	41.8%	814	41.7%	468	41.7%
Union City (C)	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Weehawken (T)	125	6.1%	61	6.1%	77	6.1%	65	6.1%	76	6.1%
West New York (T)	57	0.9%	20	0.8%	112	0.9%	50	0.9%	92	0.9%
Hudson County (Total)	18,445	21.3%	12,231	26.1%	15,251	16.3%	12,891	21.1%	20,664	20.8%

Source: US Census Bureau, ACS 5-Year Estimates; NOAA 2022



**Table 11-11. Estimated Vulnerable Person Located in the Category 4 SLOSH Hazard Area**

Jurisdiction	Estimated Number of Vulnerable Persons Located in the Category 4 SLOSH Hazard Area									
	Over 65	Percent of Jurisdiction Total	Under 5	Percent of Jurisdiction Total	Non-English Speaking	Percent of Jurisdiction Total	Disability	Percent of Jurisdiction Total	Poverty Level	Percent of Jurisdiction Total
Bayonne (C)	4,749	47.7%	2,435	47.7%	2,697	47.7%	3,270	47.7%	4,012	47.7%
East Newark (B)	170	55.2%	58	54.7%	262	55.3%	115	55.0%	353	55.3%
Guttenberg (T)	248	15.3%	124	15.3%	309	15.3%	205	15.3%	288	15.4%
Harrison (T)	1,109	53.7%	635	53.7%	2,202	53.7%	776	53.7%	1,461	53.8%
Hoboken (C)	3,809	98.7%	4,047	98.7%	2,578	98.7%	3,035	98.7%	4,452	98.7%
Jersey City (C)	10,260	31.4%	6,430	31.4%	9,130	31.4%	7,033	31.4%	13,547	31.4%
Kearny (T)	559	10.2%	276	10.2%	575	10.2%	327	10.2%	436	10.2%
North Bergen (T)	485	4.6%	177	4.6%	506	4.6%	283	4.6%	339	4.6%
Secaucus (T)	1,798	53.6%	566	53.6%	1,153	53.6%	1,046	53.6%	601	53.6%
Union City (C)	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Weehawken (T)	125	6.1%	61	6.1%	77	6.1%	65	6.1%	76	6.1%
West New York (T)	57	0.9%	20	0.8%	112	0.9%	50	0.9%	92	0.9%
Hudson County (Total)	23,369	27.0%	14,829	31.7%	19,601	21.0%	16,205	26.5%	25,657	25.8%

Source: US Census Bureau, ACS 5-Year Estimates; NOAA 2022



11.2.2 General Building Stock

All buildings are exposed to severe weather hazards such as hailstorms and lightning strikes. While hailstorms are not frequently known to cause major injuries or damage in New Jersey, an extreme event can carry hail stones at speeds greater than 100 miles per hour (National Weather Service 2019). This could cause structural damage for the general building stock in the County. Severe summer weather that causes lightning could be a threat to the County's general building stock if the lightning starts a fire. Over 22,000 fires caused by lightning occurred annually throughout the U.S. between 2007 and 2011, which was valued at approximately \$450 million of damages per year (National Fire Protection Association 2013).

STORM SURGE

Understanding the distribution of buildings in SLOSH hazard areas is crucial for assessing potential risks and economic impacts in Hudson County. Table 11-12 and Table 11-13 provides an overview of the number and replacement cost value of buildings located in the SLOSH hazard areas across various jurisdictions within the county. The City of Hoboken has the highest number of buildings in all four SLOSH hazard areas, with 11,843 buildings in Category 1, 13,370 in Category 2, 13,839 buildings in Category 3, and 14,064 in Category 4. However, the City of Jersey City leads with the highest replacement cost values in each category; \$11 billion in Category 1, \$15 billion in Category 2, \$16 billion in Category 3, and \$ 17 billion in Category 4. The replacement cost value of these buildings is significant, highlighting the potential economic impact of storm surges.

Hudson County has a significant number of buildings located in SLOSH hazard areas, highlighting the potential risk from storm surges. In the Category 1 hazard area, there are 18,592 residential buildings, 1,225 commercial buildings, 1,597 industrial buildings, and 890 buildings classified as "other," which include government, religious, agricultural, and educational structures. These numbers increase in Category 2 to 23,720 residential buildings, 1,802 commercial buildings, 1,995 industrial buildings, and 1,182 other buildings. Category 3 sees further increases, with 27,004 residential buildings, 2,229 commercial buildings, 2,127 industrial buildings, and 1,337 other buildings. Finally, in Category 4, there are 31,515 residential buildings, 2,604 commercial buildings, 2,217 industrial buildings, and 1,526 other buildings.

Table 11-14 and Table 11-15 provide a breakdown of these numbers by jurisdiction, offering insights into the distribution of buildings at risk across different areas within Hudson County.

HURRICANE AND OTHER HIGH WINDS

For hurricane and other high wind events, building construction plays a major role in the extent of damage. Residential structures are generally more susceptible to wind damage than commercial and industrial structures. Wood and masonry buildings tend to experience more damage than concrete or steel buildings. High-rise buildings are very vulnerable structures. Mobile homes are the most vulnerable to damage, even if tied down. The Hazus hurricane wind model was run to estimate potential losses to buildings. Expected building damage was evaluated across the following wind damage categories: no damage/very minor damage, minor damage, moderate damage, severe damage, and total destruction. Table 11-16 summarizes the definition of the damage categories.

**Table 11-12. Buildings in the Category 1 and 2 SLOSH Hazard Area**

Jurisdiction	Jurisdiction Total Buildings		Buildings in Category 1 SLOSH Hazard Area				Buildings in Category 2 SLOSH Hazard Area			
			Number of Buildings		Replacement Cost Value		Number of Buildings		Replacement Cost Value	
	Count	Replacement Cost Value	Count	% of Jurisdiction Total	Value	% of Jurisdiction Total	Count	% of Jurisdiction Total	Value	% of Jurisdiction Total
Bayonne (C)	9,264	\$11,278,964,959	1,877	20.3%	\$4,222,041,098	37.4%	2,561	27.6%	\$5,395,068,249	47.8%
East Newark (B)	434	\$300,712,303	1	0.2%	\$1,601,769	0.5%	11	2.5%	\$47,665,867	15.9%
Guttenberg (T)	2,574	\$1,062,772,505	150	5.8%	\$92,528,397	8.7%	207	8.0%	\$113,751,115	10.7%
Harrison (T)	2,646	\$2,812,269,922	91	3.4%	\$1,087,074,231	38.7%	414	15.6%	\$1,732,792,311	61.6%
Hoboken (C)	14,289	\$6,922,849,652	11,843	82.9%	\$5,838,382,906	84.3%	13,370	93.6%	\$6,346,248,021	91.7%
Jersey City (C)	38,336	\$29,829,276,781	7,252	18.9%	\$11,474,465,546	38.5%	9,755	25.4%	\$14,876,225,158	49.9%
Kearny (T)	7,207	\$9,630,626,567	551	7.6%	\$5,313,922,062	55.2%	855	11.9%	\$6,190,109,947	64.3%
North Bergen (T)	6,002	\$9,906,706,329	71	1.2%	\$561,623,503	5.7%	153	2.5%	\$2,797,013,276	28.2%
Secaucus (T)	3,844	\$12,075,088,549	267	6.9%	\$3,040,659,861	25.2%	1,153	30.0%	\$8,182,403,520	67.8%
Union City (C)	1,729	\$4,009,712,429	0	0.0%	\$0	0.0%	0	0.0%	\$0	0.0%
Weehawken (T)	2,112	\$1,638,112,105	170	8.0%	\$509,711,071	31.1%	174	8.2%	\$587,120,098	35.8%
West New York (T)	4,594	\$3,076,856,343	31	0.7%	\$243,770,001	7.9%	46	1.0%	\$277,053,042	9.0%
Hudson County (Total)	93,031	\$92,543,948,444	22,304	24.0%	\$32,385,780,444	35.0%	28,699	30.8%	\$46,545,450,604	50.3%

Source: NJOIT, GIS 2024; Microsoft BING 2019; RS Means 2024; NOAA 2022

**Table 11-13. Buildings in the Category 3 and 4 SLOSH Hazard Area**

Jurisdiction	Jurisdiction Total Buildings		Buildings in Category 3 SLOSH Hazard Area				Buildings in Category 4 SLOSH Hazard Area			
			Number of Buildings		Replacement Cost Value		Number of Buildings		Replacement Cost Value	
	Count	Replacement Cost Value	Count	% of Jurisdiction Total	Value	% of Jurisdiction Total	Count	% of Jurisdiction Total	Value	% of Jurisdiction Total
Bayonne (C)	9,264	\$11,278,964,959	3,404	36.7%	\$6,397,556,411	56.7%	4,975	53.7%	\$7,765,048,711	68.8%
East Newark (B)	434	\$300,712,303	112	25.8%	\$187,129,871	62.2%	252	58.1%	\$235,969,989	78.5%
Guttenberg (T)	2,574	\$1,062,772,505	281	10.9%	\$136,640,484	12.9%	371	14.4%	\$169,927,275	16.0%
Harrison (T)	2,646	\$2,812,269,922	847	32.0%	\$1,982,782,174	70.5%	1,434	54.2%	\$2,281,013,461	81.1%
Hoboken (C)	14,289	\$6,922,849,652	13,839	96.9%	\$6,555,445,768	94.7%	14,064	98.4%	\$6,674,645,372	96.4%
Jersey City (C)	38,336	\$29,829,276,781	10,818	28.2%	\$15,986,330,951	53.6%	12,498	32.6%	\$17,033,306,753	57.1%
Kearny (T)	7,207	\$9,630,626,567	1,065	14.8%	\$6,362,369,050	66.1%	1,234	17.1%	\$6,506,189,027	67.6%
North Bergen (T)	6,002	\$9,906,706,329	300	5.0%	\$3,912,288,917	39.5%	591	9.8%	\$5,026,660,826	50.7%
Secaucus (T)	3,844	\$12,075,088,549	1,808	47.0%	\$9,997,760,391	82.8%	2,219	57.7%	\$10,285,056,179	85.2%
Union City (C)	1,729	\$4,009,712,429	0	0.0%	\$0	0.0%	0	0.0%	\$0	0.0%
Weehawken (T)	2,112	\$1,638,112,105	176	8.3%	\$588,949,188	36.0%	177	8.4%	\$591,520,181	36.1%
West New York (T)	4,594	\$3,076,856,343	47	1.0%	\$296,750,758	9.6%	47	1.0%	\$296,750,758	9.6%
Hudson County (Total)	93,031	\$92,543,948,444	32,697	35.1%	\$52,404,003,963	56.6%	37,862	40.7%	\$56,866,088,532	61.4%

Source: NJOIT, GIS 2024; Microsoft BING 2019; RS Means 2024; NOAA 2022

**Table 11-14. Buildings in the SLOSH Categories 1 and 2 Hazard Area by General Occupancy Class**

Jurisdiction	Category 1 SLOSH Hazard Area				Category 2 SLOSH Hazard Area			
	Residential	Commercial	Industrial	Other ^a	Residential	Commercial	Industrial	Other ^a
Bayonne (C)	913	61	823	80	1,434	101	923	103
East Newark (B)	0	0	1	0	2	0	9	0
Guttenberg (T)	138	0	0	12	195	0	0	12
Harrison (T)	31	8	37	15	285	40	54	35
Hoboken (C)	11,185	430	27	201	12,592	533	27	218
Jersey City (C)	5,872	636	320	424	7,881	908	418	548
Kearny (T)	128	22	319	82	318	61	364	112
North Bergen (T)	13	30	11	17	18	41	62	32
Secaucus (T)	176	14	49	28	847	94	127	85
Union City (C)	0	0	0	0	0	0	0	0
Weehawken (T)	115	20	10	25	118	20	11	25
West New York (T)	21	4	0	6	30	4	0	12
Hudson County (Total)	18,592	1,225	1,597	890	23,720	1,802	1,995	1,182

Source: NJOIT, GIS 2024; Microsoft BING 2019; RS Means 2024; NOAA 2022

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

**Table 11-15. Buildings in the SLOSH Categories 3 and 4 Hazard Area by General Occupancy Class**

Jurisdiction	Category 3 SLOSH Hazard Area				Category 4 SLOSH Hazard Area			
	Residential	Commercial	Industrial	Other ^a	Residential	Commercial	Industrial	Other ^a
Bayonne (C)	2,191	150	932	131	3,639	222	949	165
East Newark (B)	87	4	19	2	212	16	19	5
Guttenberg (T)	269	0	0	12	359	0	0	12
Harrison (T)	663	69	64	51	1,174	125	67	68
Hoboken (C)	12,919	666	27	227	13,070	734	27	233
Jersey City (C)	8,789	987	460	582	10,277	1,069	499	653
Kearny (T)	493	78	367	127	639	92	367	136
North Bergen (T)	74	74	96	56	237	135	121	98
Secaucus (T)	1,370	177	149	112	1,759	187	155	118
Union City (C)	0	0	0	0	0	0	0	0
Weehawken (T)	118	20	13	25	118	20	13	26
West New York (T)	31	4	0	12	31	4	0	12
Hudson County (Total)	27,004	2,229	2,127	1,337	31,515	2,604	2,217	1,526

Source: NJOIT, GIS 2024; Microsoft BING 2019; RS Means 2024; NOAA 2022

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

**Table 11-16. Description of Damage Categories**

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 cover, with no or very limited water penetration.	≤2%	No	No	No	No	No
Minor Damage Maximum of one broken window, door or garage door. Moderate roof cover loss that can be covered to prevent additional water entering the building. Marks or dents on walls requiring painting or patching for repair.	>2% and ≤15%	One window, door, or garage door failure	No	<5 impacts	No	No
Moderate Damage Major roof cover damage, moderate window breakage. Minor roof sheathing failure. Some resulting damage to interior of building from water.	>15% and ≤50%	> 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: FEMA 2022

Building damage as a result of the 100-year and 500-year MRP hurricane wind events were estimated using Hazus, as summarized in Table 11-17. Fourteen residential buildings will be completely destroyed by the 100-year MRP event, and seven residential, five commercial, and one industrial building will be severely damaged. For the 500-year MRP event, most of the losses are estimated to be within the residential occupancy class. Up to 1,014 residential buildings will be completely destroyed and 399 residential buildings will experience severe damages. Furthermore, 4,405 will be moderately damaged and 19,239 will have minor damages.

Table 11-18 summarizes the replacement cost value damage estimated for the 100- and 500-year MRP wind-only events. The total estimated damage to buildings for all occupancy types across Hudson County is estimated to be approximately \$6 million and \$65 million for the 100- and 500-year MRP events. Most of these losses are to residential buildings. Due to differences in building construction, residential structures are generally more susceptible to wind damage than commercial and industrial structures. The damage counts include buildings damaged at all severity levels from minor damage to destruction. Total dollar damage reflects the overall impact to buildings at an aggregate level. The City of Jersey City is estimated to experience the greatest damage in a 100-and 500-year MRP event, approximately \$3 million and \$32 million. Damages to buildings is a direct result of wind speeds, direction, and duration, which is dependent upon the storm's intensity and track.

**Table 11-17. Expected Damage from the 100- and 500-Year MRP Events**

Total Number of Buildings in Occupancy	Severity of Expected Damage	100-Year Mean Return Period		500-Year Mean Return Period	
		Building Count	% Buildings in Occupancy Class	Building Count	% Buildings in Occupancy Class
Residential Exposure (Single and Multi-Family Dwellings)					
79,906	NONE	74,515	93.3%	54,848	68.6%
	MINOR	5,022	6.3%	19,239	24.1%
	MODERATE	348	0.4%	4,405	5.5%
	SEVERE	7	<0.1%	399	0.5%
	DESTRUCTION	14	<0.1%	1,014	1.3%
Commercial Buildings					
7,174	NONE	6,619	92.3%	4,804	67.0%
	MINOR	399	5.6%	1,239	17.3%
	MODERATE	151	2.1%	1,015	14.2%
	SEVERE	5	0.1%	115	1.6%
	DESTRUCTION	0	0.0%	0	0.0%
Industrial Buildings					
2,746	NONE	2,604	94.8%	1,997	72.7%
	MINOR	126	4.6%	480	17.5%
	MODERATE	15	0.5%	237	8.6%
	SEVERE	1	<0.1%	33	1.2%
	DESTRUCTION	0	0.0%	0	0.0%
Other Buildings ^a					
3,204	NONE	3,063	95.6%	2,406	75.1%
	MINOR	124	3.9%	526	16.4%
	MODERATE	17	0.5%	245	7.6%
	SEVERE	0	0.0%	28	0.9%
	DESTRUCTION	0	0.0%	0	0.0%

Source: Hazus v6.1; NJOIT 2024; Microsoft BING 2019

a. "Other" occupancy classes include Government, Religion, Agricultural, and Education Buildings



Table 11-18. Estimated Building Damage by General Occupancy by the 100- and 500-Year MRP Events

Jurisdiction	Estimated Building Losses (Residential)		Estimated Building Losses (Commercial)		Estimated Building Losses (Industrial)		Estimated Damages (All Other Occupancies)		Estimated Building Losses (All Occupancies)	
	100-Year MRP Event	500-Year MRP Event	100-Year MRP Event	500-Year MRP Event	100-Year MRP Event	500-Year MRP Event	100-Year MRP Event	500-Year MRP Event	100-Year MRP Event	500-Year MRP Event
Bayonne (C)	\$20,021,151	\$110,239,810	\$2,753,811	\$14,239,300	\$1,819,939	\$16,751,806	\$1,077,729	\$7,688,761	\$25,672,630	\$148,919,677
East Newark (B)	\$461,740	\$1,735,376	\$23,053	\$81,793	\$44,507	\$261,481	\$14,108	\$65,964	\$543,407	\$2,144,614
Guttenberg (T)	\$2,066,130	\$20,368,030	\$75,038	\$652,985	\$12,116	\$221,088	\$29,677	\$500,022	\$2,182,961	\$21,742,125
Harrison (T)	\$3,899,895	\$15,235,112	\$318,137	\$1,200,470	\$320,272	\$2,088,307	\$315,128	\$1,595,318	\$4,853,432	\$20,119,207
Hoboken (C)	\$15,969,311	\$150,855,257	\$1,163,530	\$9,126,772	\$276,164	\$3,916,206	\$516,793	\$7,501,487	\$17,925,798	\$171,399,722
Jersey City (C)	\$33,509,837	\$212,348,508	\$5,433,894	\$34,729,460	\$1,776,882	\$24,512,719	\$3,263,414	\$32,435,485	\$43,984,027	\$304,026,172
Kearny (T)	\$8,710,108	\$35,196,712	\$930,520	\$3,581,018	\$1,395,547	\$13,160,112	\$565,003	\$3,628,253	\$11,601,177	\$55,566,096
North Bergen (T)	\$7,834,814	\$59,877,860	\$1,786,879	\$13,111,892	\$667,155	\$10,335,475	\$221,056	\$2,796,207	\$10,509,905	\$86,121,434
Secaucus (T)	\$5,191,138	\$29,777,110	\$2,194,157	\$12,145,899	\$1,786,011	\$19,748,108	\$236,696	\$2,243,563	\$9,408,002	\$63,914,680
Union City (C)	\$5,526,504	\$41,572,040	\$891,232	\$7,087,577	\$45,182	\$814,008	\$280,876	\$3,449,418	\$6,743,793	\$52,923,043
Weehawken (T)	\$2,725,699	\$25,753,810	\$375,649	\$3,583,729	\$79,867	\$1,214,398	\$68,722	\$1,086,576	\$3,249,936	\$31,638,513
West New York (T)	\$3,181,753	\$25,869,150	\$508,728	\$4,214,040	\$46,495	\$808,295	\$159,292	\$2,278,855	\$3,896,268	\$33,170,341
Hudson County (Total)	\$109,098,080	\$728,828,775	\$16,454,628	\$103,754,935	\$8,270,138	\$93,832,003	\$6,748,492	\$65,269,911	\$140,571,337	\$991,685,623

Source: Hazus v6.1; NJOIT 2024; Microsoft BING 2019; RS Means 2024





11.2.3 Community Lifelines and Other 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. Lack of power to emergency facilities, including police, fire, EMS, and hospitals, will inhibit a community's ability to effectively respond to an event and maintain the safety of its citizens.

STORM SURGE

Community lifelines are essential services that enable the continuous operation of critical government and business functions and are crucial to human health and safety or economic security. In SLOSH hazard areas, these lifelines are particularly vulnerable to disruption. Table 11-19 through Table 11-22 provide detailed information on the distribution and risk levels of various community lifelines within different SLOSH hazard categories across Hudson County. Overall, Hudson County has 391 facilities located in Category 1 SLOSH hazard areas, representing 31.6 percent of the jurisdiction's total. In Category 2, there are 499 facilities (40.3 percent), in Category 3, there are 563 facilities (45.4 percent), and in Category 4, there are 628 facilities (50.7 percent). The Transportation lifeline has the highest number of facilities in all SLOSH Hazard categories; Category 1 (98), Category 2 (127), Category 3 (155) and Category 4 (179). Refer to Section 3 (County Profile) for more information about the critical facilities and lifelines in Hudson County.

HURRICANE AND OTHER HIGH WINDS

Table 11-23 and Table 11-24 summarize the damage state probabilities for critical facilities during the 100-year and 500-year MRP events.

In the event of a 100-year MRP event, the Safety and Security sector is expected to face the most significant impact, with a loss of 300 days. This sector also has the highest probabilities of damage, with a 7.8 percent chance of minor damage and a 9.1 percent chance of moderate damage. Severe and complete damage probabilities are much lower, at 0.2 percent and less than 0.1 percent. The Hazardous Materials sector also shows notable probabilities of damage, with a 5.5 percent chance of minor damage and a 2.0 percent chance of moderate damage. Severe damage is expected at 0.5 percent, and complete damage is less than 0.1 percent.

In the event of a 500-year MRP event, the Transportation and Energy sectors are expected to sustain the most significant damage. The Transportation sector has the highest probabilities, with an 18.3 percent chance of minor damage, 10.1 percent chance of moderate damage, and 1.5 percent chance of severe damage, with no expected complete damage. The Energy sector follows closely, with a 17.9 percent chance of minor damage, 9.2 percent chance of moderate damage, and 1.2 percent chance of severe damage, also with no expected complete damage. Additionally, the Safety and Security sector is notable for its significant loss of 300 days, despite having lower probabilities of damage.

**Table 11-19. Number of Facilities in Category 1 SLOSH Hazard Area, by Lifeline Category**

Jurisdiction	Number of Facilities in Category 1 SLOSH Hazard Area, by Lifeline Category									Total Facilities in Hazard Area	
	Communications	Energy	Food, Hydration, Shelter	Hazardous Materials	Health & Medical	Safety & Security	Transportation	Water Systems	Other Critical Facilities	Count	% of Jurisdiction Total
Bayonne (C)	0	10	0	3	0	4	9	8	3	37	31.9%
East Newark (B)	0	0	0	0	0	0	0	0	0	0	0.0%
Guttenberg (T)	0	0	0	0	0	0	0	0	0	0	0.0%
Harrison (T)	1	2	0	1	0	1	0	0	1	6	13.3%
Hoboken (C)	1	3	26	5	7	23	9	4	37	115	82.1%
Jersey City (C)	1	15	4	19	3	30	51	11	19	153	35.3%
Kearny (T)	0	10	0	7	0	4	16	7	0	44	41.1%
North Bergen (T)	0	1	0	0	2	0	1	2	2	8	8.0%
Secaucus (T)	2	0	0	2	2	0	4	2	0	12	14.3%
Union City (C)	0	0	0	0	0	0	1	0	0	1	1.1%
Weehawken (T)	0	0	1	0	0	1	7	3	2	14	30.4%
West New York (T)	0	0	0	0	0	0	0	1	0	1	2.1%
Hudson County (Total)	5	41	31	37	14	63	98	38	64	391	31.6%

Source: Hudson County 2024; HIFLD 2024; NJGIN 2024; NOAA 2022

**Table 11-20. Number of Facilities in Category 2 SLOSH Hazard Area, by Lifeline Category**

Jurisdiction	Number of Facilities in Category 2 SLOSH Hazard Area, by Lifeline Category									Total Facilities in Hazard Area	
	Communications	Energy	Food, Hydration, Shelter	Hazardous Materials	Health & Medical	Safety & Security	Transportation	Water Systems	Other Critical Facilities	Count	% of Jurisdiction Total
Bayonne (C)	0	10	0	6	0	5	13	10	3	47	40.5%
East Newark (B)	0	0	0	0	0	0	1	0	0	1	11.1%
Guttenberg (T)	0	0	0	0	0	0	0	0	0	0	0.0%
Harrison (T)	1	2	0	2	0	2	1	1	2	11	24.4%
Hoboken (C)	1	3	26	5	8	24	9	6	43	125	89.3%
Jersey City (C)	1	18	5	20	3	45	56	12	27	187	43.1%
Kearny (T)	0	10	0	7	0	5	20	10	0	52	48.6%
North Bergen (T)	0	3	0	1	2	0	3	4	2	15	15.0%
Secaucus (T)	4	3	0	2	3	5	15	6	4	42	50.0%
Union City (C)	0	0	0	0	0	0	1	0	0	1	1.1%
Weehawken (T)	0	0	1	0	0	1	8	3	2	15	32.6%
West New York (T)	0	0	0	0	0	1	0	2	0	3	6.3%
Hudson County (Total)	7	49	32	43	16	88	127	54	83	499	40.3%

Source: Hudson County 2024; HIFLD 2024; NJGIN 2024; NOAA 2022

Note: % = Percent



Table 11-21. Number of Facilities in Category 3 SLOSH Hazard Area, by Lifeline Category

Jurisdiction	Number of Facilities in Category 3 SLOSH Hazard Area, by Lifeline Category									Total Facilities in Hazard Area	
	Communications	Energy	Food, Hydration, Shelter	Hazardous Materials	Health & Medical	Safety & Security	Transportation	Water Systems	Other Critical Facilities	Count	% of Jurisdiction Total
Bayonne (C)	0	10	3	6	0	8	16	10	5	58	50.0%
East Newark (B)	0	0	0	0	0	0	1	0	0	1	11.1%
Guttenberg (T)	0	0	0	0	0	0	0	0	0	0	0.0%
Harrison (T)	1	2	0	2	1	4	3	1	2	16	35.6%
Hoboken (C)	1	3	28	5	8	27	9	6	45	132	94.3%
Jersey City (C)	1	19	5	20	3	48	64	12	28	200	46.1%
Kearny (T)	0	10	0	7	0	5	21	11	0	54	50.5%
North Bergen (T)	0	3	0	1	2	1	7	10	2	26	26.0%
Secaucus (T)	5	3	1	2	4	5	22	6	6	54	64.3%
Union City (C)	0	0	0	0	0	0	1	0	0	1	1.1%
Weehawken (T)	0	0	1	0	0	1	11	3	2	18	39.1%
West New York (T)	0	0	0	0	0	1	0	2	0	3	6.3%
Hudson County (Total)	8	50	38	43	18	100	155	61	90	563	45.4%

Source: Hudson County 2024; HIFLD 2024; NJGIN 2024; NOAA 2022



**Table 11-22. Number of Facilities in Category 4 SLOSH Hazard Area, by Lifeline Category**

Jurisdiction	Number of Facilities in Category 1 SLOSH Hazard Area, by Lifeline Category									Total Facilities in Hazard Area	
	Communications	Energy	Food, Hydration, Shelter	Hazardous Materials	Health & Medical	Safety & Security	Transportation	Water Systems	Other Critical Facilities	Count	% of Jurisdiction Total
Bayonne (C)	0	10	6	6	1	14	20	11	7	75	64.7%
East Newark (B)	0	0	1	0	1	0	1	0	0	3	33.3%
Guttenberg (T)	0	0	0	0	0	0	0	0	0	0	0.0%
Harrison (T)	1	3	1	2	1	8	6	1	5	28	62.2%
Hoboken (C)	1	3	29	5	8	28	9	6	45	134	95.7%
Jersey City (C)	1	19	5	22	3	52	74	12	30	218	50.2%
Kearny (T)	0	10	0	7	0	5	21	11	0	54	50.5%
North Bergen (T)	0	3	0	1	2	4	10	11	3	34	34.0%
Secaucus (T)	5	3	1	2	4	7	26	6	6	60	71.4%
Union City (C)	0	0	0	0	0	0	1	0	0	1	1.1%
Weehawken (T)	0	0	1	0	0	1	11	3	2	18	39.1%
West New York (T)	0	0	0	0	0	1	0	2	0	3	6.3%
Hudson County (Total)	8	51	44	45	20	120	179	63	98	628	50.7%

Source: Hudson County 2024; HIFLD 2024; NJGIN 2024; NOAA 2022

**Table 11-23. Estimated Impacts to Critical Facilities for the 100-Year MRP Event**

Name	Loss of Days	Average Percent Probability of Sustaining Damage 100-Year Mean Return Period Hurricane			
		Minor	Moderate	Severe	Complete
Communications	0	4.1%	0.8%	<0.1%	0.0%
Energy	0	4.6%	0.5%	<0.1%	0.0%
Food, Hydration, Shelter	0	4.1%	1.4%	<0.1%	0.0%
Hazardous Materials	0	5.5%	2.0%	0.5%	<0.1%
Health and Medical	0	2.4%	0.2%	0.0%	0.0%
Safety and Security	300	7.8%	9.1%	0.2%	<0.1%
Transportation	0	4.5%	0.7%	<0.1%	0.0%
Water Systems	0	4.2%	0.4%	<0.1%	0.0%

Source: Hazus v6.1; Hudson County 2024; HIFLD; NJGIN 2024

Table 11-24. Estimated Impacts to Critical Facilities for the 500-Year MRP Event

Name	Loss of Days	Average Percent Probability of Sustaining Damage 500-Year Mean Return Period Hurricane			
		Minor	Moderate	Severe	Complete
Communications	0	16.0%	7.9%	1.0%	<0.1%
Energy	0	17.9%	9.2%	1.2%	0.0%
Food, Hydration, Shelter	0	15.8%	9.8%	0.7%	<0.1%
Hazardous Materials	0	16.4%	12.1%	5.2%	0.5%
Health and Medical	2	11.8%	8.6%	0.1%	0.0%
Safety and Security	300	12.7%	12.1%	0.5%	<0.1%
Transportation	0	18.3%	10.1%	1.5%	0.0%
Water Systems	0	17.7%	8.6%	1.2%	0.0%

Source: Hazus v6.1; Hudson County 2024; HIFLD; NJGIN 2024

11.2.4 Economy

Severe weather events can have both short- and long-lasting impacts on the economy. High wind events may threaten safety, damage buildings, and impact the economy, including loss of business function, damage to inventory, relocation costs, wage loss, and rental loss due to the repair or replacement of buildings. Recovery and clean-up costs can also be costly and impact the economy as well (NJOEM 2024). 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 or replacement of buildings. Impacts to transportation lifelines affect both short-term (e.g., evacuation activities) and long-term (e.g., day-to-day commuting and goods transport) transportation needs. Utility infrastructure



(power lines, gas lines, electrical systems) could suffer damage, resulting in the loss of power, which can impact business operations and heating or cooling provision to the population.

Debris management can be costly and impact the local economy. Hazus estimates the amount of debris that might be produced as result of the 100- and 500-year MRP wind events. Table 11-25 summarizes the estimated debris by municipality, which should be considered a lower-bound analysis. Because the estimated debris production does not include debris generated by flooding, this is likely a conservative estimate and could be higher if multiple impacts occur.

Table 11-25. Debris Production for 100- and 500-Year Mean Return Period Event Winds

Jurisdiction	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
Bayonne (C)	3,401	18,243	0	120	1,792	4,362	15,024	35,995
East Newark (B)	60	245	0	1	16	36	135	304
Guttenberg (T)	216	2,618	0	19	8	33	87	335
Harrison (T)	563	2,291	0	11	140	308	1,029	2,321
Hoboken (C)	2,084	20,707	0	162	78	271	744	2,572
Jersey City (C)	5,867	36,268	0	144	3,801	10,670	24,377	68,607
Kearny (T)	1,296	5,855	0	34	3,876	10,017	14,506	35,739
North Bergen (T)	1,078	9,460	0	37	1,367	4,785	8,057	28,338
Secaucus (T)	1,110	6,601	0	20	2,225	6,765	11,268	34,488
Union City (C)	1,034	7,323	0	25	105	351	942	3,169
Weehawken (T)	368	3,527	0	22	300	1,008	2,682	9,006
West New York (T)	540	4,335	0	16	77	310	566	2,231
Hudson County (Total)	17,617	117,473	0	611	13,785	38,916	79,417	223,106

Source: Hazus v6.1; NJOIT 2024; Microsoft BING 2019

During a 100-year MRP wind event, Hudson County is expected to generate significant amounts of debris. The City of Jersey City stands out with the highest estimates, producing 5,867 tons of brick and wood debris. Additionally, tree debris in the City of Jersey City is projected at 3,801 tons, with an eligible tree volume of 24,377 cubic yards. Overall, Hudson County is anticipated to produce a total of 17,617 tons of brick and wood debris during this event. Tree debris across the County is estimated at 13,785 tons, with an eligible tree volume reaching 79,417 cubic yards.

In the event of a 500-year MRP wind event, the debris estimates increase substantially. The City of Jersey City is projected to generate the highest amount of debris, with 36,268 tons of brick and wood debris. Additionally, tree debris in the City of Jersey City is estimated at 10,670 tons, with an eligible tree volume of 68,607 cubic yards. Overall, Hudson County is expected to produce a total of 117,473 tons of brick and wood debris during a 500-year MRP event. Tree debris across the County is estimated at 38,916 tons, with an eligible tree volume reaching 223,106 cubic yards.



11.2.5 Natural, Historic and Cultural Resources

NATURAL

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 (United States Environmental Protection Agency 2023).

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 (United States Climate Resilience Toolkit 2016). 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 Hudson County. The impacts of hurricane related winds on the environment typically take place over a larger area. Where these events occur, widespread, severe damage to tree and plant species is likely. This includes uprooting or destruction of trees and an increased threat of wildfire in areas where dead trees are not removed. Chapter 9 (Flood) provides additional environmental impacts due to flooding from heavy rainfalls.

HISTORIC

Winds associated with severe weather can cause significant damage to historic infrastructure. Historic sites are particularly vulnerable due to their age and construction prior to modern building standards. The materials used in these structures may be aged and prone to maintenance issues, making them more susceptible to damage. Additionally, any damage repair may require compliance with stringent landmark laws, complicating and increasing the cost of repairs.

Historic buildings are at risk of structural damage during flood events caused by thunderstorm or hurricane rains. Many historic resources and structures were built close to waterways, which increases their flood risk. Severe flood events could result in devastating loss of life and property in and around these historical landmarks.

CULTURAL

Winds associated with severe weather can cause significant damage or destruction to cultural resources. The historic buildings that house such resources may be particularly vulnerable due to their construction prior to modern building standards, which may not withstand high winds. The materials used in these structures may be aged and prone to maintenance issues, further increasing their susceptibility to damage.

Cultural heritage sites exposed to severe weather are subject to weathering and deterioration. Outdoor cultural events are at risk, as severe weather can lead to postponements or cancellations. The vulnerability of cultural resources is heightened by their irreplaceable nature. Damage to these sites can result in the loss of unique historical and cultural artifacts, which cannot be easily restored or replaced. Additionally, any damage repair may require compliance with stringent landmark laws, complicating and increasing the cost of repairs.



11.3 Future Changes That May Affect Risk

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

11.3.1 Potential or Planned Development

Understanding future changes that impact vulnerability in Hudson County is crucial for planning development and ensuring appropriate mitigation, planning, and preparedness measures. New development and residents will face hurricane and tropical storm hazards, but increased standards and codes may reduce their vulnerability to wind and flood-related hazards compared to older buildings.

New development will alter the landscape, replacing open land and vegetation with buildings, roads, and other infrastructure. This transformation can make surfaces that were once permeable and moist become impermeable and dry, increasing susceptibility to fires caused by lightning.

As noted in Chapter 3 (County Profile), areas targeted for future growth and development have been identified across the County. These areas are vulnerable to severe storm events, and new development sites should adhere to building codes that provide high wind protection and flood-proofing measures. Specific areas of recent and new development are detailed in tables and hazard maps included in the jurisdictional annexes in Volume II of this plan.

11.3.2 Projected Changes in Population

The New Jersey Department of Labor and Workforce Development produced populations projections by County from 2014 to 2019, 2024, 2029, and 2034. According to these projections, Hudson County is projected to have an increase in population in the upcoming years. These projection totals include a population of 747,400 by 2029, and 766,500 by 2034 (State of New Jersey 2017).

An increase in population amplifies severe weather risks. Higher density means more people are vulnerable to casualties and injuries, especially in urban areas. Resource demand rises, leading to potential shortages during crises. More infrastructure is needed, which can be costly to repair after severe weather. Urbanization often reduces natural landscapes that mitigate weather impacts, increasing flood risks. Emergency response systems can be overwhelmed, delaying rescue efforts. Vulnerable groups may need extra resources, further straining services. Overall, a growing population heightens severe weather challenges and risks.

11.3.3 Climate Change

Future climate change in New Jersey, including rising temperatures and increased precipitation, will heighten the risk of severe weather. By 2050, temperatures could rise by 4.1 to 5.7 °F, leading to hotter summers and milder winters. Precipitation is expected to increase, with more intense rain events and potential for prolonged droughts. These changes will make storms more frequent and severe, impacting the region's vulnerability to extreme weather events.



11.3.4 Other Identified Conditions

As discussed in previous sections, most studies project that the County will see an increase in average annual temperatures and precipitation. As the climate warms and other changes in climate continue to unfold, the intensity of summer weather may change, producing more ideal conditions for severe storms to form. It is anticipated that the County will continue to experience direct and indirect impacts of severe weather events annually that may induce secondary hazards such as infrastructure deterioration or failure, utility failures, power outages, water quality and supply concerns, and transportation delays, accidents, and inconveniences.



12. SEVERE WINTER WEATHER

12.1 Hazard Profile

12.1.1 Hazard Description

A winter storm is a weather event in which the main types of precipitation are snow, sleet, or freezing rain. They can be a combination of heavy snow, blowing snow, and dangerous wind chills and are typically accompanied by low temperatures. According to the National Severe Storms Laboratory (NSSL), the following three basic components are needed to make a winter storm (NOAA 2021):

- Below freezing temperatures (i.e., cold air) in the clouds and near the ground to make snow and ice.
- Lift, something to raise the moist air to form clouds and cause precipitation, such as warm air colliding with cold air and being forced to rise over the cold dome or air flowing up a mountainside.
- Moisture to form clouds and precipitation, such as air blowing across a large lake or the ocean.

Some winter storms can immobilize an entire region, while others might only affect a single community. The aftermath of a winter storm can impact a community or region for days, weeks, or even months, potentially causing cold temperatures, flooding, storm surge, closed or blocked roadways, downed utility lines, and power outages. Hudson County's winter storms include, but are not limited to heavy snow, blizzards, sleet, ice storms, and nor'easters.

HEAVY SNOW

Snow is precipitation in the form of ice crystals (NSIDC 2024). It originates in clouds when temperatures are below the freezing point (32 °F) and water vapor in the atmosphere condenses directly into ice without going through the liquid stage. Once an ice crystal has formed, it absorbs and freezes additional water vapor from the surrounding air, growing into snow crystals, which then fall to the earth. Snowflakes are clusters of ice crystals that form from a cloud. Figure 12-1 depicts snow creation.

BLIZZARDS

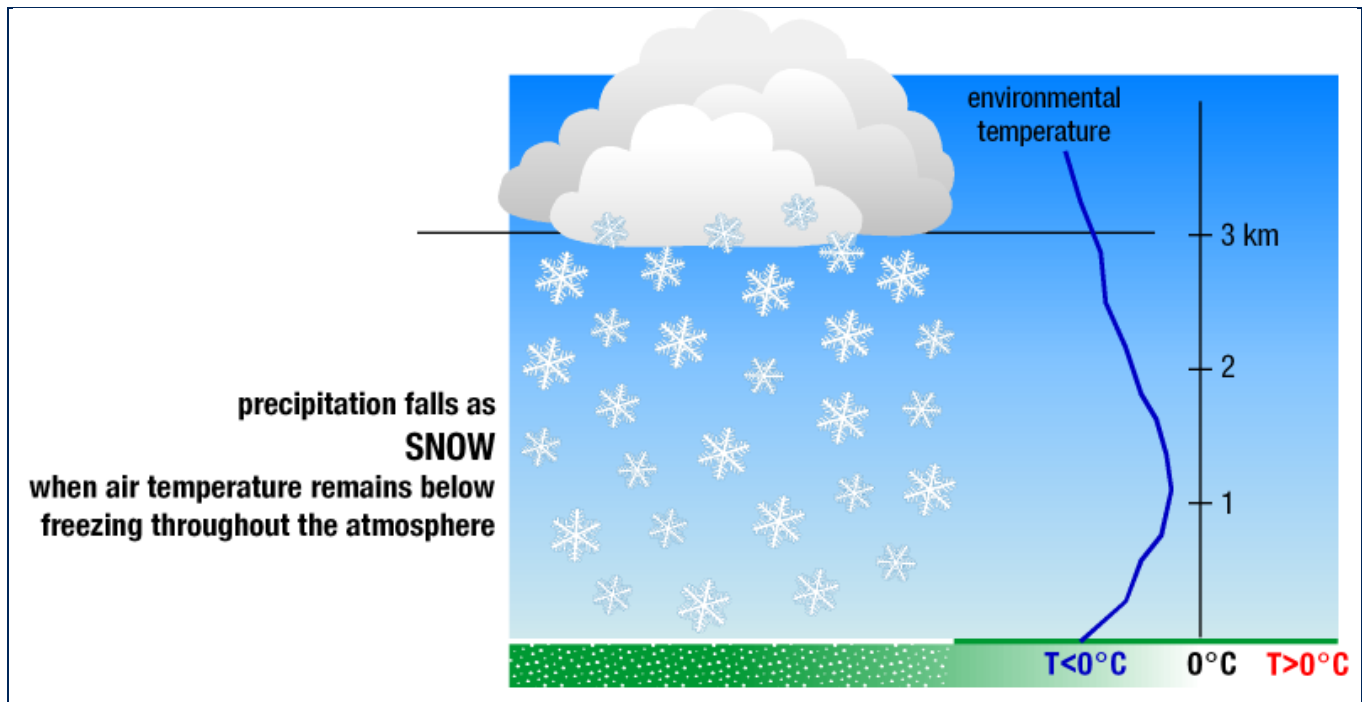
A blizzard is a winter snowstorm with sustained or frequent wind gusts of 35 miles per hour (mph) or more, accompanied by falling or blowing snow reducing visibility to 0.25 miles or less, as the predominant conditions over a three-hour period (NOAA NWS n.d.). Extremely cold temperatures often are associated with blizzard conditions but are not a formal part of the definition. The hazard, created by the combination of snow, wind, and low visibility, significantly increases when temperatures are below 20 °F. A severe blizzard is categorized as having temperatures near or below 10 °F, winds exceeding 45 mph, and visibility reduced by snow to near zero (NOAA NWS n.d.).

Storm systems powerful enough to cause blizzards usually form when the jet stream dips far to the south, allowing cold air from the north to clash with warm, moister air from the south. Blizzard conditions often develop on the northwest side of an intense storm system. The difference between the lower pressure in the storm and the higher pressure to the west creates a tight pressure gradient, resulting in strong winds and extreme conditions caused by the blowing snow (Lam 2019).





Figure 12-1. Snow Creation



Source: NOAA 2023

ICE STORMS

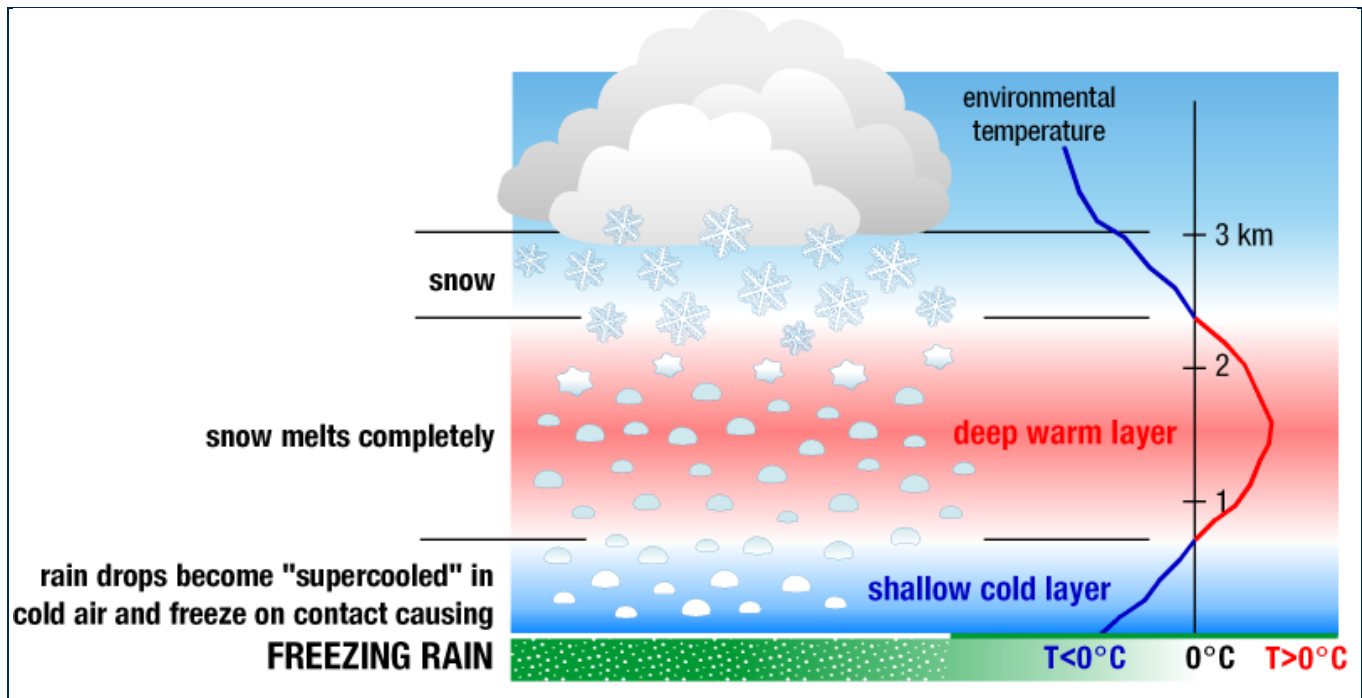
An ice storm describes those events when damaging accumulations of ice are expected during freezing rain situations. Significant ice accumulations typically are accumulations of 0.25-inches or greater (NOAA n.d.). Heavy accumulations of ice can bring down trees, power lines, utility poles, and communication towers. Ice can disrupt communications and power for days. Even small accumulations of ice can be extremely dangerous to motorists and pedestrians (NWS 2019). Figure 12-2 depicts freezing rain creation.

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 are most frequent and strongest between September and April. These storms usually develop between Georgia and New Jersey within 100 miles of the coastline and typically move from southwest to northeast along the Atlantic Coast (NWS n.d.). Nor'easters can span thousands of miles, impacting large areas of coastline. To be classified a nor'easter, a storm must have the following conditions (NJOEM 2024):

- Persists for at least a 12-hour period
- Has a closed circulation
- Shows general movement from the south-southwest to the north-northeast
- Contains wind speeds greater than 23 miles per hour (mph)

Figure 12-2. Freezing Rain Creation



Source: NOAA 2023

A nor'easter event can cause heavy rain, heavy snow, and wind, with storm surges, waves, and coastal flooding in areas along the coast. With a forward speed much slower than that of a hurricane, a nor'easter can linger for days and cause tremendous damage to affected areas. Approximately 20 to 40 nor'easters occur in the northeastern United States every year (NPS 2023). New Jersey can experience 10 to 20 nor'easters each year, with five to 10 of those having significant impact on the state (NJOEM 2024).

The intensity of a nor'easter can rival that of a tropical cyclone in that, on occasion, it may flow or stall off the mid-Atlantic coast resulting in prolonged episodes of precipitation, coastal flooding, and high winds. Figure 12-3 displays the formation of a Nor'easter.

SLEET

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 (NSIDC 2024). A sleet storm involves significant accumulations of solid pellets, which form from the freezing of raindrops or partially melted snowflakes causing slippery surfaces, posing a hazard to pedestrians and motorists (NSIDC 2024). Figure 12-4 depicts sleet creation.

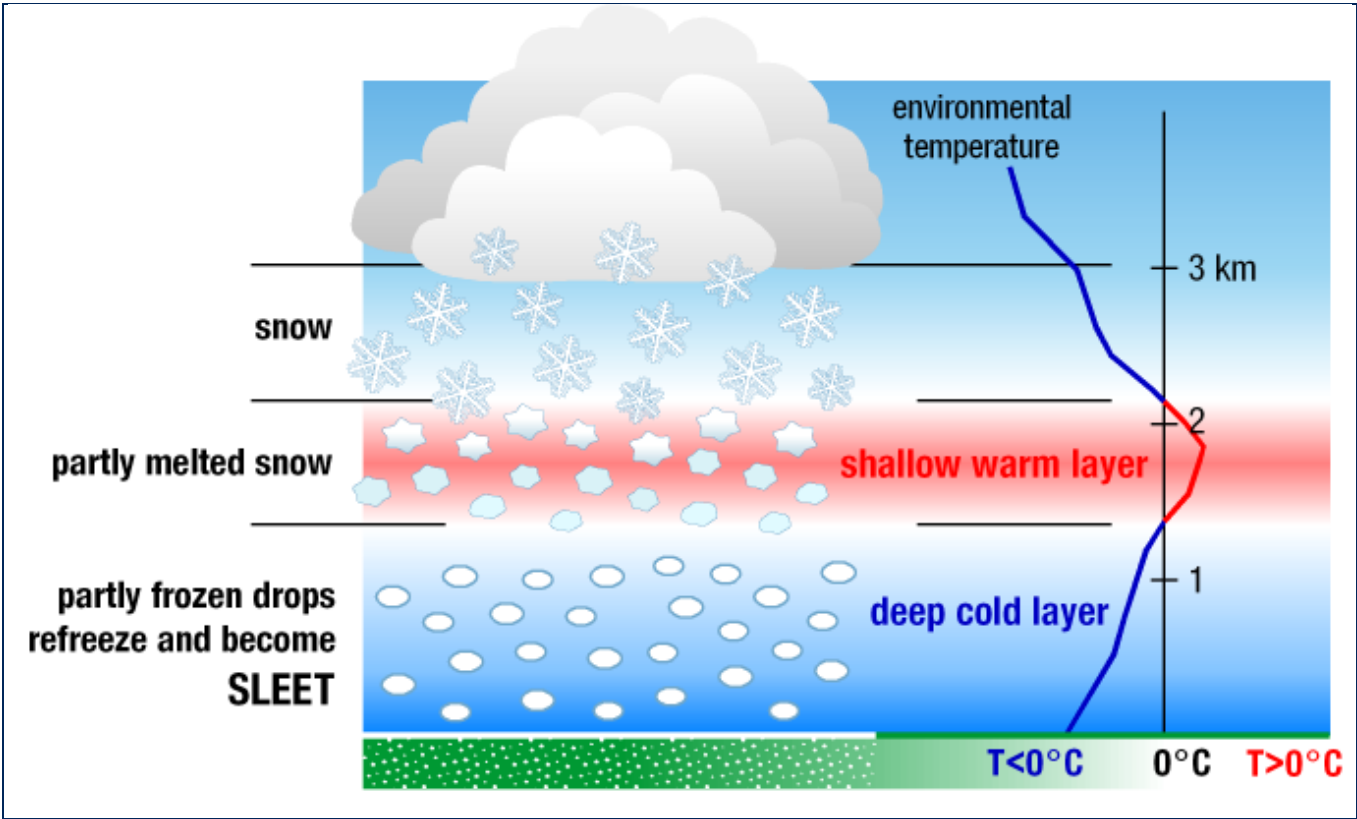


Figure 12-3. Formation of a Nor'easter



Source: NOAA 2023

Figure 12-4. Sleet Creation



Source: NOAA 2023





12.1.2 Location

HEAVY SNOW, BLIZZARDS, AND SLEET

The severe winter weather hazard has the potential to impact the entire county. However, 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.

ICE STORMS

All regions of New Jersey are subject to ice storms. The distribution of ice storms often coincides with general distribution of snow within several zones in the State (NJOEM 2024). A cold rain may be falling over the southern portion of the State, freezing rain over the central region, and snow over the northern counties as a coastal storm moves northeastward offshore. A locality's distance to the passing storm center is often the crucial factor in determining the temperature and type of precipitation during a winter storm.

NOR'EASTER

Historical data shows that several nor'easters have impacted the State. Nor'easters can occur any time of the year but are most frequent and strongest between September and April (NWS n.d.). The entire State of New Jersey is susceptible to the effects of these storms, depending on the storm's track. However, coastal communities and other low-lying areas of the State are particularly vulnerable. As development and re-development increase, even less-intense storms may lead to costly storm damage. Most of the damage following these storms often results from residual wind damage, as was demonstrated during recent storms.

12.1.3 Extent

HEAVY SNOW, BLIZZARDS, ICE STORMS, AND SLEET

The magnitude or severity of a severe winter weather depends on several factors, including snowfall rates, regional climatological susceptibility to snowstorms, snowfall amounts, wind speeds, temperatures, visibility, storm duration, topography, time of occurrence during the day and week (e.g., weekday versus weekend), and time of season.

The extent of a severe winter weather can be classified both by meteorological measurements and by evaluating societal impacts. The National Oceanic and Atmospheric Administration's (NOAA) National Climatic Data Center (NCDC) is currently producing the Regional Snowfall Index (RSI) for significant snowstorms that impact the eastern two-thirds of the United States. The RSI ranks snowstorm impacts on a scale from 1 to 5 and is based on the spatial extent of the storm, the amount of snowfall, and the interaction of the extent and snowfall totals with population. The NCDC has analyzed and assigned RSI values to over 500 storms since 1900 (NOAA n.d.). Table 12-1 presents the five RSI ranking categories.

**Table 12-1. RSI Ranking Categories**

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

Source: NOAA n.d.

Note: RSI = Regional Snowfall Index

The NWS operates a widespread network of observing systems, such as geostationary satellites, Doppler radars, and automated surface observing systems that feed into the current state-of-the-art numerical computer models to provide a look into what will happen next, ranging from hours to days. The models are then analyzed by NWS meteorologists who then write and disseminate forecasts (NOAA 2017).

The NWS uses winter weather watches, warnings, and advisories to ensure that people know what to expect in the coming hours and days. Winter weather advisories inform people that winter weather conditions are expected to cause significant inconveniences that may be hazardous. A winter storm watch means that 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 12 to 48 hour notice of the possibility of severe winter weather. A watch is upgraded to a winter storm warning when hazardous winter weather, in the form of heavy snow, heavy freezing rain or heavy sleet, is imminent or occurring. They are usually issued 12 to 24 hours before the event is expected to begin. The NWS may also issue a blizzard warning when snow and strong winds combine and produce a blinding snow, deep drifts, and wind chill (NWS 2021).

NOR'EASTER

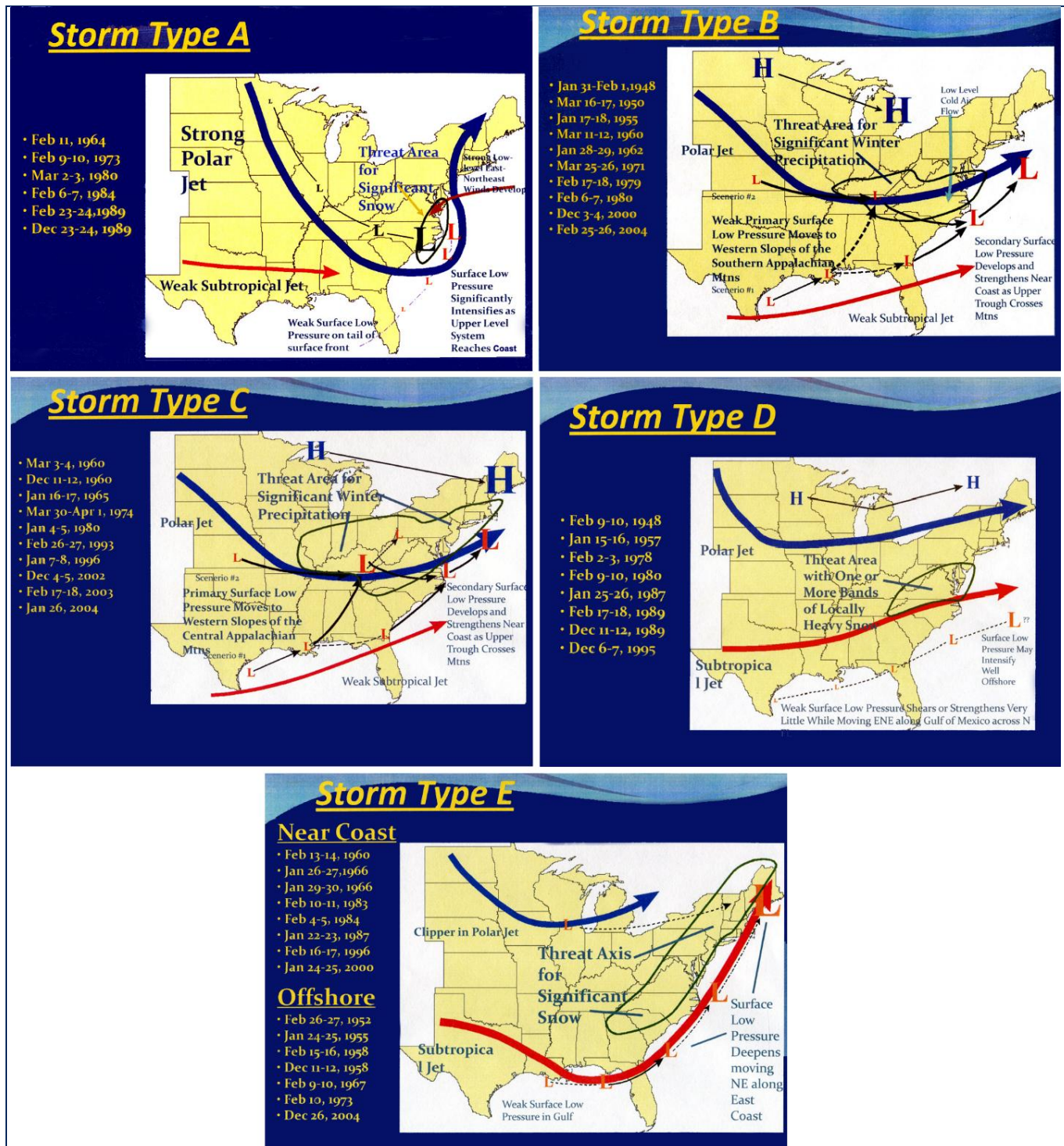
The extent of a nor'easter can be classified by meteorological measurements and by evaluating its societal impacts. Nor'easters have the potential to impact society to a greater extent than hurricanes and tornadoes. These storms often have a diameter three to four times larger than a hurricane and therefore impact much larger areas. More homes and properties become susceptible to damage as the size and strength of a nor'easter intensifies (NWS n.d.). The severity of a nor'easter depends on several factors including a region's climatological susceptibility to snowstorms, snowfall amounts, snowfall rates, wind speeds, temperatures, visibility, storm duration, topography, time of occurrence during the day (e.g., weekday versus weekend), and season.

Nor'easters are classified into two major categories, which were developed by researcher J. E. Miller in 1946. The first type of nor'easter, and the most common, is the Miller Type A nor'easter. These classic nor'easters form in the Gulf of Mexico and develop into full-fledged storms that moves along the East Coast. Miller Type B nor'easters originate as low-pressure systems in the United States' Midwest. These less-common systems diminish after crossing the Appalachian Mountains and reform into nor'easters on the East Coast (National Geographic 2022).

A study written by Albright and Cobb (2004) showed that there are five predominant patterns that produce four inches or more of snowfall across the Mid-Atlantic. They added classification types C through E, adding onto the Miller Classification (Siebers n.d.). View Figure 12-5 for visuals on the formation of each Miller Category.



Figure 12-5. Nor'easter Miller Classifications



Source: Siebers n.d.



12.1.4 Previous Occurrences

FEMA MAJOR DISASTER AND EMERGENCY DECLARATIONS

Between 1954 and 2023, Hudson County was included in five major disaster (DR) or emergency (EM) declarations for severe winter weather-related events (FEMA 2023). Table 12-2 lists these declarations.

Table 12-2. FEMA Declarations for Severe Winter Weather Events in Hudson County (1954 to 2023)

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

Sources: FEMA 2024

USDA DECLARATIONS

The Secretary of Agriculture from the U.S. Department of Agriculture (USDA) is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in contiguous counties. Between 2019 and 2023, Hudson County was not included in any USDA severe winter weather-related agricultural disaster declarations (USDA 2024).

PREVIOUS EVENTS

Known hazard events that impacted Hudson County between August 2019 and December 2023 are discussed in Table 12-3. For events prior to 2019, refer to the 2020 Hudson County HMP.

12.1.5 Probability of Future Occurrences

PROBABILITY BASED ON PREVIOUS OCCURRENCES

Information on previous severe winter weather occurrences in the County was used to calculate the probability of future occurrence of such events, as summarized in Table 12-4. Based on historical records and input from the Steering Committee, the probability of occurrence for severe winter weather in the County is considered “occasional.”

Table 12-4 does not include the annual probability of nor’easters or freezing rain because these events are not discretely recorded in the National Centers for Environmental Information (NCEI) database. Because of limitations in classifying and tracking of nor’easter events, it is nearly impossible to assign probabilities to nor’easters, except over the long-term. High activity seasons are when storm activity exceeds the historical 75th percentile. This means that seasons with this number of storms are expected to occur during one out of four years. Lower activity seasons are defined as when storm activity falls below the historical 75th percentile; meaning this number of storms are expected to occur during three out of four years (NWS n.d.).

**Table 12-3. Severe Winter Weather Events in Hudson County (2019 to 2023)**

Event Date	FEMA or State Declaration Number	Hudson County included in declaration?	Location Impacted	Description
December 1, 2019	N/A	N/A	County-wide	Snowfall totals amounted roughly 2.5 inches, based on reports in Harrison.
December 16, 2020	N/A	N/A	County-wide	A winter storm developed along the Atlantic Coast, producing about 10 inches of snow based on reports in Kearny and Harrison. Wind gust speeds reached 43 mph at Bayonne and 47 mph at Newark-Liberty Airport.
February 1, 2021	N/A	N/A	County-wide	A winter storm developed over the Ohio Valley and Middle Atlantic, producing about around 17 to 18 inches of snow based on reports in Hoboken and Harrison, respectively. Wind gusts reached 41 mph based on records from Bayonne.
February 7, 2021	N/A	N/A	County-wide	A winter storm developed off the North Carolina and Virginia coast. Moderate to heavy snow fell across the urban corridor in northeast New Jersey during the morning and early afternoon hours. Snowfall accumulation ranged from four to eight inches.
February 18, 2021	N/A	N/A	County-wide	A long winter weather event produced moderate to heavy snowfall and sleet across northeast New Jersey. Precipitation became freezing rain during the late afternoon and overnight. Snowfall accumulation ranged from 4 to 5 inches.
January 6, 2022	N/A	N/A	County-wide	Hudson County received around six inches of snow.
January 28, 2022	N/A	N/A	County-wide	A nor'easter produced wind gusts up to 40 mph across northeastern New Jersey. Snowfall accumulations reached 7 inches in Harrison and 8.5 inches in Hoboken and Jersey City.
February 13, 2022	N/A	N/A	County-wide	A winter weather event produced light snowfall across northeastern New Jersey. The maximum snow accumulation recorded in the County was 2.7 inches in Harrison.
February 27, 2023	N/A	N/A	County-wide	A cold air mass led to widespread snowfall of one to three inches throughout Hudson County.

Sources: NOAA-NCEI 2024

Table 12-4. Probability of Future Severe Winter Weather Events in Hudson County

Hazard Type	Number of Occurrences Between 1996 and 2023	Percent Chance of Occurring in Any Given Year
Heavy Snow	30	100%
Blizzard	3	11%
Ice Storms	0	0%
Winter Storms*	22	79%
Winter Weather	15	54%
Sleet	0	0%
Total		100%

Sources: NOAA-NCEI 2024

Notes: Nor'easter events are not tracked in the NCEI database but are often recorded as winter storms



EFFECT OF CLIMATE CHANGE ON FUTURE PROBABILITY

Providing projections of future climate change for a specific region is challenging. Shorter-term projections are more closely tied to existing trends making longer-term projections even more challenging. The further out a prediction reaches the more subject to changing dynamics it becomes. Coastal areas may be impacted by climate change in different ways. Coastal areas are sensitive to sea-level rise, changes in the frequency and intensity of storms, increase in precipitation, and warmer ocean temperatures.

Climate change includes major changes in temperature, precipitation, or wind patterns, which occur over several decades or longer. Temperatures in the northeastern United States have increased 1.5 degrees Fahrenheit (°F) on average since 1900. Most of this warming has occurred since 1970. New Jersey, for example, has observed an increase in average annual temperatures of 1.2°F between the period of 1971-2000 and 2001-2010 (Sustainable Jersey Climate Change Adaptation Task Force 2011). By the 2020s, the average annual temperature in New Jersey is projected to increase by 1.5°F to 3°F above the statewide baseline (1971 to 2000), which was 52.7°F. By 2050, the temperature is projected to increase 3°F to 5°F (NOAA 2023). Winter temperatures across the Northeast have seen an increase in average temperature of 4°F since 1970 (Fourth National Climate Assessment 2017). The increase in temperatures is expected to be felt more during the winter months (December, January, and February), resulting in less intense cold waves, fewer sub-freezing days, and less snow accumulation (NJDEP 2020).

As temperatures increase, Earth's atmosphere can hold more water vapor which leads to a greater potential for precipitation. Currently, New Jersey receives an average of 46 inches of precipitation each year. Since the end of the twentieth century, the State has experienced slight increases in the amount of precipitation it receives each year, and over the last 10 years there has been a 7.9 percent increase. By 2050, annual precipitation in New Jersey could increase by 4 percent to 11 percent. By the end of this century, heavy precipitation events are projected to occur two to five times more often and with more intensity than in the last century. The State will experience more intense rain events, less snow, and more rainfalls (NJDEP 2020). Most of the additional precipitation is expected to come during the winter months (NOAA 2023).

In terms of snowfall and ice storms in New Jersey, 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 when winter storms do occur, they are more intense and severe than in the past. Some climatologists predict that climate change may play a role in the frequency and intensity of nor'easters. Two ingredients are needed to produce strong nor'easters and intense snowfall: (1) temperatures which are just below freezing, and (2) massive moisture coming from the Gulf of Mexico. When temperatures are far below freezing, snow is less likely. As temperatures increase in the winter months, they will be closer to freezing rather than frigidly cold. Future climate change has been predicted to produce more moisture, thus increasing the likelihood that these two ingredients (temperatures just below freezing and intense moisture) will cause more intense snow events. However, the exact effect on winter weather is still highly uncertain (Sustainable Jersey Climate Change Adaptation Task Force 2011). Future enhancements in climate modeling will provide an improved understanding of how the climate will change and impact Hudson County.



12.1.6 Cascading Impacts on Other Hazards

Severe winter weather may exacerbate flooding. As discussed, the heavy precipitation and freezing and thawing of snow and ice can create major flooding issues in the County. Nor'easter events can also create coastal flooding which can impact the southeastern portion of the County. Refer to Chapter 9 (Flood) for more information about the flood hazard of concern.

Severe winter weather events, especially nor'easters, often coincide with or are followed by extreme cold events and generate strong winds that create very low wind chills. For more information on the extreme cold hazard, refer to Chapter 8 (Extreme Temperature).

High winds and ice and snow accumulation can be destructive to the functionality of utilities by breaching power lines and disconnecting the utility systems. Severe winter weather could also result in falling trees and branches due to ice, snow, and strong winds. Fallen trees and branches increases available fuel for wildfires. For more information on the wildfire hazard, refer to Chapter 13 (Wildfire).

12.2 Vulnerability and Impact Assessment

All of Hudson County is vulnerable to severe winter weather events. The following subsections discuss Hudson County's vulnerability, in a qualitative nature, to the severe winter weather hazard.

12.2.1 Life, Health, and Safety

OVERALL POPULATION

The entire population of Hudson County (724,854) is exposed to severe winter weather events (US Census Bureau 2020). Likely impacts of this hazard include the following:

- Snow accumulation and frozen or slippery road surfaces increase the frequency and impact of traffic accidents for the general population, resulting in personal injuries or deaths.
- Winter weather indirectly and deceptively kills hundreds of people in the U.S. each year, primarily due to automobile accidents, overexertion, and exposure.
- These events are often accompanied by strong winds, creating blizzard conditions with blinding wind-driven snow, drifting snow, extreme cold temperatures, and dangerous wind chills.
- People can suffer heart attacks while shoveling snow or succumb to hypothermia from prolonged exposure to cold.
- Heavy accumulations of ice can bring down trees and power lines, disabling electric power and communications for days or weeks.



SOCIALLY VULNERABLE POPULATION

The homeless and elderly are considered most susceptible to this hazard. The elderly are considered susceptible to this hazard due to their increased risk of injuries and death from falls and overexertion and/or hypothermia from attempts to clear snow and ice.

Without a quantitative assessment of potential impacts of a drought on socially vulnerable populations, the Planning Partners can best assess mitigation options through an understanding of the general numbers and locations of such populations across Hudson County. Section 3.6.4 provides detailed data on socially vulnerable populations within the planning area. Table 12-5 summarizes highlights of this information. For planning purposes, it is reasonable to assume that percentages and distribution of socially vulnerable populations affected by a drought will be similar to the countywide numbers.

Table 12-5. Distribution of Socially Vulnerable Populations by Municipality

Category	Countywide Total		Municipality Highest in Category		Municipality Lowest in Category	
	Number	Percent	Number	Percent	Number	Percent
Population Over 65	86,664	12.0%	Jersey City 32,671	North Bergen 16.6%	East Newark 308	Hoboken 6.4%
Population Under 5	86,664	12.0%	Jersey City 20,476	Bayonne 7.1%	East Newark 106	East Newark 4.1%
Non-English-Speaking Population	93,494	12.9%	Jersey City 29,070	West New York 24.5%	East Newark 474	Hoboken 4.3%
Population With Disability	61,174	8.4%	Jersey City 22,396	Union City 11.2%	East Newark 209	Weehawken 6.2%
Population Below Poverty Level	99,546	13.7%	Jersey City 43,134	East Newark 24.6	East Newark 638	Seacaucus 5.1%
Households Below ALICE Threshold	63,893	21%	Jersey City 119,278	Union City 49%	East Newark 846	Hoboken 20%

12.2.2 General Building Stock

The entire general building stock inventory is exposed and vulnerable to the severe winter weather hazard and could be more at risk from aging infrastructure. An extreme blizzard or snowstorm event can carry and deposit significant amounts of snow that are heavy enough to damage roofs and aging buildings. In general, the structural impacts include partial damages to roofs and building frames, rather than an entire building.

Table 12-6 provides estimates of potential damage costs from severe winter weather for various jurisdictions within Hudson County. It includes the number of buildings in each jurisdiction and the estimated losses at different assumed damage levels (1, 5, and 10 percent).

**Table 12-6. Estimated Potential Damage Costs from Severe Winter Weather in Hudson County**

Jurisdiction	Number of Buildings Total (All Occupancies)	1% Damage Loss Estimate	5% Damage Loss Estimate	10% Damage Loss Estimate
Bayonne (C)	9,264	\$112,789,650	\$563,948,248	\$1,127,896,496
East Newark (B)	434	\$3,007,123	\$15,035,615	\$30,071,230
Guttenberg (T)	2,574	\$10,627,725	\$53,138,625	\$106,277,251
Harrison (T)	2,646	\$28,122,699	\$140,613,496	\$281,226,992
Hoboken (C)	14,289	\$69,228,497	\$346,142,483	\$692,284,965
Jersey City (C)	38,336	\$298,292,768	\$1,491,463,839	\$2,982,927,678
Kearny (T)	7,207	\$96,306,266	\$481,531,328	\$963,062,657
North Bergen (T)	6,002	\$99,067,063	\$495,335,316	\$990,670,633
Secaucus (T)	3,844	\$120,750,885	\$603,754,427	\$1,207,508,855
Union City (C)	1,729	\$40,097,124	\$200,485,621	\$400,971,243
Weehawken (T)	2,112	\$16,381,121	\$81,905,605	\$163,811,211
West New York (T)	4,594	\$30,768,563	\$153,842,817	\$307,685,634
Hudson County (Total)	93,031	\$925,439,484	\$4,627,197,422	\$9,254,394,844

Source: NJOIT, Office of GIS 2024; Microsoft BING 2019, RS Means 2024

12.2.3 Community Lifelines and Other Critical Facilities

Full functionality of critical facilities such as police, fire, and medical facilities is essential for response during and after a severe winter weather event. These critical facility structures are largely constructed of concrete and masonry; therefore, they should only suffer minimal structural damage from severe winter weather 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 of winter weather related damages including cracks and potholes caused by freezing plowing are required (NWS 2019).

Heavy accumulations of snow and ice can bring down trees, electrical wires, telephone poles and lines, and communication towers. Communications and power can be disrupted for days while utility companies work to repair the extensive damage. Bridges and overpasses are particularly dangerous because they freeze before other surfaces (NWS 2019). Heavy snow can immobilize a region and paralyze a city, shutting down all air and rail transportation and disrupting medical and emergency services (NOAA 2023).

12.2.4 Economy

The cost of snow and ice removal, roadway treatments (salt and brine) and repair of roads from the freeze/thaw process and plowing damages can drain local financial resources. In addition to snow removal costs, severe winter weather affects the ability of persons to commute into and out of the area for work or school. The loss of power and closure of roads prevents the commuter population traveling to work within and outside of the County and may cause a loss in



economic productivity. The economic impact of winter weather each year is huge, with costs for snow removal, damage, and loss of business in the millions (NOAA 2023).

According to FEMA's National Risk Index, Hudson County's expected annual losses from severe winter weather events are as follows (FEMA 2024):

- Ice Storm: \$213,000
- Winter Weather: \$244,000

12.2.5 Natural, Historic and Cultural Resources

NATURAL

Severe winter weather can have a major impact on the environment. For example, an excess amount of snowfall and earlier warming periods may affect natural processes such as flow within water resources. 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. (NSIDC n.d.).

Rain-on-snow events can also exacerbate runoff rates with warming winter weather. Consequentially, these flow rates and excess volumes of water can erode banks, tear apart habitat along the banks and coastline, and disrupt terrestrial plants and animals. Road-salt runoff can cause groundwater salinization, modify the soil structure, and result in loss or reduction in lake turnover. Additionally, road salt can cause changes in the composition of aquatic invertebrate assemblages and pose threats to birds, roadside vegetation, and mammals (Tiwari and Rachlin 2018).

HISTORIC

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

Historic buildings, archaeological sites, and artifacts are vulnerable to severe winter weather due to several factors. Freeze-thaw cycles can cause significant damage as water seeps into cracks, freezes, expands, and then thaws, leading to the gradual breakdown of materials like stone, brick, and mortar. Snow and ice introduce moisture into structures and artifacts, which can freeze and cause expansion and cracking, while fluctuating humidity levels can deteriorate organic materials like wood and textiles.

CULTURAL

Cultural heritage sites, particularly those exposed to the elements, are subject to weathering. The weight of accumulated snow and ice can stress roofs and other structural elements, potentially leading to collapses. Extreme cold makes materials more brittle and susceptible to cracking, and sudden temperature changes can cause thermal shock, damaging delicate artifacts. Additionally, severe winter weather can hinder access and maintenance, making it challenging to perform necessary upkeep and repairs (NPS 2016).



12.3 Future Changes That May Affect Risk

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

12.3.1 Potential or Planned Development

Areas targeted for future growth and development have been identified across the County. As development and re-development increase, even less-intense storms may lead to costly storm damage. Potential or planned development can influence the risk and impact of severe winter weather in several ways. As development expands into previously undeveloped areas, more people and properties become exposed to the risks of severe winter weather, leading to higher potential for economic losses and disruptions.

Urbanization often leads to the creation of urban heat islands, which are warmer than their rural surroundings due to human activities and infrastructure. While this might reduce the severity of winter weather in urban areas, it can also lead to more significant temperature contrasts and potentially more intense weather events.

New developments might not always be designed with severe winter weather in mind, especially in regions that historically experience milder winters, increasing the vulnerability of buildings, roads, and utilities to damage from snow, ice, and freezing temperatures. Rapid development can also strain local resources and emergency services, making it more challenging to respond effectively to severe winter weather events.

Additionally, development can alter natural landscapes, affecting local weather patterns and potentially increasing the frequency or severity of winter weather events. For example, deforestation and changes in land cover can influence local climate conditions.

12.3.2 Projected Changes in Population

The New Jersey Department of Labor and Workforce Development produced populations projections by County from 2014 to 2019, 2024, 2029, and 2034. According to these projections, Hudson County is projected to have an increase in population in the upcoming years. These projection totals include a population of 747,400 by 2029, and 766,500 by 2034 (State of New Jersey 2017). An increase in population density can significantly hinder the ability of residents in the County to mobilize or receive essential services during severe winter weather events, as higher demand for resources and services can overwhelm infrastructure and emergency response systems. Refer to Chapter 3 (County Profile), which includes a more thorough discussion about population trends for the County.

12.3.3 Climate Change

Climate is defined not simply as average temperature and precipitation but also by the type, frequency, and intensity of weather events. Both globally and at the local scale, climate change has the potential to alter the prevalence and severity of extremes such as winter weather. While predicting changes of severe winter weather events under a



changing climate is difficult, understanding vulnerabilities to potential changes is a critical part of estimating future climate change impacts on human health, society, and the environment (NASA 2023).

12.3.4 Other Identified Conditions

New Jersey will see an increase in average annual temperatures and precipitation. Climate change has the ability to make winter weather events less frequent, but more severe when they do happen. Annual precipitation amounts in the region are projected to increase, primarily in the form of heavy rainfalls, which have the potential to freeze into heavy snowfall and icing. This increase in snow and ice could result in an increased risk to life and health, an increase in structural losses, a diversion of additional resources to response and recovery efforts, and an increase in business closures affected by severe winter events due to loss of service or access (The Climate Reality Project 2022).



13. WILDFIRE

13.1 Hazard Profile

13.1.1 Hazard Description

A wildfire is any non-structural fire that occurs in the wildland (forested, semi-forested, or less developed areas), including naturally occurring fires and human-caused fires, whether accidental or intentional (prescribed burns or arson). Most wildfires in New Jersey are caused by humans (NPS 2023). Wildfires can be highly destructive and difficult to control. They result in the uncontrolled destruction of forests, brush, field crops, grasslands, real estate, and personal property. In the State of New Jersey each year, an average of 1,500 wildfires damage or destroy 7,000 acres of forests. Wildfires also threaten homeowners who live within or adjacent to forest environments (NJFFS 2023).

The height of wildfire season in New Jersey is March through May, corresponding with the driest live fuel moisture periods of the year, though wildfires can occur every month of the year. Drought, snow pack, and local weather conditions can expand the length of the fire season. Fires in the early and late fire season usually are human-caused. Lightning generally is the cause of most fires in the peak season (NJOEM 2024).

Within the New Jersey Department of Environmental Protection (NJDEP), the New Jersey Forest Fire Service (NJFFS) is responsible for protecting the 3.15 million acres of public and private wildland in the State. Headquartered in Trenton, NJFFS is under the direction of the State fire warden and is broken up into three divisions (A, B, and C). Hudson County is in a secondary response area of Division A, as shown in Figure 13-1. NJFFS has 85 full-time employees that provide an array of services including staffing the State's 21 fire towers, which are operational during the months of March, April, May, October, and November (NJFFS 2020).

13.1.2 Location

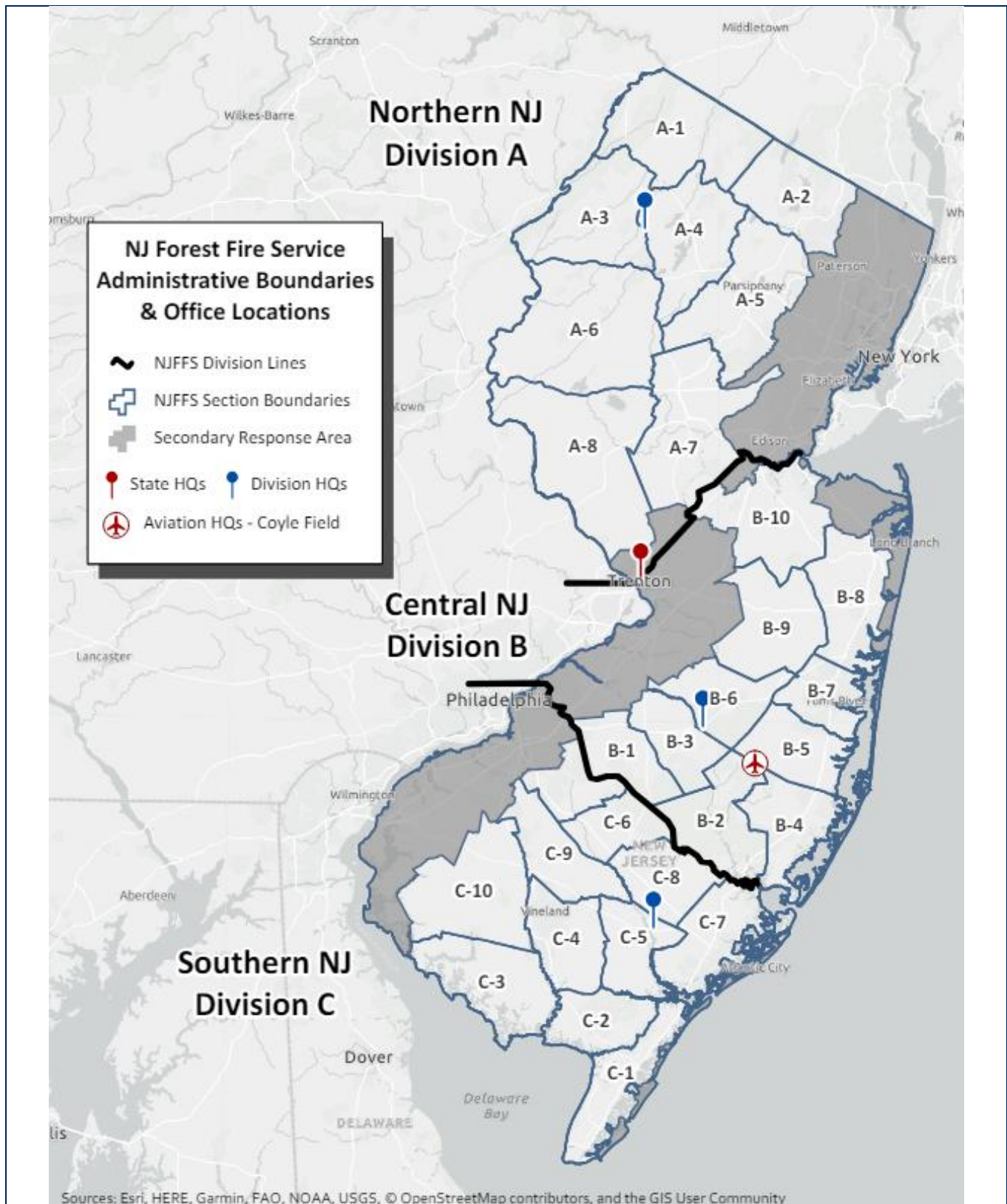
NJFFS created the New Jersey Wildfire Risk Assessment to provide a consistent, comparable set of scientific results to be used as a foundation for wildfire mitigation and prevention planning in New Jersey. This assessment permits an area of interest to be defined for the user; a report for the wildfire hazard potential for Hudson County was created, identifying four measures of wildfire hazard—wildfire fuel hazard, wildfire hazard potential, wildfire burn probability, and surface fuel mapping—as described in the sections below.

WILDFIRE FUEL HAZARD AREAS

A majority of the County has low fuel hazard and low risk. Very small areas throughout the County are identified as having extreme fuel hazards (NJFFS 2024). These areas include the Meadowlands and areas along the Hackensack River in Secaucus, Liberty State Park in Jersey City, and parts of Kearny near the marshland. NJFFS developed Wildfire Fuel Hazard data for the entire state based on NJDEP data (NJHC 2000). Refer to Figure 13-2 for the locations of fuel hazards in Hudson County. The risk levels in Hudson County vary from very low to high.



Figure 13-1. NJFFS Administrative Boundaries



Source: NJDEP 2020



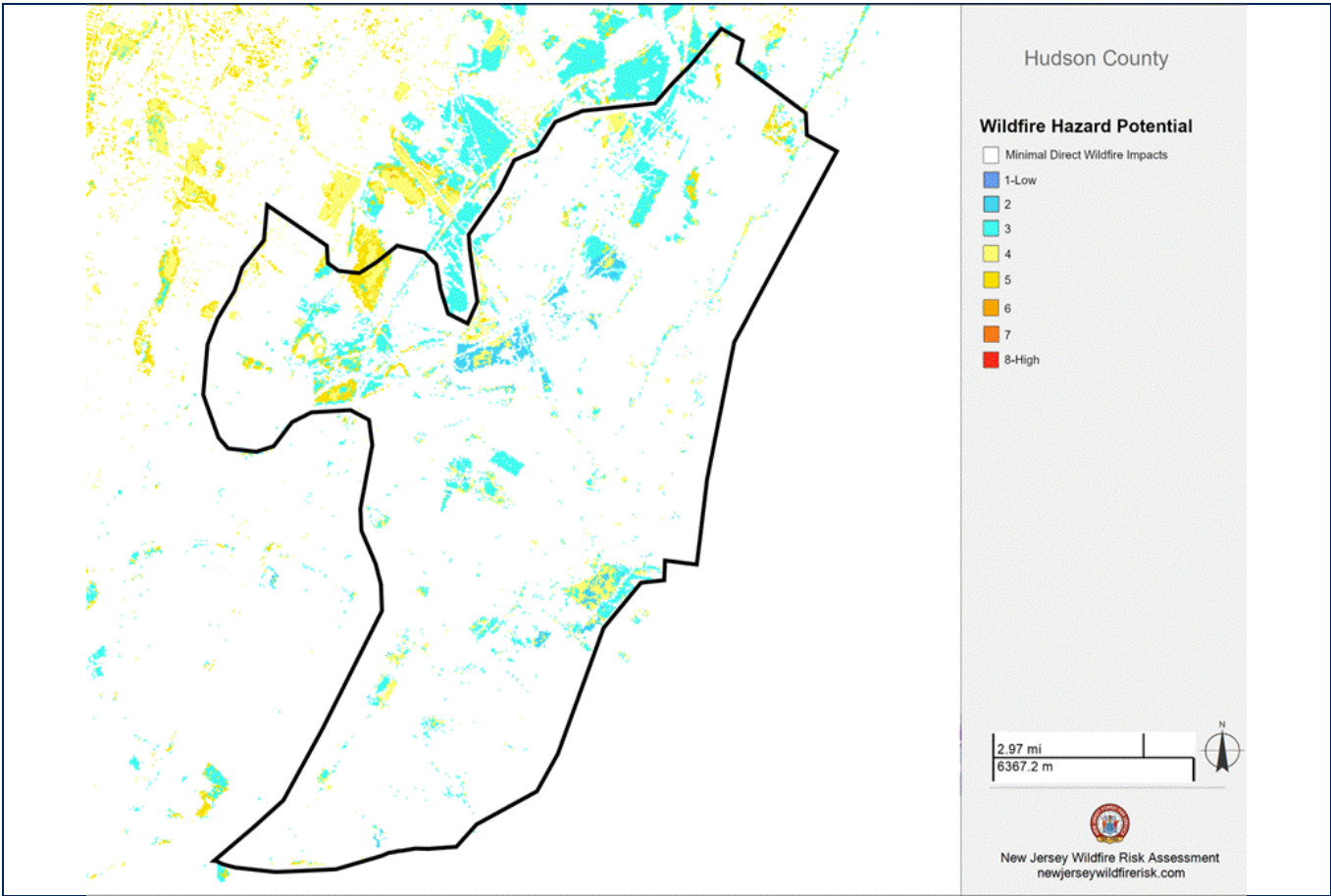
Figure 13-2. Wildfire Fuel Hazard for Hudson County





NJFFS created the New Jersey Wildfire Risk Assessment provides a consistent, comparable set of scientific results to be used as a foundation for wildfire mitigation and prevention planning in the state of New Jersey. This assessment tool permits an area of interest to be defined for the user; a report for the wildfire hazard potential for Hudson County was created. The wildfire hazard potential (WHP) dataset represents an index that quantifies the relative potential for wildfire that may be difficult to control. Figure 13-3 displays the WHP for Hudson County, and Table 13-1 shows the number of acres impacted by each WHP category.

Figure 13-3. Wildfire Hazard Potential for Hudson County



Source: New Jersey Forest Fire Service 2024

Table 13-1. Wildfire Hazard Potential in Hudson County

	Wildfire Hazard Potential Category	Acres	Percent
	Minimal Direct Wildfire Impacts	33,209	91.0 %
	1-Low	0	0.0 %
	2	412	1.1 %
	3	1,617	4.4 %
	4	842	2.3 %

	Wildfire Hazard Potential Category	Acres	Percent
	5	430	1.2 %
	6	1	0.0 %
	7	0	0.0 %
	8-High	0	0.0 %
	Total	36,511	100.0 %

Source: New Jersey Forest Fire Service 2024



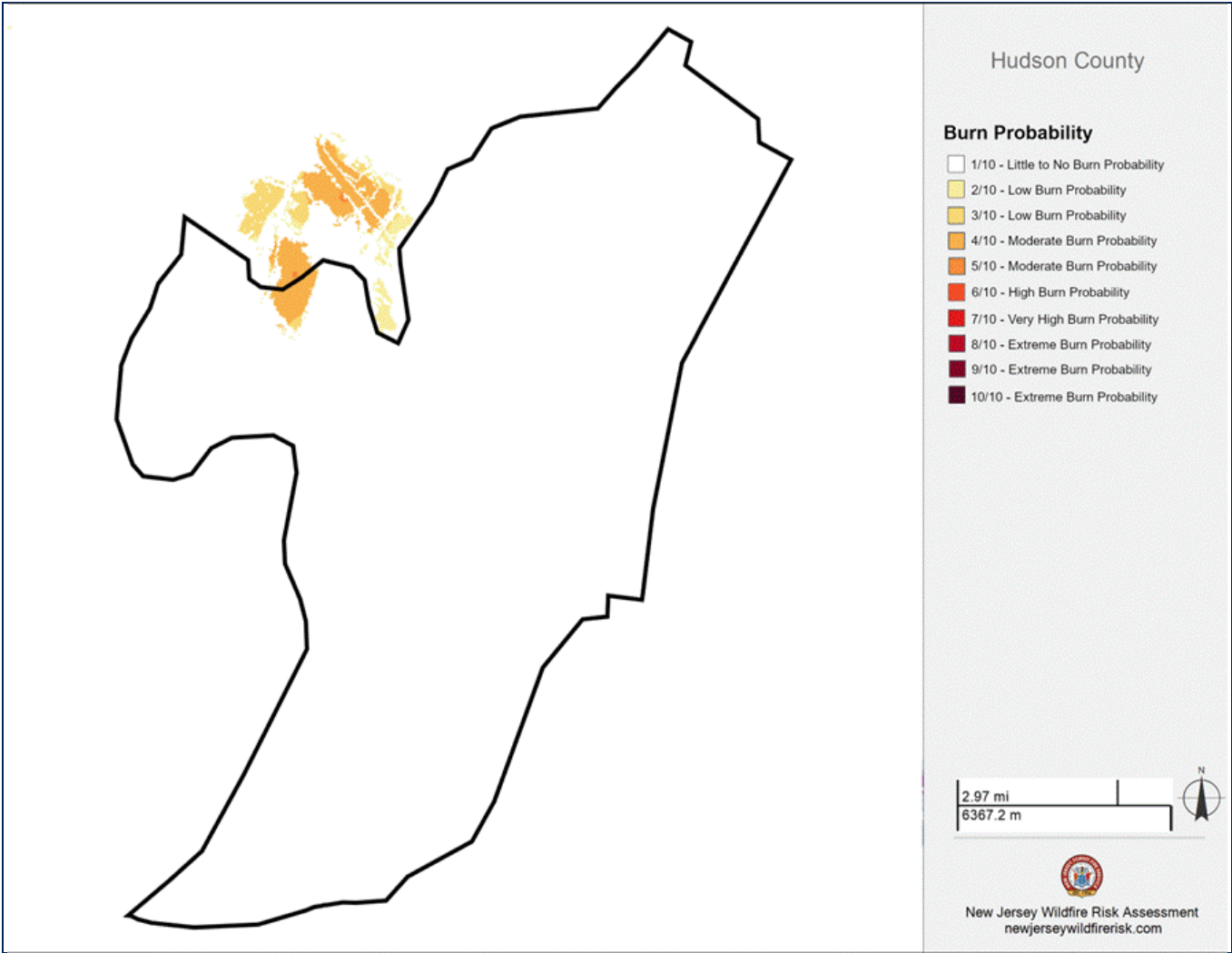


BURN PROBABILITY

Burn probability is the annual probability of wildfire burning in a specific location. At the community level, burn probability or wildfire likelihood is averaged where housing units occur. Burn Probability is based on fire behavior modeling across thousands of simulations of possible fire seasons. In each simulation, factors contributing to the probability of a fire occurring, including weather, topography, and ignitions are varied based on patterns derived from observations in recent decades (New Jersey Forest Fire Service 2024).

Burn Probability is not predictive and does not reflect any currently forecasted weather or fire danger conditions. Burn Probability is simply a probability that any specific location may experience wildfire in any given year. It does not say anything about the intensity of fire if it occurs (New Jersey Forest Fire Service 2024). Table 13-2 displays Hudson County’s Burn Probability; also refer to Figure 13-4.

Figure 13-4. Hudson County Burn Probability



Source: New Jersey Forest Fire Service 2024



**Table 13-2. Hudson County Burn Probability**

	Burn Probability Category	Acres	Percent
	1/10 - Little to No Burn Probability	36,327	99.5 %
	2/10 - Low Burn Probability	3	0.0 %
	3/10 - Low Burn Probability	18	0.0 %
	4/10 - Moderate Burn Probability	166	0.5 %
	5/10 - Moderate Burn Probability	0	0.0 %
	6/10 - High Burn Probability	0	0.0 %
	7/10 - Very High Burn Probability	0	0.0 %
	8/10 - Extreme Burn Probability	0	0.0 %
	9/10 - Extreme Burn Probability	0	0.0 %
	10/10 - Extreme Burn Probability	0	0.0 %
	Total	36,514	100.0 %

Source: New Jersey Forest Fire Service 2024

13.1.3 Extent

The extent (that is, magnitude or severity) of wildfires depends on the 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. 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 (NJDEP 2023).

- The National Fire Danger Rating System's (NFDRS) **Buildup Index** measures the combined cumulative effects of daily drying and precipitation fuels with a ten-day time lag constant. It is a rating of the total amount of fuel available for combustion (NOAA 2020).
- The **Keetch-Byram 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 eight inches) and is expressed in hundredths of an inch of soil moisture depletion (NPS 2023).

In addition to the two indices, the NJFFS uses the NFDRS to measure relative seriousness of burning conditions and threat of fire in the State (Western Fire Chiefs Association 2023). 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 (USFS n.d.). The NJFFS adapted the color system for their purposes, as shown in Table 13-3.

A fire behavior fuel model contains the parameters required by the surface fire spread model to compute surface fire behavior characteristics, including rate of spread, flame length, fire line intensity, and other fire behavior metrics. As the name might suggest, surface fuels account only for surface fire potential and surface fuels are generally defined to be less than six feet in height off the ground. Surface fuels typically are categorized into one of six primary fuel types based on the primary carrier of the surface fire: 1) Grass, 2) Grass/Shrub, 3) Shrub, 4) Timber/Understory, 5) Timber Litter and 6) Slash. These surface fuel models provide the input parameters needed to compute surface fire behavior. Figure 13-5 and Table 13-4 visualize the surface fuel in Hudson County (New Jersey Forest Fire Service 2024).

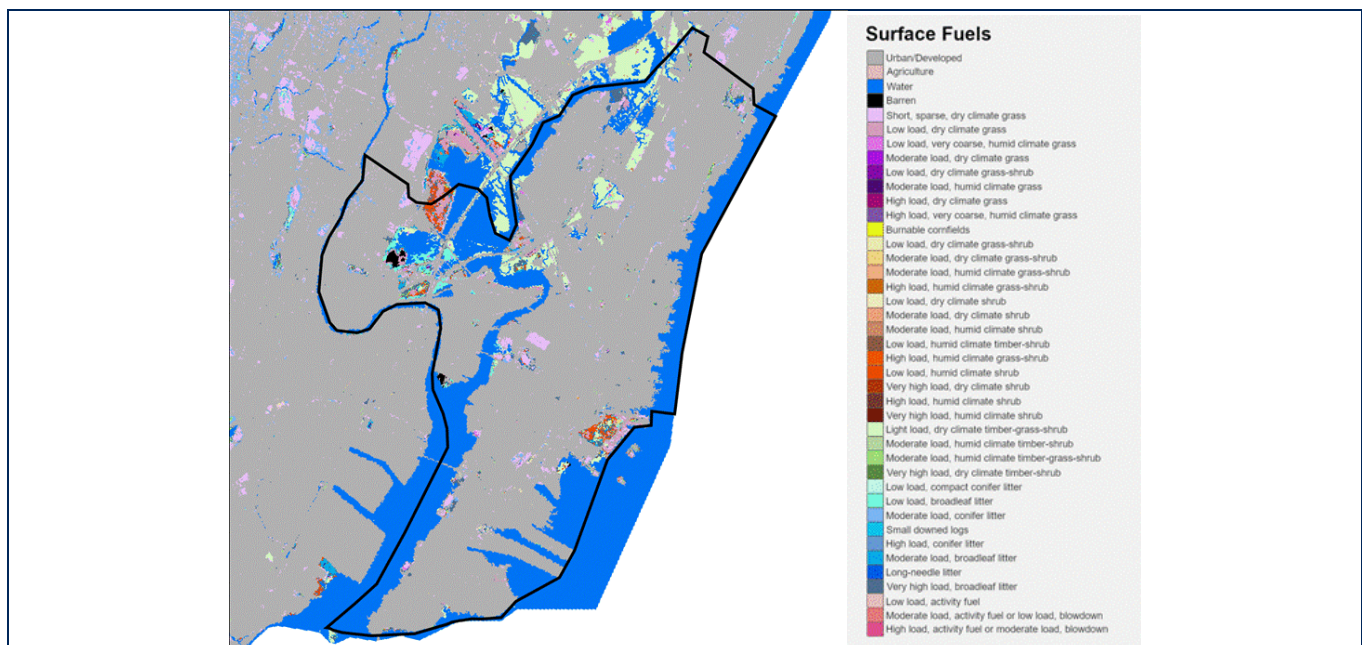


Table 13-3 Fire Danger Rating and Color Code

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.
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: USFS n.d.

Figure 13-5. Surface Fuels in Hudson County



Source: New Jersey Forest Fire Service 2024



Table 13-4. Surface Fuels in Hudson County

	Surface Fuel Model	Description	Acres	Percent		Surface Fuel Model	Description	Acres	Percent
	NB1	Urban/Developed	25,445	69.7 %		SH5	High load, humid climate grass-shrub	0	0.0 %
	NB3	Agriculture	0	0.0 %		SH6	Low load, humid climate shrub	194	0.5 %
	NB8	Water	7,691	21.1 %		SH7	Very high load, dry climate shrub	0	0.0 %
	NB9	Barren	68	0.2 %		SH8	High load, humid climate shrub	0	0.0 %
	GR1	Short, sparse, dry climate grass	771	2.1 %		SH9	Very high load, humid climate shrub	0	0.0 %
	GR2	Low load, dry climate grass	292	0.8 %		TU1	Light load, dry climate timber-grass-shrub	842	2.3 %
	GR3	Low load, very coarse, humid climate grass	42	0.1 %		TU2	Moderate load, humid climate timber-shrub	2	0.0 %
	GR4	Moderate load, dry climate grass	0	0.0 %		TU3	Moderate load, humid climate timber-grass-shrub	77	0.2 %
	GR5	Low load, dry climate grass-shrub	0	0.0 %		TU5	Very high load, dry climate timber-shrub	0	0.0 %
	GR6	Moderate load, humid climate grass	5	0.0 %		TL1	Low load, compact conifer litter	5	0.0 %
	GR7	High load, dry climate grass	0	0.0 %		TL2	Low load, broadleaf litter	240	0.7 %
	GR8	High load, very coarse, humid climate grass	0	0.0 %		TL3	Moderate load, conifer litter	192	0.5 %
	AG9	Burnable cornfields	0	0.0 %		TL4	Small downed logs	0	0.0 %
	GS1	Low load, dry climate grass-shrub	32	0.1 %		TL5	High load, conifer litter	0	0.0 %
	GS2	Moderate load, dry climate grass-shrub	20	0.1 %		TL6	Moderate load, broadleaf litter	95	0.3 %
	GS3	Moderate load, humid climate grass-shrub	0	0.0 %		TL8	Long-needle litter	0	0.0 %
	GS4	High load, humid climate grass-shrub	0	0.0 %		TL9	Very high load, broadleaf litter	485	1.3 %
	SH1	Low load, dry climate shrub	0	0.0 %		SB1	Low load, activity fuel	0	0.0 %
	SH2	Moderate load, dry climate shrub	0	0.0 %		SB2	Moderate load, activity fuel or low load, blowdown	0	0.0 %
	SH3	Moderate load, humid climate shrub	11	0.0 %		SB3	High load, activity fuel or moderate load, blowdown	0	0.0 %
	SH4	Low load, humid climate timber-shrub	10	0.0 %					
Total								36,519	100.0 %

Source: New Jersey Forest Fire Service 2024



13.1.4 Previous Occurrences

FEMA MAJOR DISASTER AND EMERGENCY DECLARATIONS

Between 1954 and 2023, Hudson County was not included in any major disaster (DR) or emergency (EM) declarations for wildfire-related events (FEMA 2023).

USDA DECLARATIONS

The Secretary of Agriculture from the U.S. Department of Agriculture (USDA) is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in contiguous counties. Between 2019 and 2023, Hudson County was not included in any USDA wildfire-related agricultural disaster declarations (USDA 2024).

PREVIOUS EVENTS

No know wildfire events occurred within Hudson County between August 2019 and December 2023, but the County was affected by wildfire smoke from fires originating in Canada in 2023 (NJDEP 2024). Table 13-5 summarizes this event and its impacts. For events prior to 2019, refer to the 2019 Hudson County HMP.

Table 13-5. Wildfire Events in Hudson County (2019 to 2023)

Event Date	Event Type	FEMA or State Declaration Number	County included in declaration?	Location Impacted	Description
June 1 to August 21, 2023	Wildfire	N/A	N/A	County-wide	Wildfire smoke from fires in Nova Scotia, Canada produced unsafe air conditions in the Northeast. NJDEP recorded 23 ozone and fine particulate exceedance days between June 1 and August 21, citing the Nova Scotian wildfires as the causes.

Source: NJDEP 2024

The NJFFS keeps records of wildfires and prescribed burns in the State of New Jersey; Hudson County’s statistics between 2018 and 2023 can be viewed in Table 13-6. In Hudson County, between 2018 and 2023, there have been a total of 6 fires with a total acre burned of 28.75 and no occurrences of prescribed burns.

13.1.5 Probability of Future Occurrences

PROBABILITY BASED ON PREVIOUS OCCURRENCES

Information on previous wildfire occurrences in the County was used to calculate the probability of future occurrence of such events, as summarized in Table 13-7. Based on historical records and input from the Steering Committee, the probability of occurrence for wildfire in the County is considered “occasional.”

**Table 13-6. Wildfires and Prescribed Burns in Hudson County 2018-2023**

Year	Wildfires		Prescribed Burns	
	Number of Fires	Acres Burned	Number of Treatments	Acres Treated
2018	none reported	none reported	0	0
2019	1	2.5	0	0
2020	none reported	none reported	0	0
2021	none reported	none reported	0	0
2022	none reported	none reported	0	0
2023	5	26.25	0	0
Total	6	28.75	0	0

Source: New Jersey Forest Fire Service 2024

Table 13-7. Probability of Future Wildfire Events in Hudson County

Hazard Type	Number of Occurrences Between 1996 and 2023	Percent Chance of Occurring in Any Given Year
Wildfire	6	22.2%

Source: NOAA-NCEI 2024

Notes: This table includes events that occurred in Hudson County, so it does not include the air quality impacts from the Canadian wildfires in 2023.

EFFECT OF CLIMATE CHANGE ON FUTURE PROBABILITY

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 (US EPA 2022). Potential climate change impacts on wildfire risk include the following:

- Higher temperatures are expected to increase the amount of moisture that evaporates from land and water. This can lead to more frequent and severe droughts, which, in turn, increases the likelihood of wildfires (US EPA 2022).
- A gradual change in temperatures will alter the growing environment of many tree species in New Jersey, reducing the growth of some trees and increasing the growth of others.
- Warmer temperatures may lead to longer dry seasons and multi-year droughts, creating triggers for insects and invasive species. An increase in invasive species, such as the emerald ash borer, can lead to the destruction and death of trees, adding more fuel for fires.
- Increased temperature and change in precipitation will also affect fuel moisture during wildfire season and the length of time during which wildfires can burn during a given year (US EPA 2022).
- A warmer atmosphere holds more moisture, which is one of the key items for triggering a lightning strike. If the frequency of lightning strikes increases, the potential for wildfires from these strikes also increases (National Geographic 2014).



Based on these projections, Hudson County 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 (US EPA 2022).

13.1.6 Cascading Impacts on Other Hazards

Wildfires can increase the probability of other natural disasters, specifically floods and mudflows. Wildfires, particularly large-scale fires, can dramatically alter the terrain and ground conditions, making land already devastated by fire susceptible to floods. Lands impacted by wildfire increase the risk of flooding and mudflow in those areas impacted by wildfire. Normally, vegetation absorbs rainfall, reducing runoff. However, wildfires leave the ground charred, barren, and unable to absorb water; thus, creating conditions perfect for flash flooding and mudflows. Flood risk in these impacted areas remain significantly higher until vegetation is restored, which can take up to five years after a wildfire (FEMA 2021).

13.2 Vulnerability and Impact Assessment

A spatial analysis was conducted using the 2009 NJDEP Wildfire Fuel Hazard spatial layer. For the purposes of the assessment, an asset (population, structures, critical facilities, and lifelines) is considered exposed and potentially vulnerable to the wildfire hazard if it is located in the 'extreme', 'very high' and 'high' wildfire fuel hazard areas. Refer to Section 4.2 (Methodology and Tools) for additional details on the methodology used to assess wildfire risk.

13.2.1 Life, Health, and Safety

Wildfires have the potential to impact human health and life of residents and responders, structures, infrastructure, and natural resources. The most vulnerable populations include emergency responders and those within a short distance of the interface between the built environment and the wildland environment. First responders are exposed to the dangers from the initial incident and after-effects from smoke inhalation and heat stroke.

Smoke generated by wildfire consists of visible and invisible emissions that contain particulate matter (soot, tar, water vapor, and minerals), gases (carbon monoxide, carbon dioxide, nitrogen oxides), and toxics (formaldehyde, benzene). Emissions from wildfires depend on the type of fuel, the moisture content of the fuel, the efficiency (or temperature) of combustion, and the weather. Public health impacts associated with wildfire include difficulty in breathing, odor, and reduction in visibility.

OVERALL POPULATION

Table 13-8 summarizes the estimated population exposed to the wildfire hazard by municipality. Based on the analysis, an estimated 859 residents, or 0.1-percent of the County's population, live in the extreme, high, and very high wildfire fuel hazard areas. Overall, the City of Bayonne has the greatest number of individuals located in the extreme, very high, and high fuel hazard areas (366 persons).

**Table 13-8. Population in Wildfire Fuel Hazard Areas**

Jurisdiction	Total Population	Population Exposure to The Wildfire Fuel Hazard Area (Extreme High, Very High, High)	
		Number of Persons	% of Jurisdiction Total
City of Bayonne	71,686	366	0.5%
Borough of East Newark	2,594	0	0.0%
Town of Guttenberg	12,017	0	0.0%
Town of Harrison	19,450	0	0.0%
City of Hoboken	60,419	0	0.0%
City of Jersey City	292,449	223	0.1%
Town of Kearny	41,999	0	0.0%
Township of North Bergen	63,361	12	<0.1%
Town of Secaucus	22,181	250	1.1%
City of Union City	68,589	0	0.0%
Township of Weehawken	17,197	8	<0.1%
Town of West New York	52,912	0	0.0%
Hudson County	724,854	859	0.1%

Source: U.S. Census Bureau 2020; NJFFS 2012

SOCIALLY VULNERABLE POPULATION

Smoke and air pollution from wildfires can be a severe health hazard, especially for sensitive populations, including children, the elderly, and those with respiratory and cardiovascular diseases.

Table 13-9 presents the estimated socially vulnerable populations located within the Wildfire Fuel Hazard (High, Very High, and Extreme). There are 114 persons over the age of 65 years, 52 persons under the age of 5 years, 76 non-English speakers, 75 persons with a disability, and 88 living in poverty located in these areas. Economically disadvantaged populations are more vulnerable to wildfire 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.

13.2.2 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 or concrete. Table 13-10 summarizes the estimated building stock inventory located in the defined hazard area by municipality. Approximately 1.3 percent (\$1.2 billion) of the County's building replacement cost value is located in the extreme, very high, and high wildfire fuel risk hazard area. The Township of Secaucus has the greatest number of buildings located in the wildfire hazard area (52 structures, 1.4 percent of its total).

**Table 13-9. Estimated Number of Vulnerable Persons Located in the Wildfire Fuel Hazard (High, Very High, and Extreme)**

Jurisdiction	Estimated Number of Vulnerable Persons Located in the Wildfire Fuel Hazard (High, Very High, and Extreme)				
	Persons Over 65	Persons Under 5	Non-English Speaking Persons	Persons with a Disability	Persons in Poverty
City of Bayonne	50	26	28	35	43
Borough of East Newark	0	0	0	0	0
Town of Guttenberg	0	0	0	0	0
Town of Harrison	0	0	0	0	0
City of Hoboken	0	0	0	0	0
City of Jersey City	24	15	22	17	32
Town of Kearny	0	0	0	0	0
Township of North Bergen	2	0	2	1	1
Town of Secaucus	37	11	24	22	12
City of Union City	0	0	0	0	0
Township of Weehawken	1	0	0	0	0
Town of West New York	0	0	0	0	0
Hudson County	114	52	76	75	88

Source: U.S. Census Bureau ACS 5-Year Estimates; NJFFS 2012

Table 13-10. Estimated Number and Total Replacement Cost Value of Structures Located in the Extreme, Very High, or High Wildfire Fuel Risk Hazard Area

Jurisdiction	Jurisdiction Total Buildings		Number of Buildings		Replacement Cost Value (RCV)	
	Number of Buildings	Replacement Cost Value (RCV)	Count	% of Jurisdiction Total	Value	% of Jurisdiction Total
City of Bayonne	9,264	\$11,278,964,959	49	0.5%	\$152,090,974	1.3%
Borough of East Newark	434	\$300,712,303	0	0.0%	\$0	0.0%
Town of Guttenberg	2,574	\$1,062,772,505	0	0.0%	\$0	0.0%
Town of Harrison	2,646	\$2,812,269,922	0	0.0%	\$0	0.0%
City of Hoboken	14,289	\$6,922,849,652	0	0.0%	\$0	0.0%
City of Jersey City	38,336	\$29,829,276,781	39	0.1%	\$557,805,690	1.9%
Town of Kearny	7,207	\$9,630,626,567	11	0.2%	\$7,626,936	0.1%
Township of North Bergen	6,002	\$9,906,706,329	6	0.1%	\$61,754,915	0.6%
Town of Secaucus	3,844	\$12,075,088,549	52	1.4%	\$414,530,037	3.4%
City of Union City	1,729	\$4,009,712,429	0	0.0%	\$0	0.0%
Township of Weehawken	2,112	\$1,638,112,105	2	0.1%	\$3,638,993	0.2%
Town of West New York	4,594	\$3,076,856,343	3	0.1%	\$6,781,464	0.2%
Hudson County (Total)	93,031	\$92,543,948,444	162	0.2%	\$1,204,229,010	1.3%

Source: NJOIT 2024; Microsoft BING 2019; RS Means 2024; NJFFS 2012



Table 13-11 displays the distribution of buildings at risk from wildfires across different jurisdictions and occupancy classes within Hudson County. In summary, Hudson County has 162 buildings at risk, comprising 103 residential, 13 commercial, 16 industrial, and 30 government, religious, agricultural, and educational structures. The Township of Secaucus has the highest number of residential buildings in this hazard area (37).

Table 13-11. Buildings in the Extreme, Very High, or High Wildfire Fuel Risk Hazard Area, by General Occupancy Class

Jurisdiction	Buildings in the Wildfire Fuel Hazard (High, Very High, and Extreme) by General Occupancy Class			
	Residential	Commercial	Industrial	Government, Religion, Agricultural, and Education
City of Bayonne	39	1	4	5
Borough of East Newark	0	0	0	0
Town of Guttenberg	0	0	0	0
Town of Harrison	0	0	0	0
City of Hoboken	0	0	0	0
City of Jersey City	25	2	2	10
Town of Kearny	0	0	3	8
Township of North Bergen	1	4	1	0
Town of Secaucus	37	6	3	6
City of Union City	0	0	0	0
Township of Weehawken	1	0	0	1
Town of West New York	0	0	3	0
Hudson County (Total)	103	13	16	30

Source: NJOIT 2024; Microsoft BING 2019; NJFFS 2012

13.2.3 Community Lifelines and Other Critical Facilities

Wildfires can have an impact on the water supplies throughout the County because of residual pollutants like char or debris landing in water resources which can clog wastewater pipes, culverts, etc. Wildfires may also impact transportation routes, blocking residents and commuters from getting in and out of the County during a wildfire event because of char and debris polluting the air making it difficult to drive, or the flames having close proximity to the roadways making the route an unsafe passageway. In general, roads and bridges surrounding the areas of fire risk are important because they provide ingress and egress to large areas and, in some cases, to isolated neighborhoods. Fires can create conditions that block or prevent access and can isolate residents and emergency service providers.

In Hudson County, several jurisdictions have no facilities in wildfire fuel hazard areas. The City of Jersey City has the highest number of facilities in the hazard area, totaling nine facilities, which is 2.1 percent of the jurisdiction total. Overall, Hudson County has 19 facilities in wildfire fuel hazard areas, representing 1.5 percent of the county's total facilities. Table 13-12 highlights the varying degrees of vulnerability to wildfire hazards across the county's jurisdictions.



Table 13-12. Number of Facilities in the Wildfire Fuel Hazard Area

Jurisdiction	Number of Facilities in the Wildfire Fuel Hazard Area, by Lifeline Category									Total Facilities in Hazard Area	
	Communications	Energy	Food, Hydration, Shelter	Hazardous Materials	Health & Medical	Safety & Security	Transportation	Water Systems	Other Critical Facilities	Count	% of Jurisdiction Total
Bayonne (C)	0	1	0	0	0	0	0	1	0	2	1.7%
East Newark (B)	0	0	0	0	0	0	0	0	0	0	0.0%
Guttenberg (T)	0	0	0	0	0	0	0	0	0	0	0.0%
Harrison (T)	0	0	0	0	0	0	0	0	0	0	0.0%
Hoboken (C)	0	0	0	0	0	0	0	0	0	0	0.0%
Jersey City (C)	0	0	1	0	0	0	4	4	0	9	2.1%
Kearny (T)	0	0	0	0	0	0	0	2	0	2	1.9%
North Bergen (T)	0	0	0	0	0	0	0	0	0	0	0.0%
Secaucus (T)	0	0	0	0	0	0	1	2	1	4	4.8%
Union City (C)	0	0	0	0	0	0	0	0	0	0	0.0%
Weehawken (T)	0	1	0	0	0	0	1	0	0	2	4.3%
West New York (T)	0	0	0	0	0	0	0	0	0	0	0.0%
Hudson County (Total)	0	2	1	0	0	0	6	9	1	19	1.5%

Source: Hudson County 2024; HIFLD 2024; NJGIN 2024; NJFFS 2012



13.2.4 Economy

Wildfire events can have major economic impacts on a community from the initial loss of structures and the subsequent loss of revenue from destroyed business. These events may cost thousands of taxpayer dollars to suppress and control and may 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 Hudson County or its municipalities, it is not possible to estimate future losses due to wildfire events currently.

13.2.5 Natural, Historic and Cultural Resources

Natural

Wildfires are naturally occurring events in the ecosystem cycle, but intense wildfires can burn and kill plant and animal life. Intense fire can also heat narrow and shallow waterways, resulting in damage to aquatic systems. Post-fire runoff polluted with debris and contaminants can be harmful to terrestrial ecosystems and aquatic life (USGS 2023). Intense wildfire events that destroy existing ecosystems can cause an increase in invasive species that may be able to move into an area with a lack of natural competitors (U.S. Department of the Interior 2012).

Historic

Wildfires pose a significant threat to historic resources, with the potential to cause extensive damage or even complete destruction. The impact on historic infrastructure from wildfires is largely dependent on the construction materials used. Many historic structures are constructed from wood, a highly flammable material. Furthermore, these structures were often built before the implementation of strict building codes and before there was a comprehensive understanding of wildfire risks.

Cultural

Wildfires are a major threat to cultural resources, with the potential to cause extensive damage, and in some cases, complete destruction. The potential impacts on cultural resources from wildfire depend heavily on the materials used to construct the facility in which cultural resources are located. In many instances, historic structures house cultural resources and artifacts; many historic structures are made of wood, which is a highly flammable material. Outdoor events are likely to be postponed or cancelled as the result of wildfire conditions, as smoke conditions can have harmful impacts to the human body.

13.3 Future Changes That May Affect Risk

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



13.3.1 Potential or Planned Development

As discussed and illustrated in Chapter 3 (County Profile), areas targeted for future growth and development have been identified across the County. Any changes in development can impact the County's risk to the wildfire hazard of concern. Therefore, the County should implement wildfire management strategies in existing building code to protect structures against the residual impacts from wildfire such as heat, debris, and char. Furthermore, development should be built with access to transit routes that will enable easier evacuation during a wildfire event.

13.3.2 Projected Changes in Population

The New Jersey Department of Labor and Workforce Development produced populations projections by County from 2014 to 2019, 2024, 2029, and 2034. According to these projections, Hudson County is projected to have a decrease in population in the upcoming years. These projection totals include a population of 747,400 by 2029 and 766,500 by 2034 (State of New Jersey 2017). With the population increasing, changes in population density can significantly impact the number of persons exposed to the wildfire hazard. Fire suppression capabilities are high at the State and local levels. However, new development and changes in population with a mix of additional structures, ornamental vegetation, and wildland fuels will require continued assessment of the hazard and mitigation risk.

13.3.3 Climate Change

According to the USDA Forest Service, climate change will likely alter the atmospheric patterns that affect fire weather. Changes in fire patterns will, in turn, impact carbon cycling, forest structure, and species composition. Climate change associated with warmer temperatures, changes in rainfall, and increased periods of drought may create an atmospheric and fuel environment that is more conducive to large, severe fires (United Nations 2021).

Understanding the climate/fire/vegetation interactions is essential for addressing issues associated with climate change that include (USFS 2011):

- Effects on regional circulation and other atmospheric patterns that affect fire weather
- Effects of changing fire regimes on the carbon cycle, forest structure, and species composition, and
- Complications from land use change, invasive species and an increasing wildland-urban interface.

As discussed earlier, average temperatures are anticipated to increase in New Jersey, 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 and droughts have the potential to increase the likelihood of a wildfire. The increased potential combined with stronger winds may make it harder to contain fires and thus increase the County's vulnerability to this hazard.

13.3.4 Other Identified Conditions

Climate change associated with warmer temperatures, changes in rainfall, and increased periods of drought may create an atmospheric and fuel environment that is more conducive to large, severe fires (United Nations 2021). Changes in climate patterns may impact the distribution and perseverance of insect outbreaks that create dead trees (increase



fuel). When climate alters fuel loads and fuel moisture, forest susceptibility to wildfires changes. Climate change also may increase winds that spread fires. Faster fires are harder to contain and are more likely to expand into residential neighborhoods.



14. HAZARD RANKING

Hazard rankings have been used as one of the bases for identifying the jurisdictional hazard mitigation strategies included in Volume II. These rankings may vary among the jurisdictions. For example, a hazard may be ranked low in one municipality but due to differences in vulnerability and impact, be ranked as high for the County or another municipality. Jurisdictional ranking results are presented in each jurisdictional annex in Volume II.

14.1 Hazard Ranking Methodology

Each jurisdiction participating in this HMP has differing levels of vulnerability to and potential impacts from each of the hazards assessed in this plan. Each jurisdiction needs to recognize the hazards that pose the greatest risk to its community and direct its attention and resources accordingly to manage risk and reduce losses. To achieve this, the hazards of concern were ranked using methodologies promoted by FEMA's hazard mitigation planning guidance and input from all participating jurisdictions. Relative ranking scores were generated by FEMA's Hazus risk assessment tool.

14.2 Categories Used in Ranking

The ranking methodology is based on four risk assessment categories, with the following scoring parameters defined for each category:

- **Level**—The level is a qualitative description of how each hazard rates in each category (such as low to high, or unlikely to frequent)
- **Benchmark value**—The benchmark values are clearly determinable quantities or descriptions that define which level should apply to each hazard
- **Numeric value**—The numeric value is the hazard's score in each category, based on the assigned level
- **Weighting**—The weighting is a multiplier applied to each hazard's numeric value in each category, to represent the relative importance of the category (the higher the weighting, the more important the category)

The following sections describe the categories and their associated scoring parameters.

14.2.1 Probability of Occurrence

The probability of occurrence of the hazard scenario evaluated was estimated by examining the historical record or calculating the likelihood of annual occurrence. When no scenario was assessed, an examination of the historical record and judgment was used to estimate the probability of occurrence of an event that will impact the County. Table 14-1 summarizes the scoring parameters for probability of occurrence.

The hazard ranking methodology for some hazards of concern is based on a scenario event that only impacts specific areas (such as a floodplain), while others are based on their potential risk to the County as a whole. In order to account for these differences, the hazard ranking scores were adjusted using professional judgment.

**Table 14-1. Values and Weights for Probability of Occurrence**

Level	Benchmark Value	Numeric Value	Weighting
Unlikely	Hazard event has less than a 1 percent annual probability of occurring.	0	30%
Rare	Hazard event has between 1 and 10 percent annual probability of occurring.	1	
Occasional	Hazard event has between 10 and 100 percent annual probability of occurring.	2	
Frequent	100 percent annual probability; hazard event is likely to occur multiple times per year.	3	

CONSEQUENCE

Consequence represents the expected vulnerability and impact associated with the hazard. This is rated for three subcategories: vulnerability of people; vulnerability of property; and economic impacts on the community. A numeric value based on defined benchmarks is assigned for each subcategory, and a factor is applied to those values representing the relative importance of each subcategory. The total numeric value for consequence is the sum of the factored numeric values for each subcategory. Table 14-2 summarizes the scoring parameters for consequence.

Table 14-2. Values and Weights for Consequence

Level	Benchmark Value	Numeric Value	Factor	Weighting
Population (Numeric Value x 3)				30%
None	No population vulnerable to the hazard	0	3	
Low	14 percent or less of population is exposed to a hazard with potential for measurable life-safety impact due to its extent and location.	1		
Medium	15 to 29 percent of population is exposed to a hazard with potential for measurable life-safety impact due to its extent and location.	2		
High	30 percent or more of population is exposed to a hazard with potential for measurable life-safety impact, due to its extent and location.	3		
Property (Numeric Value x 2)				
None	No property vulnerable to the hazard	0	2	
Low	Property vulnerability is 14 percent or less of the total number of structures for your community.	1		
Medium	Property vulnerability is 15 to 29 percent of the total number of structures for the community.	2		
High	Property vulnerability is 30 percent or more of the total number of structures for the community.	3		
Economy (Numeric Value x 1)				
None	No estimated loss due to the hazard	0	1	
Low	Loss estimate is 9 percent or less of the total replacement cost for the community.	1		
Medium	Loss estimate is 10 to 19 percent of the total replacement cost for the community.	2		
High	Loss estimate is 20 percent or more of the total replacement cost for the community.	3		



ADAPTIVE CAPACITY

Adaptive capacity describes a jurisdiction's administrative, technical, planning/regulatory and financial ability to protect from or withstand a hazard event. Mitigation measures that can increase a jurisdiction's capacity to withstand and rebound from events include codes or ordinances with higher standards to withstand hazards due to design or location; deployable resources; or plans and procedures for responding to an event.

A rating of "weak" for adaptive capacity means a jurisdiction does not have the capability to effectively respond, which increases vulnerability. A "strong" adaptive capacity means the jurisdiction does have the capability to effectively respond, which decreases vulnerability. These ratings were assigned using the results of the core capability assessment, with input from each jurisdiction. Table 14-3 summarizes the scoring parameters for adaptive capacity.

Table 14-3. Values and Weights for Adaptive Capacity

Level	Benchmark Value	Numeric Value	Weighting
Weak	Weak, outdated, or inconsistent plans, policies, codes, or ordinances in place; no redundancies; limited to no deployable resources; limited capabilities to respond; long recovery.	1	30%
Moderate	Plans, policies, codes/ordinances in place and meet minimum requirements; mitigation strategies identified but not implemented on a widespread scale; county/jurisdiction can recover but needs outside resources; moderate county/Jurisdiction capabilities.	0	
Strong	Plans, policies, codes/ordinances in place and exceed minimum requirements; mitigation/protective measures in place; county/jurisdiction has ability to recover quickly because resources are readily available, and capabilities are high.	-1	

CLIMATE CHANGE

Current climate change projections were evaluated as part of the hazard ranking to account for potential increases in severity or frequency of the hazard. This is important because the hazard ranking helps guide and prioritize the mitigation strategy as a long-term future vision for mitigating the hazards of concern. The potential impacts that climate change may have on each hazard of concern are discussed in the risk assessment chapters for each hazard. Table 14-4 summarizes the scoring parameters for climate change. The benchmark values are similar to confidence levels outlined in the Fifth National Climate Assessment.

Table 14-4. Values and Weights for Climate Change

Level	Benchmark Value	Numeric Value	Weighting
Low	No local data are available; modeling projects are uncertain on whether there is increased future risk; confidence level is low (inconclusive evidence).	1	10%
Medium	Studies and modeling projections indicate a potential for exacerbated conditions due to climate change; confidence level is medium to high (moderate evidence).	2	
High	Studies and modeling projections indicate exacerbated conditions and increased future risk due to climate change; very high confidence level (strong evidence, well documented, and acceptable methods).	3	



14.2.2 Total Ranking Score

The total ranking score based on the categories described above is calculated using the following equation:

Risk Ranking Score Equation

Ranking Score= [(Consequence on Population x 3) + (Consequence on Property x 2) + (Consequence on Economy x 1) x 0.3] + [Adaptive Capacity x 0.3] + [Climate Change x 0.1] + [Probability of Occurrence x 0.3]

Using this equation, the highest possible ranking score is 6.9. The higher the number, the greater the relative risk. Based on the score for each hazard, a hazard ranking is assigned to each hazard of concern as follows:

- Low = Values less than 3.9
- Medium = Values between 3.9 and 4.9
- High = Values greater than 4.9.

All Planning Partners applied the same methodology to develop the hazard rankings to ensure consistency in the overall ranking of risk. However, each jurisdiction had the ability to alter rankings based on local knowledge and experience in handling each hazard.

14.3 Hazard Ranking Results

Using the methodology described above, the hazard ranking for the identified hazards of concern was determined for each planning partner. The hazard ranking for Hudson County is detailed in the following tables that present the stepwise process for the ranking:

- Table 14-5 shows the unweighted numeric values assigned for the probability of occurrence for each hazard.
- Table 14-6 shows the numeric values assigned for each subcategory of consequence for each hazard. Results are shown for applying the subcategory factors, but not the category-wide weighting.
- Table 14-7 shows the unweighted numeric values assigned for adaptive capacity and climate change for each hazard.
- Table 14-8 shows the total weighted hazard ranking scores for each hazard of concern.

The countywide hazard ranking includes the entire planning area and may not reflect the highest risk for all Planning Partners. The overall ranking for each jurisdiction is included in Table 14-9 and in the annexes in Volume II.

*Table 14-5. Probability of Occurrence for Hazards of Concern for Hudson County*

Hazard of Concern	Probability	Numeric Value
Dam and Levee Failure	Rare	1
Drought	Occasional	2
Extreme Temperature	Frequent	3
Flood	Frequent	3
Geological Hazards	Occasional	2
Severe Weather	Occasional	2
Severe Winter Weather	Occasional	2
Wildfire	Occasional	2

Table 14-6. Consequence Rating for Hazards of Concern for Hudson County

Hazard of Concern	Population			Property			Economy			Total Impact Rating (Population + Property + Economy)
	Consequence	Numeric Value	Multiplied by Factor (3)	Consequence	Numeric Value	Multiplied by Factor (2)	Consequence	Numeric Value	Multiplied by Factor (1)	
Dam and Levee Failure	Medium	2	6	Medium	2	4	Medium	2	2	12
Drought	High	3	9	Low	1	2	Low	1	1	12
Extreme Temperature	Medium	2	6	Low	1	2	Low	1	1	9
Flood	High	3	9	Medium	2	4	High	3	3	16
Geological Hazards	Medium	2	6	Medium	2	4	High	3	3	13
Severe Weather	Medium	2	6	High	3	6	High	3	3	15
Severe Winter Weather	Medium	2	6	Medium	2	4	Medium	2	2	12
Wildfire	Low	1	3	Low	1	2	Low	1	1	6

**Table 14-7. Adaptive Capacity and Climate Change Ratings for Hazards of Concern for Hudson County**

Hazard of Concern	Adaptive Capacity		Climate Change	
	Level	Numeric Value	Level	Numeric Value
Dam and Levee Failure	Medium	0	Medium	2
Drought	Medium	0	High	3
Extreme Temperature	Medium	0	High	3
Flood	High	-1	High	3
Geological Hazards	Medium	0	Medium	2
Severe Weather	Medium	0	Medium	2
Severe Winter Weather	Medium	0	Medium	2
Wildfire	Medium	0	Medium	2

Table 14-8. Total Hazard Ranking Scores for the Hazards of Concern for Hudson County

Hazard of Concern	Probability x 30%	Total Consequence x 30%	Adaptive Capacity x 30%	Changing Future Conditions x 10%	Total Hazard Ranking Score
Dam and Levee Failure	0.3	3.6	0	0.2	4.1
Drought	0.6	3.6	0	0.3	4.5
Extreme Temperature	0.9	2.7	0	0.3	3.9
Flood	0.9	4.8	-0.3	0.3	5.7
Geological Hazards	0.6	3.9	0	0.2	4.7
Severe Weather	0.6	4.5	0	0.2	5.3
Severe Winter Weather	0.6	3.6	0	0.2	4.4
Wildfire	0.6	1.8	0	0.2	2.6

Note: Low (yellow) = Values less than 3.9; Medium (orange) = Values between 3.9 and 4.9; High (red) = Values greater than 4.9



Table 14-9. Overall Ranking of Hazards by Jurisdiction

	Dam and Levee Failure	Drought	Extreme Temperature	Flood	Geological Hazards	Severe Weather	Severe Winter Weather	Wildfire
City of Bayonne	Low	Medium	Medium	High	Low	High	Medium	Low
Borough of East Newark	Low	Medium	Low	Medium	High	High	Medium	Low
Town of Guttenberg	Low	Medium	Low	Medium	Medium	High	Medium	Low
Town of Harrison	Low	Medium	Low	High	High	High	Medium	Low
City of Hoboken	Low	Medium	Medium	High	High	High	Medium	Low
City of Jersey City	Low	Medium	Medium	High	Medium	High	Medium	Low
Town of Kearny	Low	Medium	Low	High	Low	High	Medium	Low
Township of North Bergen	Low	Medium	Low	High	Low	High	Medium	Low
Town of Secaucus	Low	Medium	Low	High	Low	High	Medium	Low
City of Union City	Low	Medium	Medium	Medium	Low	High	Medium	Low
Township of Weehawken	Low	Medium	Low	High	Low	High	Medium	Low
Town of West New York	Low	Medium	Low	Medium	Low	High	Medium	Low
Hudson County	Medium	Medium	Medium	High	Medium	High	Medium	Low

Note: Low (yellow) = Values less than 3.9; Medium (orange) = Values between 3.9 and 4.9; High (red) = Values greater than 4.9



15. CAPABILITY ASSESSMENT

A capability assessment is an inventory of a community's missions, programs, and policies and an analysis of its capacity to carry them out (FEMA 2003). This assessment is an integral part of the planning process. It enables identification, review, and analysis of current local and state programs, policies, regulations, funding, and practices that could either facilitate or hinder mitigation. Through assessing its capabilities, a jurisdiction learns how or whether it can implement certain mitigation actions by determining the following:

- Limitations that may exist on undertaking actions
- The range of local and/or state administrative, programmatic, regulatory, financial, and technical resources available to assist in implementing their mitigation actions
- Actions that are infeasible because they are outside the scope of current capabilities
- Types of mitigation actions that may be technically, legally, administratively, politically, or fiscally challenging or infeasible
- Opportunities to enhance local capabilities to support long-term mitigation and risk reduction

This chapter presents a summary and description of the existing plans, programs, and regulatory mechanisms at all levels of government (federal, state, county, local) that reduce hazard risks and support hazard mitigation within the planning area. These capabilities are presented in three categories:

- Planning and regulatory capabilities
- Administrative and technical capabilities
- Fiscal capabilities

Each Planning Partner's annex in Volume II also includes a capability assessment specific to those jurisdictions. In addition to the above categories, the annexes review capabilities in the more localized categories of adaptive capacity and education and outreach.

15.1 Capability Assessment Process

Each participating jurisdiction's annex in Volume II includes a capability assessment specific to those jurisdictions. In addition to the capability categories in this chapter, the annexes review capabilities in the more localized categories of adaptive capacity and education and outreach. All participating jurisdictions were tasked with developing or updating their capability assessment for this update, evaluating the effectiveness of their capabilities in supporting hazard mitigation and identifying opportunities to enhance local capabilities. Each jurisdiction identified how it has integrated hazard mitigation into its existing planning, regulatory, and operational/administrative framework and how it intends to promote ongoing integration.

The contracted consultant met with Hudson County and each jurisdiction virtually to review the capability assessment from the 2020 HMP and update accordingly. The consultant also reviewed plans, codes, and ordinances to enhance the information provided by the jurisdictions.



15.2 Planning and Regulatory Capabilities

Planning and regulatory capabilities are based on ordinances, policies, local laws, state statutes, plans, and programs that relate to managing growth and development. Planning and regulatory capabilities refer not only to current plans and regulations, but also to the jurisdiction's ability to change and improve those plans and regulations as needed. This section summarizes planning and regulatory capabilities for Hudson County. Further information is provided in the jurisdictional annexes in Volume II.

15.2.1 Federal

Several national programs incentivize or support mitigation activities. These programs are a key component of hazard mitigation capabilities. The following sections discuss the administration and application of these programs in Hudson County.

NATIONAL FLOOD INSURANCE PROGRAM

The U.S. Congress established the National Flood Insurance Program (NFIP) with the passage of the National Flood Insurance Act of 1968 (FEMA's 2002 NFIP: Program Description). The NFIP is a federal program enabling property owners in participating communities to purchase insurance as a protection against flood losses in exchange for State and community floodplain management regulations that reduce future flood damages. The flood hazard profile in Chapter 9 provides further information on the NFIP as implemented in Hudson County.

There are three components to the NFIP: flood insurance, floodplain management and flood hazard mapping. Communities participate in the NFIP by adopting and enforcing floodplain management ordinances to reduce future flood damage. In exchange, the NFIP makes federally backed flood insurance available to homeowners, renters, and business owners in these communities. Community participation in the NFIP is voluntary. Flood insurance is designed to provide an alternative to disaster assistance to reduce the escalating costs of repairing damage to buildings and their contents caused by floods. Flood damage in the U.S. is reduced by nearly \$1 billion each year through communities implementing sound floodplain management requirements and property owners purchasing flood insurance. Additionally, buildings constructed in compliance with NFIP building standards suffer approximately 80% less damage annually than those not built in compliance (American Institutes for Research 2006).

Participation in the NFIP is based on an agreement between local communities and the federal government in which the community adopts and enforces a floodplain management ordinance to reduce future flood risks to new construction and substantial improvements in special flood hazard areas (SFHA), and the federal government makes flood insurance available within the community (FEMA 2020).

The NFIP is administered by the Federal Insurance and Mitigation Administration (FIMA) and the Mitigation Directorate, components of the FEMA. The NJDEP provides floodplain management assistance to local communities throughout the state through the NFIP Community Assistance Program. NJDEP currently carries out its responsibilities under the Community Assistance Program with its floodplain staff within the Bureau of Dam Safety and Flood Control (NJDEP 2023).



All municipalities in Hudson County actively participate in the NFIP. As of 2024, there were 23,564 NFIP policies in Hudson County. There have been 10,586 claims made, totaling over \$368 million for damages to structures and contents. There are 612 NFIP Repetitive Loss (RL) properties in the County. Further details on the County's flood vulnerability may be found in the flood hazard profile in Chapter 9.

Municipal compliance with the NFIP is described in each of the jurisdictional annex in Volume II (Jurisdictional Annexes). The County's municipalities have been compliant with the NFIP. To enhance their flood damage prevention programs and enhance compliance with the NFIP in the future, several municipalities propose actions in their mitigation strategies to ensure that their floodplain administrators complete training on floodplain management and the NFIP or update their flood damage prevention ordinance. All municipalities have included an action to improve Substantial Damage determination procedures. In addition, Hudson County's mitigation strategy includes an action to encourage and empower municipalities to participate in FEMA's Community Rating System. Additional information on the NFIP program and its implementation throughout the County may be found in the flood hazard profile in Chapter 9.

The state and municipalities within it may adopt higher regulatory standards when implementing the provisions of the NFIP. Specifically identified are the following:

- **Base Flood Elevation (BFE):** The elevation of surface water due to flooding that has a 1 percent chance of being equaled or exceeded in any given year.
- **Freeboard:** By law, New Jersey requires Base Flood Elevation plus 3 feet (BFE+3) for all inland construction, and BFE+5 for coastal construction. When there is a base flood elevation available, the lowest floor, including any basement, must be at or above the base flood elevation. Elevation may be by means of properly compacted fill, a solid slab foundation, or a crawl space foundation that contains permanent openings to let flood waters in and out. Non-residential structures may be flood-proofed in lieu of elevation. Where a local floodplain administrator has information to estimate a base flood elevation, such as historical flood records or a hydraulic study, that elevation must be used. Communities may go beyond this requirement, providing for additional freeboard.
- **Cumulative Substantial Improvements/Damages:** The NFIP allows improvements valued at up to 50 percent of the building's pre-improvement value to be permitted without meeting flood protection requirements. Over the years, a community may issue a succession of permits for different repairs or improvement to the same structures. This can greatly increase the overall flood damage potential for structures within a community. The community may wish to deem "substantial improvement" cumulatively so that once a threshold of improvement within a certain length of time is reached, the structure is considered to be substantially improved and must meet flood protection requirements.

Community Rating System

As an additional component of the NFIP, the Community Rating System (CRS) is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements. As a result, flood insurance premium rates are discounted to reflect the reduced flood risk resulting from the community actions meeting the three goals of the CRS: (1) reduce flood losses; (2) facilitate accurate insurance rating; and (3) promote the awareness of flood insurance (FEMA 2024).

For participating communities, flood insurance premium rates are discounted in increments of 5 percent. For example, a Class 1 community would receive a 45 percent premium discount, and a Class 9 community would receive a 5 percent



discount. Class 10 communities are those that do not participate in the CRS; they receive no discount. CRS activities can help to save lives and reduce property damage. Communities participating in the CRS represent a significant portion of the nation's flood risk; over 66 percent of the NFIP's policy base is located in these communities. As of April 2025, there is no communities within Hudson County that participate in the CRS program. Hudson County is exploring the program requirements of the Community Rating System (CRS) through technical expertise and assistance to guide interested municipalities through the application process in the program.

Risk Rating 2.0: Equity in Action

Since the 2020 HMP, FEMA updated its insurance rating methodology to incorporate factors such as frequency of flooding, different types or sources of flooding, proximity to flood sources, and building characteristics such as first floor heights and costs to rebuilt (FEMA 2022). This program, called Risk Rating 2.0, aims to provide equitable flood insurance rates by more accurately pricing the risk to homeowners. This may increase the insurance rates for some property owners. Homeowners that elect to drop NFIP insurance policies will no longer have access to Flood Mitigation Assistance funding for future mitigation efforts. The State NFIP Coordinator's Office is finding it to be increasingly difficult to communicate the benefits of mitigation to some property owners where insurance rates are likely to stay high even after mitigation due to factors such as proximity to flood sources and frequency of flooding.

The update was rolled out from October 2021 through April 2022 and was fully implemented as of April 1, 2023 (FEMA 2022). According to a July 10, 2023, article by NJ Spotlight News, 12,000 NFIP flood insurance policies in the State of New Jersey have been dropped since Risk Rating 2.0 became effective. The drop in flood insurance coverage has been attributed to rising flood insurance costs based on Risk Rating 2.0's new flood insurance calculations (NJ Spotlight News 2023). Homeowners that elect to drop NFIP insurance policies will no longer have access to Flood Mitigation Assistance funding for future mitigation efforts. At the time of this HMP update, it is difficult to determine what the aggregate cost increase through Risk Rating 2.0 will be on post-mitigation properties.

RISK MAPPING, ASSESSMENT, AND PLANNING

FEMA works with federal, state, tribal, and local partners across the nation to identify flood risk and promote informed planning and development practices to help reduce that risk through the Risk Mapping, Assessment, and Planning (Risk MAP) program. Risk MAP provides high-quality flood maps and information, tools to better assess the risk from flooding, and planning and outreach support to communities to help them take action to reduce (or mitigate) flood risk. Each Risk MAP flood risk project is tailored to the needs of each community and may involve different products and services.

According to the Risk MAP Progress interactive map available online at the time of this plan update, there are numerous active Risk MAP projects taking place throughout New Jersey (FEMA n.d.). FEMA coordinates and works directly with municipal floodplain managers during the Risk MAP project process. The State NFIP Coordinator is kept apprised of project activities and consults as needed.

Since 2006, the NJDEP and FEMA have maintained a Cooperating Technical Partnership Agreement (CTP) to perform map production together to build the next generation of FEMA and state flood mapping. New Jersey will continue to take the lead in prioritizing projects, coordinating available data sources, conducting outreach, and all essential components of data production and map adoption. Moving forward, NJDEP will be developing new floodplain data,



producing digital Flood Insurance Rate Maps (FIRMs) and post-preliminary processing (NJDEP Bureau of Flood Engineering 2023).

New Jersey will integrate its mapping program with the FEMA program. This integration hinges on creating FEMA FIRMs for New Jersey, which delineate the New Jersey Flood Hazard Area Design Flood (NJFHADF) on the mapping and plots the NJFHADF water levels on the stream profiles, the state's regulatory standard. The NJFHADF is based on the 100-year flood discharge plus 25 percent. The state is obligated to compare the state flood elevations and floodway with the FEMA data for higher flood levels and wider floodways. By including the NJFHADF on the FIRM, the state would be able to use the FEMA FIRMs as the single source for both federal and state floodplain management, freeing up staff resources and reducing errors (NJDEP Bureau of Flood Engineering 2023).

DISASTER MITIGATION ACT OF 2000

The Disaster Mitigation Act of 2000 (DMA 2000) is the current federal legislation addressing hazard mitigation planning. DMA 2000 provides an opportunity for states, tribes, and local governments to take a new and revitalized approach to mitigation planning. DMA 2000 amended the Robert T. Stafford Disaster Relief and Emergency Assistance Act by repealing the previous mitigation planning provisions and replacing them with a new set of mitigation plan requirements. This new section emphasizes the need for state, tribal, and local entities to closely coordinate mitigation planning and implementation efforts. It emphasizes planning for disasters before they occur. It specifically addresses planning at the local level, requiring plans to be in place before Hazard Mitigation Assistance grant funds are available to communities. HMPs designed to meet the requirements of DMA will remain eligible for future FEMA Hazard Mitigation Assistance funds. This plan is designed to meet the requirements of DMA, improving eligibility for future hazard mitigation funds.

The New Jersey Office of Emergency Management (NJOEM) Mitigation Unit is the lead agency in New Jersey to promote mitigation planning. The law sets forth a more granular review of mitigation planning. Once approved, the applicant is eligible to apply for federal funds for mitigation of hazards. The rules provide detailed guidance on what applicants should include in a plan.

REGULATIONS FOR LOCAL MITIGATION PLANS

FEMA policies and procedures for its review and approval of local hazard mitigation plans are outlined in Title 44 of the Code of Federal Regulations (44 CFR 201.6). The local hazard mitigation plan is the representation of the jurisdiction's commitment to reduce risks from natural hazards, serving as a guide for decision makers as they commit resources to reducing the effects of natural hazards. Local plans also serve as the basis for the state to provide technical assistance and to prioritize project funding.

ROBERT T. STAFFORD DISASTER RELIEF AND EMERGENCY ASSISTANCE ACT

The Robert T. Stafford Disaster Relief and Emergency Assistance Act provides a means for the federal government to assist state and local governments in responding to disasters. It provides for the following:

- Revising and broadening the scope of existing disaster relief programs
- Encouraging the development of comprehensive disaster preparedness and assistance plans, programs, capabilities, and organizations by state and local governments



- Achieving greater coordination and responsiveness of disaster preparedness and relief programs
- Encouraging individuals and state and local governments to protect themselves by obtaining insurance coverage to supplement or replace governmental assistance
- Encouraging hazard mitigation measures to reduce losses from disasters, including development of land-use and construction regulations
- Providing federal assistance programs for public and private losses sustained in disasters

The NJOEM Mitigation Unit is the lead state agency that reviews, submits, and administers federal funding to programs that mitigate hazards. These programs help fund cost beneficial projects that help reduce damage from hazards.

DISASTER RECOVERY REFORM ACT

The Disaster Recovery Reform Act amended the Robert T. Stafford Disaster Relief and Emergency Assistance Act as follows:

- Modified the Pre-disaster Hazard Mitigation Grant Program to permit the use of technical and financial assistance to establish and carry out enforcement activities to implement codes, specifications, and standards that incorporate the latest hazard-resistant designs
- Directed the President to establish a National Public Infrastructure Pre-disaster Mitigation Fund
- Authorized the President's contribution to the cost of hazard mitigation measures to be used to increase resilience in any area affected by a major disaster
- Directed FEMA to issue a final rulemaking that defines the terms "resilient" and "resiliency"

The NJOEM Mitigation Unit is the lead state agency that reviews, submits, and administers federal funding to programs that mitigate hazards. These programs help fund cost beneficial projects that help reduce damage from hazards

PRESIDENTIAL POLICY DIRECTIVE 8

Presidential Policy Directive 8 requires that a threat hazard identification and risk assessment (THIRA) be developed for a state to remain eligible for Homeland Security Grant Program (HSGP) and Emergency Management Program Grant (EMPG) funding.

The New Jersey Office of Homeland Security and Preparedness is the lead state agency in preparing the state's THIRA. The fiscal year 2013 New Jersey State THIRA and Strategic Planning Report was submitted to FEMA Region II in December 2013.

BUNNING-BEREUTER-BLUMENAUER FLOOD INSURANCE REFORM ACT OF 2004

The Flood Insurance Reform Act of 2004 amended the 1994 National Flood Insurance Reform Act of 1968 to reduce losses to properties for which repetitive flood insurance claim payments have been made. This Act established a program for mitigation of severe repetitive loss properties and gave FEMA the authority to fund mitigation activities for individual repetitive loss properties. The Act provides additional coverage for compliance with land-use and control measures.



The NJDEP Flood Control Division is the lead coordinator of New Jersey's NFIP efforts. NJOEM Mitigation Unit is the agency working with New Jersey communities with severe repetitive loss properties. This statute helps New Jersey residents with affordable flood insurance and gives additional tools to the state and communities to mitigate severe repetitive loss properties.

BIGGERT WATERS NATIONAL FLOOD INSURANCE REFORM ACT OF 2012

Under the Biggert-Waters National Flood Insurance Reform Act of 2012, long-term changes to the National Flood Insurance Program have been adopted that have increased rates overall to reflect the flood risk more accurately to buildings in flood hazard areas. This has significantly influenced construction and reconstruction within flood hazard areas.

Property owners are encouraged to consider long-term insurance costs when undertaking reconstruction or elevation of damaged buildings. An investment to reconstruct the lowest floor of a building an additional foot or two higher today may translate into significant future flood insurance savings.

HOMEOWNER'S FLOOD INSURANCE AFFORDABILITY ACT

This 2014 law modified provisions of the 2012 Biggert-Waters Flood Insurance Reform Act and made changes to programs not covered by that Act. It lowered rate increases on some policies, prevented some future rate increases, and implemented a surcharge on all policyholders. It repealed certain rate increases that had already gone into effect and provided for refunds to those policyholders. The Act authorized additional resources for the National Academy of Sciences to complete an affordability study.

EMERGENCY SUPPORT FUNCTION #14, LONG-TERM RECOVERY PLANNING

Emergency Support Function (ESF) #14 provides a mechanism for coordinating federal support to state, tribal, regional, and local governments, nongovernmental organizations (NGOs), and the private sector to enable community recovery from the long-term consequences of extraordinary disasters. It identifies and facilitates the use of sources of recovery funding and provides technical assistance (such as impact analyses) for community recovery and recovery planning (FEMA 2008).

ESF #14 may be activated for incidents that require a coordinated federal response to address significant long-term impacts (e.g., impacts on housing, government operations, agriculture, businesses, employment, community infrastructure, the environment, human health, and social services) to foster sustainable recovery (FEMA 2008).

Actions coordinated under ESF #14 include pre-incident planning and coordination, immediately prior to the incident, post-event planning, and operations (FEMA 2008).

Through ESF #14, NJOEM works with the Office of Homeland Security and Preparedness to have a plan for long-term planning and recovery prior to a disaster or emergency. One of the areas of planning includes mitigation. This coordination allows for another statewide plan to incorporate mitigation principles and planning.



POST-HURRICANE SANDY TRANSPORTATION RESILIENCE STUDY OF NEW YORK, NEW JERSEY, AND CONNECTICUT

The Post-Hurricane Sandy Transportation Resilience Study was part of a series of research projects funded by the Federal Highway Administration (FHWA) with a goal of mainstreaming the consideration of climate vulnerability and risk in transportation decision making. The study was intended to assess how to integrate climate resilience at multiple levels: in planning, during the project development process, and as part of operations and maintenance strategies, including asset management and emergency management.

U.S. ARMY CORPS OF ENGINEERS

Under Section 404(e) of the Clean Water Act, the U.S. Army Corps of Engineers (USACE) can issue general permits to authorize activities that have only minimal individual and cumulative adverse environmental effects. There are three types of USACE permits:

- A nationwide permit is a general permit that authorizes activities across the country unless a district or division commander revokes the nationwide permit in a state or other geographic region. There are 54 nationwide permits, and they authorize a wide variety of activities, including linear transportation projects, bank stabilization activities, residential development, commercial and industrial developments, aids to navigation and certain maintenance activities (USACE 2017).
- Standard permits are individual permits that involve full public interest review of an individual permit application and include the issuance of a public notice for any project that does not meet the terms and conditions of a nationwide permit or a letter of permission.
- Regional general permits are for small, specialized projects.

COMMUNITY DISASTER RESILIENCE ZONES

The Community Disaster Resilience Zones (CDRZ) identify census tracts most at risk from the effects of natural hazards and climate change. Using the National Risk Index datasets, FEMA has identified the most at-risk and in-need communities to create resilience zones. These designated zones will provide geographic focus for financial and technical assistance from public, private, and philanthropic agencies and organizations for the planning and implementation of resilience projects. One CDRZ was identified by FEMA in the Town of Kearny (FEMA 2023). NJOEM is identifying opportunities to provide technical assistance to these CDRZs.

15.2.2 State

MUNICIPAL LAND USE LAW

The State of New Jersey Municipal Land Use Law (MLUL; New Jersey Statutes Annotated [NJS] 40:55D-1) is the legislative foundation for the land use process in New Jersey, including decisions by planning boards and zoning boards of adjustment. It defines the powers and responsibilities of boards and is essential to their functions and decisions. It also provides the required components of a municipal master plan.

Every municipal agency must adopt and can amend reasonable rules and regulations consistent with this act or with any applicable ordinance for the administration of its functions, powers, and duties. These plans help jurisdictions review their land use plans and policies with public participation.



The MLUL requires that each municipality prepare a comprehensive plan and update that plan every 10 years. In 2017 the MLUL was amended to require that any land use plan element adopted after the amendment include a statement of strategy concerning smart growth, storm resiliency, and environmental sustainability. This section of the MLUL was further amended in 2021 to require that any land use plan element of the master plan adopted or amended after that date must include a climate change-related hazard vulnerability assessment, which must include an analysis of current and future threats to and vulnerabilities of the municipality associated with climate change-related hazards, including many of those identified in this HMP update.

INLAND FLOOD PROTECTION RULE

The Inland Flood Protection Rule, effective July 17, 2023, ensures that areas at most significant risk are better defined and that new and reconstructed assets in these areas are designed and constructed using the best available climate-informed precipitation data. The Rule accomplishes the following (NJDEP 2023):

- Establishes the new Design Flood Elevation (DFE), which raises fluvial (non-tidal) flood elevation mapped by NJDEP by 2 feet
- Requires use of future projected precipitation when calculating flood elevations
- Ensures that NJDEP's Flood Hazard Area permits conform to New Jersey Uniform Construction Code standards and meet or exceed minimum FEMA NFIP requirements
- Requires stormwater Best Management Practices (BMPs) to be designed to manage runoff for both today's storms and future storms
- Removes use of Rational and Modified Rational methods for stormwater calculations

NEW JERSEY SOIL EROSION AND SEDIMENT CONTROL ACT

New Jersey has 15 soil conservation districts, following county boundaries that implement the New Jersey Soil Erosion and Sediment Control Act (NJSA 4:24), which governs certain aspects of new development.

UNIFORM CONSTRUCTION CODE

Building codes mandate best practices and technology, much of which is designed to reduce or prevent damage from occurring when structures are under stress. As evidenced during recent storm events (e.g., Hurricane Irene and Superstorm Sandy), structures built to code and sufficiently elevated suffer far less damage during hazard events. In New Jersey, municipalities are required to adopt the New Jersey State Uniform Construction Code (UCC). The MLUL (NJSA 40:55D-1) permits every municipality in the State to adopt its own building regulations, in which all property owners must abide by these regulations at a local level. Building regulations can be amended to be more stringent than the requirements of the UCC but not looser.

The UCC Act authorizes the Commissioner of the Department of Community Affairs (DCA) to adopt and enforce rules pertaining to construction codes and provides for the administration and enforcement of those rules throughout the State. The UCC (NJAC 5:23) contains the UCC Act and all rules issued under the Act relating to the administration and enforcement of construction regulations. The UCC is composed of four basic technical subcodes for construction: building, electrical, fire protection, and plumbing. In addition, the UCC contains technical subcodes for fuel gas installations; mechanical installations; one- and two-family dwellings; accessible (barrier free) construction; the



rehabilitation of existing buildings; the construction of manufactured homes; asbestos hazard abatement; radon hazard abatement; and playground safety. In New Jersey, State-licensed, municipally employed code enforcement professionals (construction officials, subcode officials, and inspectors) are responsible for the enforcement of the UCC (NJDC n.d.). The State is conducting ongoing efforts to educate local building code officials about the requirements and enforcement of the UCC.

The Department has adopted a radon hazard sub-code which does not reference existing model standards or guidance, but which sets forth the basic requirements for a passive sub-slab or sub-membrane depressurization system. See N.J. Admin. Code 5:23-10.4. The radon control standards and procedures apply to new residential construction (and school construction) in “tier one” areas, as defined by the state, and Appendix 10-A of the sub-code lists the specific municipalities that are designated as tier one areas.

STATE PLANNING ACT, GROWTH MANAGEMENT POLICY

New Jersey’s smart growth is growth that serves the environment, the economy, and the community equally. It attempts to concentrate development into already-existing communities when possible, and it addresses the inherent interconnections between environmental protection, social equity, public health, and economic sustainability.

The State Planning Act (NJSA 52:18A) has enhanced the traditionally limited role of county land-use planning and control. The Act provides tools for municipalities when preparing their master land use plans and better opportunity for a comprehensive approach to planning so as not to harm or be in conflict with neighboring municipalities’ plans. The State Planning Act created the New Jersey State Planning Commission and the Office of State Planning as staff to the Commission. Duties of the State Planning Commission are as follows:

- To prepare and adopt a State Plan to provide a coordinated, integrated, and comprehensive plan for the growth, development, renewal, and conservation of the state and its regions
- To prepare a long-term infrastructure needs assessment, which shall provide information on present and prospective conditions, needs and costs with regard to state, county and municipal capital facilities, including water, sewerage, transportation, solid waste, drainage, flood protection, shore protection, and related capital facilities
- To develop and promote procedures to facilitate cooperation and coordination among state agencies and local governments
- To provide technical assistance to local governments
- To periodically review state and local government planning procedures and relationships
- To review any bill introduced in either house of the Legislature which appropriates funds for a capital project

NEW JERSEY STATEWIDE COMPREHENSIVE OUTDOOR RECREATION PLAN

Land preservation and recreation are cornerstones of New Jersey’s smart growth policy. The New Jersey Statewide Comprehensive Outdoor Recreation Plan provides statewide policy direction to the state, local governments, and conservation organizations in the preservation of open space and the provision of public recreation opportunities. Under the requirements of the State Planning Act, the Outdoor Recreation Plan was prepared and adopted by the State Planning Commission to guide state agencies and local governments in planning, infrastructure investment, and other public actions and initiatives that affect and support economic growth and development.



FLOOD HAZARD AREA CONTROL ACT; FLOOD HAZARD AREA CONTROL REGULATION

New Jersey enacted the Flood Hazard Area Control Act (NJSA 58:16A) to accomplish the following:

- Delineate and mark flood hazard areas
- Authorize NJDEP to adopt land-use regulations for the flood hazard area
- Control stream encroachments
- Coordinate the development, dissemination, and use of available information on floods and flood damage
- Authorize the delegation of certain administrative and enforcement functions to county governing bodies
- Integrate the flood control activities of the municipal, county, state, and federal governments

The intents of the implementing regulations (New Jersey Administrative Code [NJAC] 7:13) are as follows:

- Minimize potential on- and off-site damage to public or private property caused by development that exposes structures to flooding and increases flood heights or velocities upstream and downstream
- Safeguard the public from the dangers and damage caused by materials being swept onto nearby or downstream lands,
- Protect and enhance the public's health and welfare by minimizing the degradation of water quality from point and non-point pollution sources
- Protect wildlife and fisheries by preserving and enhancing water quality and the environment associated with the floodplain and the water courses that create them

WETLANDS ACT OF 1970

The Wetlands Act of 1970 (NJSA 13:9A) provide rules and regulations governing development in wetland areas of New Jersey. New Jersey has 15 soil conservation districts, following county boundaries that implement the New Jersey Soil Erosion and Sediment Control Act (NJSA 4:24), which governs certain aspects of new development.

COASTAL ZONE MANAGEMENT RULES PROGRAM, COASTAL ZONE MANAGEMENT ADOPTED AMENDMENT

Coastal Zone Management rules (NJAC 7:7E and 7:7-16.9) mandate that the use and development of coastal resources be considered in reviewing permit applications under the Coastal Area Facility Review Act, Wetlands Act of 1970, Waterfront Development Law, Water Quality Certification (401 of the federal Clean Water Act); and Federal Consistency Determinations (307 of the federal Coastal Zone Management Act). The rules provide a basis for recommendations to the Tidelands Resource Council on applications for riparian grants, leases, and licenses. They also provide for public access to tidal waterways and their shores.

FRESHWATER WETLAND PROTECTION ACT, FRESHWATER WETLAND PROTECTION RULES

New Jersey enacted the Freshwater Wetland Protection Act (NJSA 13:B1) to support state and local wetland protection programs through funding for projects that clearly demonstrate a direct link to increasing the state's ability to protect wetland resources. Grants are federally funded and administered by the NJDEP. The associated implementing regulations (NJAC 7:7A) support the New Jersey freshwater wetlands program.



WATERFRONT DEVELOPMENT STATUTE, COASTAL PERMIT PROGRAM

The Waterfront Development Statute (NJSA 12:5-1) sets forth requirements for filling or dredging of, or placement or construction of structures, pilings, or other obstructions in, any tidal waterway or certain upland areas adjacent to tidal waterways outside the area regulated under Coastal Area Facility Review Act. The implementing rules (NJAC 7:7) establish the procedures by which the NJDEP will review permit applications and appeals from permit decisions under the Waterfront Development Law.

SAFE DAM ACT OF 1981

Under New Jersey's Safe Dam Act (NJAC 7:24A), no municipality, corporation, or person shall (without the consent of the Commissioner of Environmental Protection) build any reservoir or construct any dam, or repair, alter, or improve existing dams, on any river or stream in New Jersey or between New Jersey and any other state that will raise the waters of the river or stream more than 5 feet above its usual mean low water height.

TIDELANDS ACT

Under New Jersey's Tidelands Dam Act (NJAC 12:3), tidelands—lands flowed by the tide of a natural waterway and lands that were previously flowed by the tide but have been filled and are no longer flowed by the tide—are owned by the people of the State of New Jersey. Individuals must get permission from the state to use these lands—in the form of a tidelands license, lease, or grant—and must pay for this use.

Grants, licenses, and leases are issued by the Tidelands Resource Council, which makes all ultimate decisions with regard to tidelands. The Tidelands Resource Council is a board of 12 Governor-appointed volunteers, along with NJDEP staff at the Bureau of Tidelands Management.

STORM WATER MANAGEMENT RULE

In response to the U. S. Environmental Protection Agency's (USEPA) Phase II rules published in December 1999, the NJDEP Storm Water Management Rule (NJAC 7:8, et seq.) was developed. This rule includes establishment of the Municipal Stormwater Regulation Program and four general permits authorizing stormwater discharges from Tier A and Tier B municipalities as well as public complexes and highway agencies that discharge stormwater from municipal separate storm sewers (MS4s). These rules set forth the required components of regional and municipal stormwater management plans.

A municipal stormwater management plan (MSWMP) documents the strategy of a specific municipality to address stormwater-related impacts. A plan may address an existing water quantity issue, such as localized flooding; an existing water quality issue, such as excess pollutant loading; or issues of water quantity and quality that may be generated by future development. MSWMPs provide the structure and process for addressing stormwater management in the municipality. They are required by the Environmental Protection Agency's Phase II Stormwater Permitting Rules; the mandatory elements of the plan are described in the Stormwater Management Rule. Counties can also develop stormwater management plans to identify and develop solutions to problems that can be managed most effectively on a regional basis (NJDEP 2004).



NEW JERSEY POLLUTANT DISCHARGE ELIMINATION SYSTEM STORMWATER RULES

The New Jersey Pollutant Discharge Elimination System (NJPDES) Stormwater Rules (NJAC 7:14A) govern the issuance of permits to entities that own or operate small, separate municipal storm sewer systems. The permit program establishes the Statewide Basic Requirements that must be implemented to reduce nonpoint source pollutant loads from these sources. The Statewide Basic Requirements include measures such as the following:

- Adopting ordinances (litter control, pet waste, wildlife feeding, proper waste disposal, etc.)
- Developing a municipal stormwater management plan and implementing ordinance(s)
- Requiring certain maintenance activities (such as street sweeping and catch basin cleaning)
- Implementing controls for solids and floatables
- Locating discharge points and stenciling catch basins
- Conducting public education

NJDEP issued final stormwater rules and four NJPDES general permits authorizing stormwater discharges from Tier A and Tier B municipalities as well as public complexes and highway agencies that discharge stormwater from municipal separate storm sewers. The general permits address stormwater quality issues related to new development, redevelopment, and existing development by requiring municipalities to implement the Statewide Basic Requirements. All municipalities have a local stormwater coordinator, and NJDEP case managers are assigned to each municipality for compliance assistance.

The Tier A and Tier B Municipal Stormwater General Permits authorize the discharge of stormwater from small municipal separate storm sewers. The Tier A permit addresses stormwater quality issues related to both new and existing development. The Tier B permit focuses on new development and redevelopment projects and public education. There are 462 Tier A municipalities and 100 Tier B municipalities.

CONSTRUCTION PERMITS

State law mandates that NJDEP make timely decisions on construction permit applications so as not to delay necessary construction projects, ensure adequate public notice of procedures, and continue effective administration of the substantive provisions of other laws (NJSA 13:1D-30). This applies to coastal and flood hazard regulations but not to freshwater wetland rules.

NEW JERSEY GREEN ACRES LAND ACQUISITION ACT OF 1961

The Legislature enacted the New Jersey Green Acres Land Acquisition Acts to achieve a system of interconnected open spaces, whose protection will preserve and enhance New Jersey's natural environment and its historic, scenic, and recreational resources for public use and enjoyment. In 1998, New Jersey voters approved a referendum that created a stable source of funding for open space, farmland, and historic preservation and recreation development. The Garden State Preservation Trust Act, passed in 1999, established a stable source of funding for preservation efforts.

Rules to implement the Green Acres laws govern the award of loans or matching grants to local governments and nonprofits for the acquisition or development of land for outdoor recreation and conservation purposes. The rules establish project eligibility requirements, application requirements, funding award categories and criteria, matching



grant and loan terms, and program administrative requirements. They contain procedures for the disposal, or diversion to a use other than recreation and conservation, of lands acquired or developed with Green Acres funding or otherwise encumbered with Green Acres restrictions.

EMERGENCY BUILDING INSPECTION ACT

The Commissioner of the Department of Community Affairs established a program to deploy state and local construction code officials to assist local construction code officials and inspectors. This program has provided flexibility and redundancy to the state and local governing bodies in the deployment of essential personnel to evaluate buildings and other structures affected by a natural or man-made disaster or emergency. New Jersey's Emergency Building Inspection Act (NJSA 52:27D-126.3) addresses how building code officials would be compensated if called to support damage assessment outside of their jurisdiction.

NEW JERSEY CIVILIAN DEFENSE AND DISASTER CONTROL ACT

New Jersey's Civilian Defense and Disaster Control Act prescribes a course of conduct for the civilian population during emergencies and centralizes control of civilian activities having to do with such emergencies under the Governor. It gives the Governor control over the resources of state and local government and other powers as may be necessary to cope with emergencies. The Act is implemented through coordination and communication among NJOEM and county emergency management coordinators, overseen by the Office of Civilian Defense Director, who is appointed by the Governor.

AGREEMENTS WITH GOVERNORS OF BORDERING STATES FOR PROTECTION OF COMMUNICATION FACILITIES

The Governor is authorized under NJSA 38A:17 to enter into agreements with the governors of any of the states bordering on New Jersey for the protection in the event of emergency of any or all interstate bridges, tunnels, ferries, and other communications facilities. NJOEM is responsible for the implementation of the Governor's directive to assist emergency response counterparts in bordering states. NJOEM manages interstate assistance through delineated lines of communication and standard operating procedures.

NEW JERSEY STATE FOREST FIRE SERVICE

Under NJSA 13:9, the State Forest Fire Service is responsible for the following:

- Determining wildfire hazards
- Removing or overseeing removal of brush, undergrowth, or other material that contributes to wildfire hazards
- Maintaining or overseeing maintenance of firebreaks
- Setting backfires
- Plowing lands
- Closing roads
- Making regulations for burning brush

The Forest Fire Service has the authority to summon any person between the ages of 18 and 50 who may be within the jurisdiction of the state, to assist in extinguishing fires. The Service can require the use of property needed for



extinguishing fires, issue permits, collect extinguishment costs and fines for violations, and direct all persons and apparatus engaged in extinguishing wildfires. The Service has the right of entry to inspect and ascertain compliance and extinguish wildfires, investigate fires to determine cause, close the woods to all unauthorized persons in an emergency, and arrest (without an official warrant) anyone violating the Forest Fire Laws. Certain forest fire mitigation efforts may occur where there is threatened and endangered habitat, even when that habitat was caused by past prescribed burning operations.

THE FIRE SERVICE RESOURCE EMERGENCY DEPLOYMENT ACT

The Fire Service Resource Emergency Deployment Act (NJSAS2:14E-11) allows for the Fire Division within the Department of Community Affairs to deploy fire assets to a pre-designated location in advance of a disaster or emergency and to move assets to a pre-designated location to avoid assets being damaged.

NEW JERSEY STATEWIDE WATER SUPPLY PLAN

NJDEP developed and periodically updates the New Jersey Statewide Water Supply Plan to guide future water supply management as follows:

- Identify surface and groundwater sources, and current demands on those resources
- Make demand projections for duration of the plan
- Identify intended uses of land purchased for water supply facilities but not yet used
- Recommend:
 - Improvements, new construction, and interconnections
 - Diversions for aquaculture
 - Legislative and administrative actions to protect watershed areas
 - Identification and purchase of land for water supply facilities
 - Administrative actions to protect surface and groundwater supplies

The 2023-2028 plan extends the planning period from 2040 to 2050 and addresses the following issues (NJDEP n.d.):

- Climate change implications for water availability and water supply demands
- Environmental justice and equity issues related to water supply management
- Potential water supply implications of source water contamination, especially regarding emerging contaminants of concern
- More specific water management recommendations for stressed water resources

2020 NEW JERSEY SCIENTIFIC REPORT ON CLIMATE CHANGE

NJDEP's Scientific Report on Climate Change summarized the effects of climate change on New Jersey's environment to inform state and local decision-makers as they seek to understand and respond to the impacts of climate change. This report identifies and presents the best available science and existing data regarding the current and anticipated environmental effects of climate change globally, nationally, and regionally (NJDEP 2023).



2021 NEW JERSEY CLIMATE CHANGE RESILIENCE STRATEGY

New Jersey's Statewide Climate Change Resilience Strategy provides a framework for policy, regulatory, and operational changes to promote the long-term resilience of New Jersey to climate change. It presents actions that New Jersey's Executive Branch can take to support the resilience of the state's communities, economy, and infrastructure. The Resilience Strategy includes 125 recommended actions across six priority areas (NJDEP 2021):

- Build resilient and healthy communities
- Strengthen the resilience of New Jersey's ecosystems
- Promote coordinated governance
- Invest in information and increase public understanding
- Promote climate informed investments and innovative financing
- Coastal resilience plan

NEW JERSEY WETLAND PROGRAM PLAN, 2023-2027

In 2023, NJDEP, the New Jersey Sports and Exposition Authority, the Pinelands Commission, and the Highlands Council developed the five-year Wetland Program Plan to direct current and future wetland protection, management and restoration efforts to the benefit of the state's wetland resources. The plan includes an environmental justice component to lessen environmental and public health stressors in historically overburdened communities.

RESILIENT ENVIRONMENTS AND LANDSCAPES RULES

Similar to the Inland Flood Protection Rule, NJDEP developed the Resilient Environments and Landscapes (REAL) Rules to modernize the State's environmental land use rules to incorporate climate risks such as sea level rise and chronic flooding and to encourage green infrastructure and renewable energy as a means to facilitate climate resilience.

Published in 2024, the REAL Rules ensure that buildings, roads, and infrastructure are built for today's conditions and the structure's lifetime and only applies to new development, redevelopment, and substantial improvements to buildings. Additionally, REAL incorporates rising sea levels into storm surge projections for Coastal Flood Hazard Areas and establishes an Inundation Risk Zone to identify structures vulnerable to permanent or daily inundation, among other objectives. The rule was published in August 2024 and is expected to become effective during the fall of 2025.

STATE PLANNING ACT OF 1985

Land preservation and recreation comprise one of the cornerstones of New Jersey's smart growth policy. The New Jersey Statewide Comprehensive Outdoor Recreation Plan provides Statewide policy direction to the State, local governments, and conservation organizations in the preservation of open space and the provision of public recreation opportunities. The State Plan was prepared and adopted by the State Planning Commission according to the requirements of the State Planning Act of 1985 as amended (NJSA 52:18A-196 et seq.) to serve as an instrument of State policy to guide State agencies and local government in the exercise of governmental powers regarding planning, infrastructure investment and other public actions and initiatives that affect and support economic growth and development in the State.



15.2.3 County

MUNICIPAL LAND USE PLANNING AND REGULATORY AUTHORITY

The Hudson County Planning Department supports all aspects of local planning and seeks to integrate consideration in natural hazard risk and support mitigation project identification and implementation through its planning programs, resources and Office of Emergency Management. Planning reviews all subdivision applications in the County and site plan applications for development along County roads that may affect traffic and drainage facilities. The Hudson County Planning Board promotes sustainability and environmentally friendly development through the Hudson County Land Development Regulations. All site plans that are approved must have met the minimum requirement of two green techniques outlined by the County's Best Management Practices list (e.g., bike racks, porous pavers, green roofs) – geared to limiting flows to drainage system and reduce runoff (meetings NJDEP Stormwater management reduction standards); no connection fees or assessments.

The Hudson County Planning Board received a North Jersey Transportation Planning Authority (NJTPA) grant funding to update the Hudson County Land Development Regulations for Smart Growth and Sustainable Development. The study was completed in June 2016 and is available online to review. The Hudson County Land Development Regulations establish standards for site plans and subdivision applications to the County Planning Board. This update reflects an increased focus on resiliency and complete streets including green technique requirements for private developers; post-Sandy green stormwater infrastructure regulations and consideration of FEMA building standards and latest best management practices; recognizes flood hazard area lines established by the NJDEP. The 2016 Land Development Regulations, with subsequent updates, will refine the requirements to more directly address stormwater runoff, and are to be presented to the Board of Chosen Freeholders for adoption in the near future.

The Hudson County Division of Planning reviewed the New Jersey Sports and Exposition Authority (NJSEA) plan and provided comments to the NJSEA.

Through the Open Space, Recreation and Historic Preservation Trust Fund, created in 2003, the County can acquire new land for open space and improve parks. The County awards grants to municipalities and non-profit organizations through the Trust Fund for these purposes. This is a capability of the County as opportunities present themselves.

The Division of Planning meets annually with the municipalities regarding the Open Space Trust Fund and their open space and park priorities. These meetings take place before the fund opens up and the Division of Planning works with municipalities to develop projects.

Hudson County has a Shade Tree Initiative that has led to the planting of new trees along County roads and the approval of the County's first Community Forestry Plan. The goals of the Shade Tree Initiative are to enhance the environment, improve human health and wellbeing, reduce stormwater runoff through retention, combat the urban heat island effect, improve the aesthetic appearance of the County's streetscape, and improve quality of life for residents. The Planning Board has a shade tree requirement, where one street tree must be provided for every 30 feet of street frontages along a County road.

The Hudson County Planning Board has several policies that promote smart growth. One example is the Low Impact Development Checklist, which encourages the use of nonstructural stormwater management strategies and provides guidance in their incorporation in land development projects. The Checklist complements the NJDEP Stormwater



Management Rules with additional oversight on vegetation, circulation, pollution prevention and consistency with the Hudson County Master Plan.

COMPREHENSIVE MASTER PLANS

With grant funding from the New Jersey Department of Community Affairs' Post-Sandy Planning Assistance Grant Program, the Hudson County Division of Planning launched the "Engaging and Strengthening Hudson County Planning Initiative." This initiative was an inclusive strategic planning process that involved a collaboration of professional planners, engineers, government officials, businesses, organizations, and the general public. The initiative establishes goals, objectives and guiding principles to create a unified vision for planning and resiliency in Hudson County. Four planning documents were the result of this larger effort that integrate natural hazard risk and emphasizes resiliency:

- **Hudson County Master Plan Re-Examination, 2017**—The goal of the Hudson County Master Plan Re-examination is to help the County and municipalities incorporate smart growth and sustainable community approaches into their development plans, regulations, and hazard mitigation goals and objectives, particularly to increase their flood resilience. The County emphasizes that this plan must address not only the probability of flooding and the vulnerability of its structures and infrastructure, but the consequences of those hazard to populations and their communities. The plan included actions identified in the 2015 Hudson County HMP. In addition, the plan has recommendation checklists with additional mitigation and resilience actions (e.g., Table 16 – Infrastructure Recommendation Checklist). Refer to 9.1-12 below for actions identified in the Master Plan and the 2020 HMP.
- **Hudson County Parks Master Plan**—The Hudson County Parks Master Plan will serve the recreation needs of residents and visitors and simultaneously prepare a parks system that is resilient to future storm events. The Plan will include a five-year plan for the recovery of Hurricane Sandy-damaged park facilities taking into account safety concerns, areas most vulnerable to potential storm damage, etc.
- **Comprehensive Economic Development Strategy (CEDS) update (2015 to 2019)**—The CEDS creates an economic roadmap to diversity and strengthen the County's economy and enable the County to apply for investment assistance under the U.S. Department of Commerce, Economic Development Administration (EDA) Public Works or Economic Adjustment Assistance Programs. In addition, the update explored short- and long-term impacts associated with Superstorm Sandy, as well as the vulnerabilities that event had exposed.
- **Hudson County Capital Improvement Plan (CIP) update**—A typical five-year CIP is an effective tool for properly planning for capital investments in County facilities and equipment to build community resiliency. The projects and strategies identified in the CIP will come from a variety of sources, including the Hudson County All Hazard Mitigation Plan, the Hudson County Strategic Recovery Report, and other planning documents, as well as interviews with the County OEM, and outreach to municipal stakeholders and the public.

A project website for this initiative (PlanHudCo.com) was launched to keep the public apprised of the planning efforts including public meetings, questionnaires, and interactive crowd sourcing map survey and other means to receive comments and feedback from residents.

EMERGENCY AND EVACUATION PLANS

The County has developed a Continuity-of-Operations (COOP) and Continuity of Government (COG) plan which is intended to provide a guide to assess the impact of a variety of disasters on the county government, and response



appropriately to maintain and restore capabilities, essential facilities, and services. The plan prioritizes the necessity of functions, departments, and key staff members and leadership for all county departments. The plan outlines operational mandates, which are legally required government functions, to guide prioritization and restoration. It also identifies critical resources such as vital files, equipment, and utilities which are needed for vital functions, as well as alternative facilities if relocations are necessary. It intends to provide a clear chain of command for implementing the plan and focuses on Recovery Time Objectives which are timelines for restoring government functions. The plan also specifies that After Action Reports be written following any implementation of the plan as documentation of actions taken and does include a guide on updating and maintenance of the plan.

The County continues to develop, enhance and implement existing emergency response plans to utilize new and developing technology/information as it becomes available. As per this plan, the County critical facility inventory was updated, lifelines were identified, and new facilities were added via geo-coding to have one spatial data set for future analysis.

15.2.4 Local

New Jersey's Home Rule Act (1917) grants municipal governments broad authorities to enact ordinances and regulations providing for public welfare and order. Municipalities can leverage these powers to address local conditions that affect their residents. To ensure a minimum set of standards, New Jersey has passed laws and regulations mandating that each municipality adopt local ordinances with the same basic criteria. Jurisdictions may adopt additional requirements but cannot have fewer requirements than the state.

The following sections described general types of plans and ordinances at the municipal level. For information on plans and regulations specific to each municipality in Hudson County, refer to Volume II.

MASTER PLANS

New Jersey's Municipal Land Use Law grants municipalities the power to enact a master plan with a land use element (NJSA 40:55D-28). Master plans create the foundation for the local zoning and land ordinances that govern development. These plans help jurisdictions review their land use plans and policies with public participation. The MLUL provides the required components of a municipal master plan and requires all zoning ordinances to be consistent with the master plan. The local zoning administrator and volunteer planning and zoning board members have the responsibility to interpret and enforce the municipality's master plan.

Current state law requires municipalities to incorporate a climate change-related hazard vulnerability assessment into any master plan land use element (PL 2021 Chapter 6). The vulnerability assessments must rely on the most recent natural hazard projections and best available science provided by the NJDEP. They must consider environmental effects associated with climate change, including but not limited to temperature, drought, and sea-level rise, and contain measures to mitigate reasonably anticipated natural hazards, such as coastal storms, shoreline erosion, flooding, storm surge, and wind.



ZONING ORDINANCES

The MLUL grants municipalities the power to adopt a zoning ordinance (NJSA 40:55D-62). Each municipality must adopt a zoning ordinance. Zoning ordinances have three major constraints:

- Municipalities may not exercise authority in ways that conflict with provisions of the federal or state constitutions.
- Municipal authority may not be exercised in conflict with authority exercised by the county, state, or federal governments.
- Municipal authority must be exercised in strict conformity with the provisions of the MLUL.

A property owner can request a variance from the municipality, and if granted, the owner can use the land in a way that is ordinarily not permitted by the local zoning ordinance. Each municipal clerk is required to file a copy of the planning and zoning ordinances of the municipality with the county planning board (NJSA 40:27-6.10). The local zoning administrator and volunteer planning and zoning board members have the responsibility to interpret and enforce the municipality's zoning and other land development ordinances.

BUILDING CODES

In New Jersey, municipalities are required to adopt the New Jersey State Uniform Construction Code (UCC). The MLUL allows municipalities to adopt their own building codes, and all property owners within a municipal boundary must abide by these laws (NJSA 40:55D-1). Local building regulations can be more stringent than the requirements of the UCC but not more lax. State-licensed, municipally employed code enforcement professionals (construction officials, subcode officials, and inspectors) are responsible for enforcement of the UCC (NJDC n.d.).

STORMWATER MANAGEMENT ORDINANCES

New Jersey establishes stormwater management design and performance standards that address water quality, water quantity, and recharge (NJAC 7:8). Municipal stormwater control ordinances must be designed to do the following:

- Reduce flood damage, including damage to life and property.
- Minimize, to the extent practical, any increase in stormwater runoff from any new development.
- Reduce soil erosion from any development or construction project.
- Ensure the adequacy of existing and proposed culverts and bridges, and other instream structures.
- Maintain groundwater recharge.
- Prevent, to the greatest extent feasible, an increase in nonpoint pollution.
- Maintain the integrity of stream channels for their biological functions, as well as for drainage.
- Minimize pollutants in stormwater runoff from new and existing development in order to restore, enhance and maintain the chemical, physical, and biological integrity of the waters of the state, to protect public health, to safeguard fish and aquatic life and scenic and ecological values, and to enhance the domestic, municipal, recreational, industrial and other uses of water.
- Protect public safety through the proper design and operation of stormwater management basins.



- Follow green infrastructure practices that use or mimic the natural water cycle to capture, filter, absorb, and/or reuse stormwater.

Municipal ordinances can be more stringent than the state requirements but not more lax. The state's Residential Site Improvement Standards allow municipalities to require stormwater runoff controls for development falling below major development to address groundwater recharge and stormwater runoff quantity, but not for water quality (NJAC 5:21-7.1) (NJDEP 2023).

STORMWATER MANAGEMENT PLANS

A municipal stormwater management plan documents the strategy of a specific municipality to address stormwater-related impacts. New Jersey's NJPDES Stormwater Rules (NJAC 7:14A) set forth the required components of municipal stormwater management plans. A plan may address an existing water quantity issue, such as localized flooding; an existing water quality issue, such as excess pollutant loading; or issues of water quantity and quality that may be generated by future development. Municipal stormwater management plans provide the structure and process for addressing stormwater management in the municipality. They are required by the U.S. Environmental Protection Agency's Phase II Stormwater Permitting Rules; the mandatory elements of the plan are described in the Stormwater Management Rule (NJDEP 2004).

EMERGENCY OPERATIONS PLANS

Local municipalities in New Jersey are required to have an approved emergency operations plan. The plan specifies the vulnerabilities for major emergencies the municipality may have and outlines the resources the municipality has or can access to meet the emergency. The plan is reviewed at the county and state offices of emergency management.

15.3 Administrative and Technical Capabilities

15.3.1 Federal

FEMA ASSISTANCE PROGRAMS AND PLAN REVIEW

FEMA is responsible for providing assistance before, during, and after disasters. FEMA is the federal reviewer of hazard mitigation plans and sets federal standards for local and state hazard mitigation plans.

COMMUNITY ASSISTANCE VISITS AND COMMUNITY ASSISTANCE CONTACTS

FEMA evaluates NFIP minimum compliance through compliance audits known as Community Assistance Visits (CAV) and Community Assistance Contacts (CAC). CAVs and CACs evaluate community compliance with the NFIP, at entry into the CRS, and to maintain participation in the CRS. FEMA may conduct these with Region 2 staff, with NJDEP staff under the Compliance Assistance Program – State Support Services Element (CAP-SSSE) grant, or with private contractors. In general, CAVs are more rigorous than CACs (NJDEP 2023).

FEMA evaluates the following key areas in a compliance audit:



- The community's flood damage prevention ordinance
- Mapping products and other ordinances used to regulate floodplain development
- Floodplain development permitting procedures
- Floodplain permit applications and other forms/records, including substantial damage and improvement determinations
- Floodplain development review and performance standards
- Floodplain development permits issued to applicants (NJDEP 2023)

NATIONAL DAM SAFETY PROGRAM

The National Dam Safety Program (NDSP) is a partnership of state and federal agencies and other stakeholders that encourages individual and community responsibility for dam safety to protect people from dam failures. It is administered through the Department of Homeland Security and FEMA. The program improves safety and security around dams in the following ways (FEMA 2023):

- Providing grants to state dam safety agencies to assist them in improving their regulatory programs
- Producing educational materials for dam owners
- Funding research to enhance technical expertise as dams are built and rehabilitated
- Establishing training programs for dam safety inspectors
- Creating a National Inventory of Dams

HURREVAC

HURREVAC is the decision support tool of the National Hurricane Program, administered by FEMA, USACE, and the National Atmospheric and Oceanic Administration's National Hurricane Center (HURREVAC n.d.). The NJOEM has established a working group with all 21 county offices of emergency management to use HURREVAC software for tracking hurricanes. HURREVAC allows NJOEM and the counties to coordinate notification, communication, activations, public warning, evacuation, and sheltering. By operating together, the state and the counties can provide the same advisories and actions.

NATIONAL WEATHER SERVICE

The National Weather Service (NWS) monitors weather and delivers weather forecasting for New Jersey. Most of the state is serviced by the Mount Holly weather forecast office (WFO), however Hudson, Passaic, Bergen, Essex, and Union County are covered by the New York WFO. The NWS also offers various education and training programs on weather-related hazards (NWS 2023).

The NWS operates the StormReady program, which provides emergency managers with guidelines on how to improve their hazardous weather operations. To be recognized by the program, a community must do the following (NWS n.d.):

- Establish a 24-hour warning point and emergency operations center
- Have more than one way to receive severe weather warnings and forecasts and to alert the public
- Create a system that monitors weather conditions locally



- Promote the importance of public readiness through community seminars
- Develop a formal hazardous weather plan, which includes training severe weather spotters and holding emergency exercises

There are no StormReady communities located in Hudson County.

U.S. ARMY CORPS OF ENGINEERS

USACE works to strengthen the nation's security by building and maintaining America's infrastructure. Projects include dredging, storm damage reduction, and ecosystem restoration in and near waterways (USACE n.d.). New Jersey is serviced by the Philadelphia and New York districts. USACE has numerous initiatives to support hazard mitigation measures, including the Silver Jackets, planning assistance, and inspections and repair of flood control structures. USACE also maintains the National Inventory of Dams and the National Levee Database.

U.S. GEOLOGICAL SURVEY

The U.S. Geological Survey (USGS) maintains gauges across New Jersey that continuously measure lake, reservoir table, stream, and tidal levels. The USGS receives the data and makes it available over the internet. USGS provides data to NJDEP for drought determinations. As project needs and funding levels change, gauges may be added or deactivated, and deactivated gauges may be reactivated (USGS 2023).

USGS also recovers high water marks post-coastal flooding (USGS 2018). In back bays and along tidal waters, the USGS manages the New Jersey Tide Telemetry System, which transmits continuously to the NWS, USGS, State Climatologist, NJDEP, NJOEM, all affected counties, and many municipalities.

15.3.2 State

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION

Bureau of Dam Safety and Flood Control

The Bureau of Dam Safety and Flood Control leads the state's efforts filling the State NFIP Coordinator position and providing CRS support. Its responsibilities include the funding of construction and operation of federal, state, and local flood control mitigation projects throughout the state. The bureau has a lead role in the development and adoption of New Jersey Flood Hazard Area mapping, as well as an active partnership with FEMA on its Map Modernization Program. The bureau assists communities that participate in the NFIP and are interested in joining CRS through the NJDEP Community Assistance Program Unit.

Dam Safety Section

The Dam Safety Section under the NJDEP Bureau of Dam Safety and Flood Control has responsibility for ensuring the safety and integrity of dams in New Jersey. The section also coordinates with the Division of State Police and local and county emergency management officials in the preparations and approval of emergency action plans.



The Dam Safety Section reviews plans and specifications for the construction of new dams or for the alteration, repair, or removal of existing dams. The section must grant approval before a dam owner can proceed with construction. Engineers from the Dam Safety Section evaluate each project, investigate site conditions, and check recommended construction materials. During construction, engineers identify conditions that may require design changes, check for compliance with approved plans and specifications, and approve foundations before material is placed.

Existing dams are periodically inspected to ensure that they are adequately maintained, and owners are directed to correct any deficiencies found. The regulations require dam owners to obtain a professional engineer to inspect their dams on a regular basis. These investigations include a comprehensive review of all pertinent material contained in the Section's files, a visual inspection, technical studies when necessary, and preparation of a comprehensive report.

Division of Water Supply and Geoscience

NJDEP's Division of Water Supply and Geoscience works to ensure an adequate, reliable, and safe water supply for the future. It is responsible for regulating groundwater and surface water diversions, permitting wells, permitting drinking water infrastructure, monitoring drinking water quality, and providing technical support for water systems to achieve compliance with federal and state standards. Division staff provide technical assistance for water systems during water supply emergencies, as needed to re-establish safe and adequate public water supplies, and to address routine non-compliance from significant deficiencies or poor water quality test results. Additionally, Water Supply provides operator licensing and training support.

New Jersey Geological and Water Survey

The New Jersey Geological and Water Survey evaluates geologic, hydrogeologic and water quality data to manage and protect water resources, to identify natural hazards and contaminants, and to provide mineral resources, including offshore sands for beach nourishment. Information provided by the survey includes GIS data and maps of geology, topography, groundwater, and aquifer recharge. In addition, data is available for wellhead protection areas, aquifer thicknesses, properties and depths, groundwater quality, drought, geologic resources, and hazards such as earthquakes, abandoned mines, karst-influenced sinkholes, and landslides.

NEW JERSEY DEPARTMENT OF THE STATE OFFICE OF PLANNING ADVOCACY

The New Jersey Office of Planning Advocacy supports and coordinates planning throughout the state to protect the environment, mitigate development hazards, and guide future growth into compact, mixed-use development and redevelopment while fostering a robust long-term economy. The Office of Planning Advocacy implements the goals of the State Development and Redevelopment Plan to achieve comprehensive, long-term planning. It integrates that planning with programmatic and regulatory land use decisions at all levels of government and the private sector.

RUTGERS UNIVERSITY

Office of the State Climatologist

The Office of the New Jersey's State Climatologist generates and archives climate data. Generated data are from the New Jersey Weather and Climate Network, which is an assemblage of 55 automated weather stations throughout the



state. A decade or more of hourly observations are available from some of the stations; others have shorter records. Since late 2012, observations are available on a five-minute basis.

Along with these records, the State Climatologist Office archives or has ready access to NWS Cooperative Weather Station data. These are daily observations from several dozen stations at any given time over the past century. Individual stations have as many as 120 years of data. Another source of generated data is the Community Collaborative Rain, Hail and Snow Network, which includes daily observations of rain and snow from as many as several hundred volunteers throughout the state.

New Jersey Climate Adaptation Alliance

New Jersey Climate Adaptation Alliance (NJADAPT) focuses on climate change preparedness for New Jersey in key impact sectors (public health; watersheds, rivers, and coastal communities; built infrastructure; agriculture; and natural resources). NJADAPT is a collaborative effort of scientists and data managers in academia, government, the private sector and non-governmental organizations who have developed a strategic plan for a New Jersey platform to host and apply climate science impacts and data. The NJADAPT website includes a flood exposure profile for community discussions about hazard impacts; New Jersey Flood Mapper (which is a tool for flooding hazards and sea level rise); and Getting to Resilience (a tool used to help communities reduce vulnerability and increase preparedness).

Rutgers Cooperative Extension of Hudson County

Rutgers Cooperative Extension is part of the federal land grant university system serving as the educational outreach arm of the U.S. Department of Agriculture. The office provides research-based information to help Hudson County residents acquire knowledge to make informed decisions to maintain or improve their quality of life.

Outreach programs are provided, including classes and conferences, telephone and in-person consultations, replies to emailed questions, newspaper columns, radio and television programs, bus trips, fairs and clubs, field meetings and demonstrations, computerized diet and financial analyses, videos, newsletters, fact sheets, speaking engagements for organizations and work sites, exhibits and displays, and web sites.

NEW JERSEY OFFICE OF EMERGENCY MANAGEMENT

Emergency management functions at the state-level are coordinated by NJOEM, a branch of the New Jersey State Police. The Superintendent of the New Jersey State Police is generally appointed as the state director of NJOEM (New Jersey State Police n.d.-a). NJOEM uses conference calling with the NWS and county offices of emergency management to share specific information and needs when severe weather is forecast. When an approaching storm warrants monitoring, NJOEM sends out e-mails with State Emergency Operations Center (EOC) status information and advice to keep all emergency managers statewide up to date. Resources are deployed as early as possible to prepare for storm impacts.

NEW JERSEY STATE POLICE EMERGENCY MANAGEMENT SECTION

The Emergency Management Section of the New Jersey State Police organizes, directs, staffs, coordinates, and reports the activities of the Communications Bureau, Emergency Response Bureau, Recovery Bureau, and Preparedness Bureau. The section is also responsible for planning, directing, and coordinating emergency operations within the state.



that are beyond local control. Hazard mitigation efforts in the state are largely coordinated through the Recovery Bureau and Preparedness Bureau. The Supervisor of the State Police Emergency Management Section serves as assistant deputy state director of NJOEM (New Jersey State Police n.d.-b).

NORTH JERSEY TRANSPORTATION PLANNING AUTHORITY

The North Jersey Transportation Planning Authority is the federally authorized Metropolitan Planning Organization for the 13-county northern New Jersey region. Each year, the Authority oversees over \$2 billion in transportation improvement projects and provides a forum for interagency cooperation and public input.

NEW JERSEY GOVERNOR'S DISASTER RECOVERY OFFICE

The New Jersey Governor's Disaster Recovery Office (GDRO) coordinates the multi-agency response to large-scale disaster events, such as COVID-19, Tropical Storm Ida, Superstorm Sandy, and other disasters, to assist in the recovery and rebuilding of the state. The GDRO also focuses on disaster resilience activities and sources of funding to mitigate damage from future events. The GDRO works with other state agencies, including NJOEM (FEMA funding), the New Jersey Department of Community Affairs (NJDEP) Disaster Recovery and Mitigation Division (HUD funding), and NJDEP (USACE and FEMA/HUD funding) to ensure that the funding received from Congress is put toward the most effective uses, including those related to hazard mitigation, and is reported to the public in a transparent manner.

The GDRO works closely with NJOEM, NJDEP, NJDCA, and other areas of the Governor's Office in developing long-term hazard mitigation strategies. Important focus areas include updating the Flood Hazard Area Control Act, deploying pre-disaster programs, and weighing in on state legislation that might fund hazard mitigation activities or change flood hazard understanding.

NEW JERSEY STATE HAZARD MITIGATION TEAM

The New Jersey State Hazard Mitigation Team (SHMT) is an advisory committee that serves as a coordination point for all FEMA-funded natural hazard mitigation activities that will be evaluated in conjunction with other federal- and state-funded recovery and resilience activities. The SHMT is responsible for periodically updating New Jersey's State Hazard Mitigation Plan and has the authority to call state, county, and local government agencies, academic institutions, and nongovernmental entities to provide input to the state plan. The SHMT meets annually or following any Presidentially declared disaster event that results in FEMA funding being made available to the State of New Jersey for hazard mitigation or resilience or to coordinate recovery activities.

The SHMT consists of seven members:

- The Executive Director of the GDRO
- The State Hazard Mitigation Officer
- The Chief Resilience Officer, or designee
- The State Director of Emergency Management, who is the Superintendent of State Police, or designee
- The Commissioner of Community Affairs, or designee
- The Commissioner of Transportation, or designee
- The Attorney General, or designee



The Governor also can appoint additional members to the SHMT. The SHMT is co-chaired by the Executive Director of the GDRO and the State Hazard Mitigation Officer.

SUSTAINABLE JERSEY

Sustainable Jersey is a nonprofit organization that provides tools, training and financial incentives to support community efforts to reduce waste, cut greenhouse gas emissions, and improve environmental equity. The organization also offers a certification program for municipal governments in New Jersey. The certification is free and completely voluntary (Sustainable Jersey 2023). Many municipalities in Hudson County participate in Sustainable Jersey but only the following municipalities are certified: West New York Town (bronze), Secaucus Town (silver), North Bergen Township (bronze), Jersey City (silver), and Hoboken City (silver) (Sustainable Jersey 2024).

15.3.3 County

HUDSON COUNTY DEPARTMENT OF PLANNING AND BUSINESS OPPORTUNITY

The Office of the Director of the Department of Planning and Business Opportunity is responsible for the management and operation of the Division of Planning, the Office of Business Opportunity, Office of Digital Information, and the Office of Data Analytics. The Director also makes recommendations to the County Administrator's office regarding policies, capital budget expenditures, department projects, and all functions of the Department's divisions and offices (Hudson County n.d.).

Division of Planning

The Hudson County Division of Planning provides information and recommendations for the orderly and proper development of the County. The Division provides staff support and technical assistance to the Hudson County Planning Board, the Hudson County Open Space Trust Fund Advisory Board and the Comprehensive Economic Development Strategy "CEDS" Committee (Hudson County n.d.).

Office of Business Opportunity and Community Services

Hudson County Office of Business Opportunity (HCOBO) is a valuable resource and support center dedicated to assisting Hudson County's small businesses — especially minority, woman, and veteran-owned businesses to thrive and prosper.

Hudson County Office of Business Opportunity (HCOBO) provides information on and linkages to business opportunities from local, state and federal entities. HCOBO is the primary connection to Hudson County's 10% Set-Aside for County goods and services contracts, and business opportunities information from the County's network of government, private and non-profit partners. Furthermore, HCOBO advises businesses on becoming certified (Hudson County n.d.).

Office of Digital Information

The Office of Digital Information (ODI) is responsible for the creation and maintenance of digital and cartographic services for the public, and Departments in Hudson County. This includes this redesigned County website and affiliated County government websites. The Office of Digital Information is also tasked with creating online forms and



applications, producing event flyers and graphics, recording content for the Hudson County Travelers Information Station (1710AM), and providing all County GIS services (Hudson County n.d.).

Office of Data Analytics

The Office of Data Analytics advances data-driven governance by establishing data collection and analytical systems throughout county government. These systems collect and reorganize everyday county data into rich insight information regarding county work performance and achievement of policy goals. Ultimately, the mission of this office is to provide the analytics necessary to support decision-making and planning throughout government (Hudson County n.d.).

HUDSON COUNTY DEPARTMENT OF HEALTH AND HUMAN SERVICES

The Department of Health and Human Services is committed to supporting the health, well-being and overall quality of life for residents by providing an array of inclusive and accessible services, education and resources with dignity, compassion and respect. This is accomplished through the provision of direct and contractual services. The department maintains cooperative working relationships with local, State, Federal and private agencies to ensure that Hudson County residents have access to vital services. The Department conducts on-going monitoring and assessments of health and human service needs in the County.

Division of Children and Youth Services

The Division has oversight of County activities related to children, youth, and young adults, and acts as a County liaison to the New Jersey Department of Children and Families and the New Jersey Juvenile Justice Commission. The Division engages parents, youth, youth serving organizations and systems and other community stakeholders to inform its planning and programming, including the identification of needs within the community and assistance with forming the best response to meet these needs.

Division of Mental Health and Addiction Services

The Division of Mental Health and Addiction Services works closely with the State Division of Mental Health and Addiction Services to oversee the provision of prevention, education, early intervention, treatment services, and recovery support services for residents in need of mental health and/or addiction services.

Division Housing and Community Development

The Hudson County Division of Housing and Community Development works to end homelessness and promote the development of affordable housing and sound community development activities in Hudson County with the use of federal and local resources.

The Division is responsible for the planning, administration and oversight of three federal programs from the U.S. Department of Housing and Urban Development (HUD): Community Development Block Grants (CDBG), Home Investment Partnerships (HOME), and Emergency Solutions Grants. The office is also charged with administering the Hudson County Homelessness Trust Fund and the Social Services for the Homeless funding. Through these programs the Division provides funding to a wide range of agencies that provide direct services and affordable housing to Hudson County citizens.



In addition, the Division leads the Hudson County Alliance to End Homelessness and serves as the lead applicant to HUD for Continuum of Care (CoC) homeless assistance funding. While the CoC funds flow directly to the nonprofits providing housing and services within the community, the Division provides the staffing required to coordinate the process.

Office of Specialized Health Services

The Hudson County Office of Specialized Health Services contracts directly with community-based organizations throughout the County, which are skilled in providing the types of services needed by persons living with HIV, using Ryan White Part A and Minority AIDS Initiative (MAI) funds. In addition to providing oversight of Ryan White Part A and MAI funds, the office oversees other Ryan White competitive funds including Ending the HIV Epidemic funds that are designed to improve HIV-related health outcomes and prevent new transmissions by identifying people who are HIV newly diagnosed and out of care, HIV diagnosed but never in HIV care and those who are not virally suppressed.

Office of Public Health Services

The Office of Public Health Services manages programs designed to improve the overall health and welfare of Hudson County residents. The focus is on addressing health equity matters and responding to public health threats via the provision of direct services at the Chest Clinic and contractual services provided by Hudson Regional Health Commission.

Office of Inclusion and Accessibility

The Office of Inclusion and Accessibility (OIA), formerly known as the Office of Disability Services, was founded in the fall of 2010 to assist Hudson County residents with disabilities by increasing access to and utilization of community-based resources. OIA convenes an Advisory Board comprised of consumers, service providers, and other stakeholders to help coordinate services, identify gaps in resources and determine priorities for Hudson County.

HUDSON COUNTY DEPARTMENT OF AGING AND VETERAN AFFAIRS

The Department of Aging and Veterans Affairs provides a wide variety of services to individuals aged 60 years or older and veterans of the armed services. The department contracts with a provider network consisting of non-profit organizations, for-profit companies, and public entities to provide individuals with services in and out of their homes. Services include certified home health aide, legal assistance, nutrition services, mental health, adult protective services, and transportation, among others.

Additionally, the department serves as the Aging and Disability Resource Connection (ADRC), a one-stop location for individuals to receive information and assistance related to senior services and concerns. The department assists with the Jersey Assistance for Community Caregiving (JACC), State Health Insurance Program (SHIP), Medicaid applications, and many other areas of interest to veterans and seniors.

The department also includes Transcend, the county transportation program. Transcend provides transportation services throughout Hudson County and beyond to seniors over the age of 60, persons with disabilities over the age of 18, and veterans.

Finally, the department provides information, assistance and referral services to veterans residing in Hudson County to improve their quality of life and ensures that indigent deceased veterans receive a proper and dignified burial. The



department also coordinates recognition events to acknowledge and display the County's appreciation for the service of veterans to this county and focuses on issues such as veteran homelessness and the problems associated with transitioning back to civilian life.

HUDSON COUNTY LEGISLATURE

The Legislature serves as the governing body of the County. Each legislator represents a district of approximately 25,000 people. The Legislature has numerous standing committees including:

- Agenda/Charter
- Environment and Public Works
- Intergovernmental Relations
- Planning and Economic Development
- Recreation and Education
- Human Services
- Transportation
- Public Safety
- Ways and Means

DEPARTMENT OF ROADS AND PUBLIC PROPERTY

The Hudson County Department of Roads and Public Property maintains public infrastructure and is responsible for operating, repairing, and maintaining all County-owned buildings, roads, and drainage. The Department also manages all County Right-of-Ways, traffic signals and traffic signs. The services and programs carried out by the Department ensure safe passage of both motorists and pedestrians while using County roads. In addition, the department provides for the storage, servicing, and control of the use of all County-owned vehicles and motorized equipment. The Department also oversees the Division of Engineering to include professional engineering services such as design, construction, construction inspection and an inventory of County Roads and Bridges. In addition, the Department includes the Office of Emergency Management, where the primary objective is to maintain the highest possible level of preparedness to protect the lives and property of the residents in Hudson County (Hudson County n.d.).

Hudson County Office of Emergency Management

The mission of the Hudson County Office of Emergency Management is to maintain the highest possible level of preparedness to protect the lives and property of the Hudson County citizenry before, during and after a natural or manmade disaster. The Hudson County Office of Emergency Management works with all emergency responders, public and private agencies, business communities, the Urban Area Security Initiative, the Regional Catastrophic Planning Group and volunteer organizations to meet this mission (Hudson County n.d.).

Hudson County Local Emergency Planning Committee

As per NJ Executive Order #284, facilities with extremely hazardous substances over the threshold planning quantity must participate in the local emergency planning process through the Local Emergency Planning Committee (LEPC) and provide necessary information which supports this committee (Hudson County n.d.).



New Jersey's county LEPCs are the next step in the established structure. In addition to coordinating emergency plans between towns, they could act as regional information sources and conduct public education and outreach programs. Several state agencies – NJ Department of Environmental Protection, NJ Department of Health, NJ State Police – collect and process information and/or provide support services to the LEPCs, emergency responders, industry and the public. Overseeing the whole structure is the State Emergency Response Commission (SERC), with one representative, appointed by the Governor, from each of eight state agencies (Hudson County n.d.).

Division of Engineering

The Division of Engineering is a Division of the Department of Roads and Public Property. The County Engineer is responsible for this Division and prepares all bid specifications for construction projects, provides construction management oversight on all capital projects, evaluates and monitors the conditions of County roads and bridges, conducts technical analyses, and recommends engineering solutions to complex problems. The County Engineer prepares and manages capital budgets on all projects and manages applications and compliance with State and Federal grants. The County Engineer also provides technical direction and support for all County transportation and facility projects, traffic signal installations, technical support services to the County Planning Board, and is responsible for administrative oversight of all federally funded wastewater projects. The Division is responsible for providing technical reviews and services affecting 61 miles of roadways, 330 signalized intersections, 736 acres in 9 County Parks, 30 bridges and viaducts, 3 Hudson/Essex joint bridges, 4 pedestrian bridges, the Correctional Center, USS Juneau Memorial Center, Meadowview Psychiatric Hospital, Public Safety Training Center, the Administration and Courthouse complex, Hudson County Plaza, Bergen Square Center and various other structures (Hudson County n.d.).

Division of Roads and Bridges

Division of Roads and Bridges handles county road related issues such as road emergencies, weather issues, potholes, lineage, traffic lights, signage and also controls the joint county moveable bridges jointly owned with Essex County, (Bridge, Clay and Jackson St.) (Hudson County n.d.).

Division of Buildings and Grounds

The Division of Buildings and Grounds, provide for the care, maintenance and repair of all County buildings, facilities and properties, other than roads and bridges. They operate, maintain and repair public parking areas and facilities acquired by the County pursuant to law. The Division maintains and operates the Meadowview Wastewater Treatment Plant (Hudson County n.d.).

Division of Central Services

The Division of Central Services provides a central pool of typists, stenographers and other clerical help to designated departments as the need arises; an internal central mail and document delivery service; printing and duplication of forms, reports and other services as the several departments of government may require; telephone and telephone operator services; gathering, security, recording and retention of such documents as are required by law to be maintained; such office supplies as are required by the departments, divisions and offices; implement and maintain a program for conversion of all County records to an electronic storage system; and are responsible for central record storage (Hudson County n.d.).



HUDSON ESSEX PASSAIC SOIL CONSERVATION DISTRICT

The Hudson Essex Passaic Soil Conservation District, serving three counties, is a special purpose subdivision of the State of New Jersey Dept of Agriculture: Division of Agriculture & Natural Resources. The District is one of 14 soil conservation districts in New Jersey empowered to conserve and manage soil and water resources in cooperation with the State Soil Conservation Committee. The District addresses stormwater, soil erosion and sedimentation issues that result from land disturbance activities (primarily construction). District certification of plans for qualifying projects is a prerequisite to local construction permits. The mission of the New Jersey Conservation Partnership is to provide leadership in the planning and implementation of natural resource management programs for the agricultural and development communities and the general public through a locally based delivery system in coordination with local, state and federal partners (Hudson Essex Passaic Soil Conservation District n.d.).

15.3.4 Local

Information about local administrative and technical capabilities is provided in the jurisdictional annexes in Volume II.

15.4 Fiscal Capabilities

15.4.1 Federal Funding Opportunities

FEMA

Hazard Mitigation Assistance Programs

FEMA Hazard Mitigation Assistance programs provide funding for activities that reduce long-term risk to people and property from future disasters. States, local, tribal and territorial governments may apply for this funding. All mitigation projects must be cost-effective, technically feasible and effective, and compliant with federal, state, territorial, tribal and local laws. All applicants and sub-applicants must have a FEMA-approved hazard mitigation plan. Individual homeowners and business owners may not apply directly to FEMA for these programs; eligible local governments may apply on their behalf. The following are the main Hazard Mitigation Assistance programs (FEMA 2023):

- The Hazard Mitigation Grant Program (HMGP) assists in implementing long-term hazard mitigation planning and projects following a Presidential major disaster declaration. Funding is generally 15 percent of the total amount of federal assistance provided to a state, territory, or federally recognized tribe following the declaration. Eligible applicants are state and local governments, nonprofit organizations or institutions that perform essential government services, and Indian tribes and authorized tribal organizations. Funds can be used for projects that will protect public or private property in an area covered by a federal disaster declaration.
- Flood Mitigation Assistance (FMA) provides funds for planning and projects to reduce risk of flood damage to structures that are insured under the NFIP. Funding depends on the amount Congress appropriates each year. At minimum, a FEMA-approved local flood mitigation plan is required before a project can be approved.
- The Pre-Disaster Mitigation (PDM) program provides funds on an annual basis for hazard mitigation planning and projects designed to reduce the risk to individuals and property from future natural hazards, while also



reducing reliance on federal funding from future disasters. Funding depends on the amount Congress appropriates each year.

- Safeguarding Tomorrow Revolving Loan Fund Program is authorized under Section 205 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act to provide capitalization grants to states, eligible federally recognized tribes, territories and the District of Columbia to establish revolving loan funds that provide hazard mitigation assistance for local governments to reduce risks from natural hazards and disasters. These low interest loans allow jurisdictions to reduce vulnerability to natural disasters, foster greater community resilience and reduce disaster suffering.

Cost Sharing

FEMA Hazard Mitigation Assistance grants require a local cost share in the range of 10 to 25 percent of the total project cost, as summarized in Table 15-1.

Table 15-1. FEMA Hazard Mitigation Assistance Grant Cost Share Requirements

Programs	Cost Share (Percent of Federal / Non-Federal Share)
Hazard Mitigation Grant Program	
HMGP	75 / 25 ^a
HMGP Post Fire	75 / 25
Flood Mitigation Assistance	
Community flood mitigation, project scoping, individual mitigation of insured properties, and planning grants	75 / 25 ^b
Socially vulnerable communities	Up to 90 / 10
Repetitive loss property ^c	90 / 10
Severe repetitive loss property ^c	100 / 0
Pre-Disaster Mitigation	
PDM	75 / 25
PDM—Small and impoverished community	Up to 90 / 10

Source: (FEMA 2023)

- Sub-applicants should consult their State Hazard Mitigation Officer for the amount of percentage of HMGP subrecipient management cost funding their state has determined to be passed through subrecipients.
- Of the 25 percent funding required from a non-federal source, no more than half can be provided as in-kind contributions from third parties.
- To be eligible for an increased federal cost share, a FEMA-approved state or tribal (standard or enhanced) mitigation plan that addressed repetitive loss properties must be in effect at the time of award, and the property is being submitted for consideration must be a repetitive loss property.

Extraordinary Circumstances

For projects in communities with no currently approved HMP, the FEMA Region may award HMGP and FMA funds under a determination of extraordinary circumstances when justification is provided and with concurrence from FEMA Headquarters. If this exception is granted, a local mitigation plan must be approved by FEMA within 12 months of the award of the project funding.



Extraordinary circumstances exist if the proposed project is consistent with the priorities and strategies identified in the state hazard mitigation plan and the local jurisdiction meets at least one of the following criteria:

- The jurisdiction meets the criteria for a small, impoverished community.
- The jurisdiction had insufficient capacity due to lack of available funding, staffing, or other necessary expertise to satisfy the mitigation planning requirement prior to the current disaster or application deadline.
- The jurisdiction had been at low risk from hazards because of low frequency of occurrence or minimal damage from previous occurrences as a result of sparse development.
- The jurisdiction experienced significant disruption from a declared disaster or another event that impacted its ability to complete the mitigation planning process prior to award or final approval of a project award.
- The jurisdiction does not have a mitigation plan for reasons beyond the control of the state, federally recognized tribe, or local community, such as Disaster Relief Fund restrictions that delay FEMA from granting a subaward prior to the expiration of the local or tribal mitigation plan.

The applicant must provide written justification that identifies the specific criteria or circumstance listed above, explains why there is no longer an impediment to satisfying the mitigation planning requirement, and identifies the specific actions or circumstances that eliminated the deficiency. If the jurisdiction does not meet at least one of the above criteria, the Region must coordinate with FEMA Headquarters for HMGP; for FMA the Region must coordinate and seek concurrence prior to granting an exception.

When an HMGP project funding is awarded under extraordinary circumstances, the recipient must acknowledge in writing to the Regional Administrator that a plan will be completed within 12 months of the subaward. The recipient must provide a work plan for completing the mitigation plan, including milestones and a timetable, to ensure that the jurisdiction will complete the plan in the required time. This requirement must be incorporated into the award (both the planning and project subaward agreements if a planning subaward is also awarded).

Rehabilitation of High Hazard Potential Dams Grant Program

The Rehabilitation of High Hazard Potential Dams (HHPD) grant program provides technical, planning, design, and construction assistance for rehabilitation activities that reduce dam risk and increase community preparedness. The HHPD Grant Program provides assistance for technical, planning, design, and construction activities for repair, removal, or rehabilitation of eligible high hazard potential dams.

Assistance to Firefighters Grant Program

The goal of the Assistance to Firefighters Grants is to enhance the safety of the public and firefighters with respect to fire-related hazards by providing direct financial assistance to eligible fire departments, nonaffiliated emergency medical services organizations, and state fire training academies. This funding is for critically needed resources to equip and train emergency personnel to recognized standards, enhance operations efficiencies, foster interoperability, and support community resilience.

Emergency Management Performance Grants Program

The Emergency Management Performance Grant (EMPG) provides state, local, tribal, and territorial emergency management agencies with the resources required for implementation of the National Preparedness System. The EMPG



supports efforts to build and sustain core capabilities in disaster prevention, protection, mitigation, response, and recovery.

Homeland Security Grant Program

The Homeland Security Grant Program (HSGP) supports efforts to build and sustain law enforcement terrorism prevention capabilities and to enhance state and major urban area fusion centers. The program funds a range of preparedness activities, including planning, organization, equipment purchase, training, exercises, and management and administration.

DISASTER AND RECOVERY ASSISTANCE PROGRAMS

Following a disaster, various types of assistance may be made available by local, state, and federal governments. The following sections describe general types of assistance that may be provided should the President of the United States declare a major disaster.

Individual Assistance

Individual Assistance (IA) provides help for homeowners, renters, businesses, and some nonprofit entities after disasters occur. This program is largely funded by the U.S. Small Business Administration.

Homeowners and renters who suffered uninsured or underinsured losses may be eligible for a Home Disaster Loan to repair or replace damaged real estate or personal property. Individuals may borrow up to \$200,000 to repair or replace real estate, \$40,000 to cover losses to personal property (such as clothing, furniture, cars, and appliances), and an additional 20 percent for mitigation. Renters are eligible for loans to cover personal property losses.

For businesses, loans may be made to repair or replace disaster-damaged property owned by the business, including real estate, machinery and equipment, inventory, and supplies. Businesses of any size are eligible. Nonprofit organizations such as charities, churches, private universities, etc. are also eligible. An Economic Injury Disaster Loan provides necessary working capital until normal operations resume after a physical disaster. These loans are restricted to small businesses. Physical disaster loans of up to \$2 million are available to qualified businesses or most private nonprofit organizations.

Public Assistance

Public Assistance (PA) provides cost reimbursement aid to local governments (state, county, local, municipal authorities, and school districts) and certain nonprofit agencies that were involved in disaster response and recovery programs or that suffered loss or damage to facilities or property used to deliver government-like services. This program is largely funded by FEMA, with both local and state matching contributions required.

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES

Social Services Block Grant Program

The Social Services Block Grant is a flexible funding source that allows states and territories to provide essential social services for the following:



- To help reduce dependency and promote self-sufficiency
- To protect children and adults from neglect, abuse, and exploitation
- To help individuals who are unable to take care of themselves to stay in their homes or to find the best institutional arrangements.

U.S. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT

Community Development Block Grants

Community Development Block Grants (CDBG) are federal funds intended to provide low and moderate-income households with decent housing, a suitable living environment, and expanded economic opportunities. Eligible activities include community facilities and improvements, roads and infrastructure, housing rehabilitation and preservation, development activities, public services, economic development, planning, and administration. Public improvements may include flood and drainage improvements. During the times of urgent need (e.g., post-disaster), CDBG funding may be used to acquire a property located in a floodplain that was severely damaged by a recent flood, demolish a structure severely damaged by an earthquake, or repair a public facility severely damaged by a hazard event.

Community Development Block Grant Disaster Recovery (CDBG-DR) grant funds are allocated to rebuild disaster-impacted areas and provide seed money to start the long-term recovery process. These grants help cities, counties, Indian tribes, and states recover from presidentially declared disasters, especially in low-income areas. CDBG-DR assistance may help communities and neighborhoods that otherwise might not recover due to limited resources.

Disaster Housing Assistance Program

The Disaster Housing Assistance Program provides emergency assistance for housing, including minor repairs of a home to establish livable conditions, mortgage assistance, and rental assistance.

HOME Investment Partnerships Program

The HOME Investment Partnerships Program provides grants to states and localities to fund a wide range of activities, including building, buying, and/or rehabilitating affordable housing for rent or homeownership or providing direct rental assistance to low-income people. HOME is the largest federal block grant to state and local governments designed exclusively to create affordable housing for low-income households. HOME funds are awarded annually as grants to participating jurisdictions. The program's flexibility allows states and local governments to use HOME funds for grants, direct loans, loan guarantees or other forms of credit enhancements, or rental assistance or security deposits. The program requires participating jurisdictions to match 25 cents of every dollar in program funds.

Section 108 Loan Guarantee Program

The Section 108 Loan Guarantee Program provides communities with a source of low-cost, long-term financing for economic and community development projects. Section 108 financing provides an avenue for communities to undertake larger, more costly projects, where they may have limited resources to invest upfront. It can fund economic development, housing, public facilities, infrastructure, and other physical development projects, including improvements to increase resilience against natural disasters. Section 108 assistance can be deployed in two ways:

- Directly by the community or its governmental or non-profit partner to carry out an eligible project



- Indirectly with a community or its partner re-lending (or, in limited circumstances, granting) the funds to a developer or business to undertake an eligible project

U.S. DEPARTMENT OF TRANSPORTATION

Federal Highway Administration Emergency Relief

Federal Highway Administration (FHWA) Emergency Relief is a grant program that can be used for the repair or reconstruction of federal-aid highways and roads on federal lands that have suffered serious damage as a result of a disaster. New Jersey State highway agencies serve as the liaison between local municipalities and FHWA, making the municipalities sub-applicants of New Jersey. The program is appropriated \$100 million annually (FHWA New Jersey Division Office n.d.).

Federal Transit Administration Emergency Relief

Federal Transit Administration (FTA) Emergency Relief is a grant program that funds capital projects to protect, repair, reconstruct, or replace equipment and facilities of public transportation systems. Administered by the FTA and directly allocated to mass transit and port authorities, this transportation-specific fund was created as an alternative to FEMA's PA.

Federal Highway Administration Recreational Trails

The Federal Highway Administration's Recreational Trails Program (RTP) provides financial assistance to states for developing and maintaining trails and trail facilities. The RTP funds come from the Federal Highway Trust Fund and represent a portion of the motor fuel excise tax collected from non-highway recreational fuel use. Since the program's inception in 1993, New Jersey has awarded more than \$16 million to federal, state, county and local governments, and non-profit agencies. Projects are funded on an 80% federal share and 20% matching share basis. In 2010, over \$1 million was available for projects. Of the funding available each year, 30% is allocated for non-motorized trail projects, 30% for motorized trail projects, and 40% for diversified use trail projects.

The NJDEP Green Acres Program administers the program in New Jersey. Projects are reviewed and recommended for funding by the New Jersey Trails Council and approved by the Federal Highway Administration under the Infrastructure Investment and Jobs Act. The Trails Council comprises interest groups for hiking, mountain biking, horseback riding, motorized trail uses and canoeing/kayaking, as well as several general trail advocates and state government representatives.

Rebuilding American Infrastructure with Sustainability and Equity Grant Program

The Rebuilding American Infrastructure with Sustainability and Equity (RAISE) grant program invests in road, rail, transit, and port projects that promise to achieve national objectives. Project sponsors at the state and local levels can obtain funding for multi-modal, multi-jurisdictional projects that are more difficult to support through traditional USDOT programs. RAISE can provide funding directly to any public entity, including municipalities, counties, port authorities, tribal governments, or others, in contrast to traditional federal programs that provide funding to very specific groups of applicants (mostly state departments of transportation and transit agencies).



U.S. DEPARTMENT OF AGRICULTURE

Community Facilities Direct Loan and Grant Program

This program provides funding to develop essential community facilities in rural areas. An essential community facility is defined as a facility that provides an essential service to the local community for the orderly development of the community in a primarily rural area and does not include private, commercial, or business undertakings. Funds can be used to purchase, construct, and/or improve essential community facilities, purchase equipment, and pay related project expenses. Rural areas including cities, villages, townships, towns, and federally recognized tribes, with no more than 20,000 residents according to the latest U.S. Census, are eligible for this program.

Emergency Loan Program

The Emergency Loan Program is triggered when a natural disaster is designated by the Secretary of Agriculture, or a natural disaster or emergency is declared by the President under the Stafford Act. These loans help producers who suffer qualifying farm-related losses directly caused by a disaster in a county that has been declared or designated as a primary disaster or quarantine area. Farmers in counties that are contiguous to the declared, designated, or quarantined area may also qualify for emergency loans. For production losses, a 30 percent reduction in a primary crop in a designated or contiguous county is required. Losses to quality, such as receiving a 30 percent reduced price for flood-damaged crops, may be eligible for assistance, too.

Emergency Watershed Protection Program

The Emergency Watershed Protection (EWP) Program offers technical and financial assistance to help communities relieve imminent threats to life and property caused by floods, fires, windstorms, and other natural disasters that impair a watershed. EWP does not require a disaster declaration by federal or state government officials. The Natural Resources Conservation Service (NRCS) state conservationist can declare a local watershed emergency and initiate EWP program assistance in cooperation with an eligible sponsor. The sponsor must sign a cooperative agreement with NRCS. The EWP program offers financial and technical assistance for various activities, including the following:

- Remove debris from stream channels, road culverts, and bridges
- Reshape and protect eroded streambanks
- Correct damaged or destroyed drainage facilities
- Establish vegetative cover on critically eroding lands
- Repair levees and structures
- Repair certain conservation practices
- Buyouts

EWP – Recovery

The EWP – Recovery program is aimed at relieving imminent hazards to life and property caused by floods, fires, windstorms, and other natural occurrences. Public and private landowners are eligible for assistance but must be represented by a project sponsor that must be a legal subdivision of the state, such as a city, county, township, or



conservation district, or Native American tribes. NRCS will pay up to 75 percent of the construction cost of emergency measures. The remaining 25 percent must come from local sources and can be in the form of cash or in-kind services.

The program funds recovery measures to safeguard lives and property as a result of a natural disaster. NRCS completes a Damage Survey Report, which provides a case-by-case investigation of the work necessary to repair or protect a site. Watershed impairments that the EWP Program addresses are debris-clogged stream channels, undermined and unstable streambanks, jeopardized water control structures and public infrastructures, wind-borne debris removal, and damaged upland sites stripped of protective vegetation by fire or drought.

EWP – Floodplain Easement

Privately owned lands or lands owned by local and state governments might be eligible for the EWP – Floodplain Easement program. To be eligible, lands must meet one of the following criteria:

- Lands that have been damaged by flooding at least once within the previous calendar year or have been subject to flood damage at least twice within the previous 10 years
- Other lands within the floodplain that would contribute to the restoration of flood storage and flow, provide for control of erosion, or improve the practical management of the floodplain easement
- Lands that would be inundated or adversely impacted as a result of a dam breach

Through this program, easements are restored to the natural environment to the extent practicable. Work can include both structural and nonstructural practices to restore flood storage and flow, control erosion, and improve the practical management of the easement. Structures within the floodplain easement must be demolished and removed or relocated outside the 100-year floodplain or dam breach inundation area.

Regional Conservation Partnership Program

The Regional Conservation Partnership Program promotes coordination of NRCS conservation activities with partners that offer value-added contributions to address on-farm, watershed, and regional natural resource concerns. Through this program, NRCS seeks to co-invest with partners to implement projects that demonstrate innovative solutions to conservation challenges and provide measurable improvements and outcomes tied to the resource concerns they seek to address.

U.S. FISH AND WILDLIFE SERVICE

Partners for Fish and Wildlife

The Partners for Fish and Wildlife Program provides free technical and financial assistance to landowners, managers, tribes, corporations, schools, and nonprofits interested in improving wildlife habitat on their land. These projects range in size from a wetland of a few acres to a grassland restoration covering several hundred thousand acres. Many Partners for Fish and Wildlife projects take place on working landscapes such as forests, farms, and ranches. Efforts are focused on areas of conservation concern, such as upland forests, wetlands, native prairies, marshes, rivers, and streams. Projects are designed to benefit federal trust species, including migratory birds and endangered, threatened, or at-risk species.



U.S. ENVIRONMENTAL PROTECTION AGENCY

Smart Growth Implementation Assistance Program

The Smart Growth Implementation Assistance program focuses on complex issues such as stormwater management, code revision, transit-oriented development, affordable housing, infill development, corridor planning, green building, and climate change. Applicants can submit proposals under four categories: community resilience to disasters, job creation, the role of manufactured homes in sustainable neighborhood design, or medical and social service facilities siting.

Water Quality Planning Grants

Water Quality Planning Grants provide funding to implement regional comprehensive water quality management planning activities as described in Section 604(b) of the federal Clean Water Act. Funds are to be used for water quality management planning activities, including tasks to determine the nature, extent, and causes of point and nonpoint source water pollution problems, and to develop plans to resolve these problems.

U.S. ECONOMIC DEVELOPMENT ADMINISTRATION

The U.S. Economic Development Administration (USEDA) is an agency of the U.S. Department of Commerce that supports regional economic development in communities. It provides funding to support comprehensive planning and makes strategic investments that foster employment creation and attract private investment in economically distressed areas of the United States.

Public Works Program

Through its Public Works Program, USEDA invests in key public infrastructure, such as traditional public works projects, including water and sewer system improvements, expansion of port and harbor facilities, brownfields, multitenant manufacturing and other facilities, business and industrial parks, business incubator facilities, redevelopment technology-based facilities, telecommunications facilities, and development facilities.

Economic Adjustment Program

Through its Economic Adjustment Program, USEDA administers its Revolving Loan Fund Program, which supplies small businesses and entrepreneurs with the gap financing needed to start or expand their business in areas that have experienced or are under threat of serious structural damage to the underlying economic base.

NATIONAL PARK SERVICE

Land and Water Conservation Fund

The Land and Water Conservation Fund (LWCF) provides funding to safeguard natural areas, water resources, and cultural heritage, and to provide recreation opportunities. Using no taxpayer dollars, the LWCF invests earnings from offshore oil and gas leasing to help strengthen communities, preserve history, and protect the national endowment of lands and waters. The LWCF program is divided into the "State Side," which provides grants to state and local



governments, and the “Federal Side,” which is used to acquire lands, waters, and interests necessary to achieve the natural, cultural, wildlife, and recreation management objectives of federal land management agencies.

RESTORE AMERICA’S ESTUARIES

Coastal Watersheds Grant Program

Restore America’s Estuaries, in coordination with and financial support from the U.S. Environmental Protection Agency, administers the National Estuary Program Coastal Watersheds Grant Program to address the following issues:

- Loss of key habitats resulting in significant impacts on fisheries and water quality such as seagrass, mangroves, tidal and freshwater wetlands, forested wetlands, kelp beds, shellfish beds, and coral reefs
- Recurring harmful algae blooms
- Unusual or unexplained marine mammal mortalities
- Proliferation or invasion of species that limit recreational uses, threaten wastewater systems, or cause other ecosystem damage
- Flooding and coastal erosion that may be related to sea-level rise, changing precipitation, or salt marsh, seagrass, or wetland degradation or loss
- Impacts of nutrients and warmer water temperatures on aquatic life and coastal ecosystems, including low dissolved oxygen conditions in estuarine waters
- Contaminants of emerging concern found in coastal and estuarine waters such as pharmaceuticals, personal care products, and microplastics

15.4.2 State

The 2024 New Jersey State Hazard Mitigation Plan features a section with further details on funding administered by state agencies that eligible jurisdictions can use to fund mitigation actions.

NEW JERSEY BOARD OF PUBLIC UTILITIES

Analysis and Technical Assistance

The New Jersey Board of Public Utilities (BPU) works with private utility companies to provide analysis of natural hazard information affecting the provision of electric power, telecommunications, public water, sewage collection and treatment, and other regulated public utilities. The data is used during response and recovery efforts in the event of emergency or disaster and is also used to analyze impacts of mitigation plans and projects. BPU also provides technical assistance for the Energy Resiliency Program.

New Jersey’s Clean Energy Program

New Jersey’s Clean Energy Program (NJCEP) promotes increased energy efficiency and the use of clean, renewable sources of energy, including solar, wind, geothermal, and sustainable biomass. NJCEP offers financial incentives, programs, and services for residential, commercial, and municipal customers. The program also offers a Community Energy Plan Grant for government entities (e.g., municipality, county, Green Team or environmental commission, or



other Sustainable Jersey organization). The grant will provide funding for an entity to create a Community Energy Master Plan to align local communities with the State Energy Master Plan.

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION

NJDEP offers a wide variety of funding opportunities for local governments and other types of organizations to fund numerous environmentally based projects involving mitigation of hazards such as flooding and wildfires. This includes funding for air quality, energy, and sustainability; compliance and enforcement; engineering and construction; land use management; local government assistance; natural and historic resources; site remediation and waste management programs; and water resource management.

Matching Grants Program for Local Environmental Agencies

NJDEP may grant state aid and/or technical assistance to a local environmental agency for any activity that the agency is authorized to perform by law and for the preparation of an environmental index. An environmental index is a report on environmental conditions in the locality and community objectives concerning open areas, parks, water supply, solid waste, wildlife protection, soil resources, air pollution, water pollution, and other related issues. The purpose of the funding is to assist local environmental commissions and soil conservation districts with funding for local environmental projects, including the following (NJDEP n.d.):

- Community education
- Environmental resource inventories
- Beach monitoring and management projects
- Environmental trail designs
- Lake rehabilitation studies
- Stream and water quality testing
- Wellhead delineation
- GIS mapping projects
- National environmental performance partnership system indicator projects
- Surveys of threatened and endangered species.

The maximum annual grant is \$2,500. Applicants must match at least 50 percent of the total cost of the project. Projects funded by this grant are reported online.

Drinking Water State Revolving Fund

Projects eligible for financing under the Drinking Water State Revolving Fund Program are those that address federal safe drinking water health standards. This includes replacement, source development and rehabilitation, treatment to comply with primary/ secondary drinking water standards, storage to prevent contamination from entering the water system and transmission lines/distribution systems to prevent contamination or to improve pressure to safe levels. The New Jersey Water Bank Financing Program, in partnership with the NJDEP Water Supply Administration, uses this funding to provide low-interest loans to help communities in New Jersey improve and safeguard their drinking water systems.

Environmental Infrastructure Financing Program

NJDEP provides below-market interest rate loans through the Environmental Infrastructure Financing Program to municipalities for capital improvements that improve water quality. Projects are ranked to address higher state priorities or high-water quality problems or improvements. Approximately one half to three quarters of each loan is a



0-percent interest NJDEP State Revolving Fund loan. The other portion comes from proceeds of highly rated tax-exempt revenue bonds. Combining these two funds results in a loan that is 50 to 75 percent lower than traditional loan rates.

Dam Restoration and Inland Water Projects Loan Program

The New Jersey Dam Restoration and Inland Water Projects Loan Program provides loans to assist local government units, private lake associations or similar organizations in the funding of a dam restoration project or an inland waters project. Application periods are established from time to time based upon availability of funds in the program.

Blue Acres Program

The Blue Acres Program purchases flood-prone properties for preservation. This program assists local government units and nonprofits in their efforts to increase and preserve permanent outdoor recreation areas for public use and enjoyment, and conservation areas for the protection of natural resources such as waterways, wildlife habitat, wetlands, forests, and view sheds. Funding for Blue Acres is a combination of dedicated state funding from the corporate business tax and federal grants.

Green Acres Program

The Green Acres Program provides low interest (2 percent) loans and grants to municipal and county governments to acquire open space and develop outdoor recreation facilities. Green Acres also provides matching grants to nonprofit organizations to acquire land for public recreation and conservation purposes. Voters authorize Green Acres funding through bond referendums. Together with public and private partners, Green Acres has protected well over a million and a half acres of open space and provided hundreds of outdoor recreational facilities in communities around the state.

NEW JERSEY INFRASTRUCTURE BANK

The New Jersey Infrastructure Bank is an independent state financing authority that provides low interest rate loans to qualified municipalities, counties, regional authorities, and water purveyors in New Jersey. Approximately \$350 million is awarded annually. The New Jersey Infrastructure Bank provides principal forgiveness opportunities and better financing packages for projects that implement climate change resilience measures.

New Jersey Water Bank

New Jersey Water Bank is a partnership between the NJDEP and the New Jersey Infrastructure Bank to provide low-cost financing for the design, construction, and implementation of projects that help protect and improve water quality and help ensure safe and adequate drinking water. Funding comes from revenue bonds used in combination with zero percent interest funds to provide very low-interest loans for water infrastructure improvements. The NJDEP administers a combination of federal and state revolving fund capitalization grants, as well as the state's matching funds, loan repayments, state appropriations, and interest earned on such funds.



NEW JERSEY STATE AGRICULTURE DEVELOPMENT COMMITTEE

Open Space and Farmland Preservation Programs

Farmland and open space preservation programs are often funded partially through grants administered by the New Jersey State Agriculture Development Committee and the New Jersey Green Acres Program. The objective of these programs is to expand the existing county and municipal park systems. Many counties in New Jersey also support land preservation acquisition through open space funding.

NEW JERSEY REDEVELOPMENT AUTHORITY

The New Jersey Redevelopment Authority is an independent state financing authority committed exclusively to the redevelopment of New Jersey's urban areas. The Authority offers several financing resources, including site acquisition funding, predevelopment assistance, several development assistance resources, and technical assistance.

NEW JERSEY DEPARTMENT OF COMMUNITY AFFAIRS

The New Jersey Department of Community Affairs (NJDCA) is a state agency created to provide administrative guidance, financial support, and technical assistance to local governments, community development organizations, businesses, and individuals to improve the quality of life in New Jersey. NJDCA offers a wide range of programs, funding, and services that respond to issues of public concern, including fire and building safety, housing production, community planning and development, and local government management and finance. Among other funding sources, NJDCA administers CDBG funding and is typically the CDBG-Disaster Relief funding recipient for the State of New Jersey.

New Jersey Small Cities Community Development Block Grants

The New Jersey Small Cities Community Development Block Grants provide funds for economic development, housing rehabilitation, community revitalization, and public facilities designated to benefit people with low and moderate incomes or to address recent local needs for which no other source of funding is available to non-entitlement counties and municipalities.

NEW JERSEY DEPARTMENT OF TRANSPORTATION

Transportation Trust Fund

The New Jersey Department of Transportation (NJDOT) is committed to advancing projects that enhance safety, renew aging infrastructure and the state's economy, and support new transportation opportunities. The Transportation Trust Fund provides assistance to local governments for the funding of road, bridge, and other transportation projects. Annually, the trust fund provides \$400 million in state aid to municipalities and counties for local transportation improvements.



NEW JERSEY TURNPIKE AUTHORITY

Capital Program

The New Jersey Turnpike Authority is dedicated to the safe and efficient movement of people and goods over the New Jersey Turnpike and the Garden State Parkway, two of the busiest toll roads in the United States. Under its capital improvement programs, the Authority has expanded capacity, repaired or replaced deteriorating bridges, reconfigured entrance and exit ramps, improved maintenance yards and toll plazas, and expanded the use of technology for collecting and communicating information about roadway conditions.

Through the Asset Management Program, the Turnpike Authority invests approximately \$50 million annually on drainage-related projects to better equip the Authority's roadways in response to major rainfall events.

15.4.3 County and Local

Hudson County and municipalities are legally able to fund mitigation projects through existing local budgets and local appropriations, including referendums and bonding. Many jurisdictions noted throughout the planning process that they are faced with increasing fiscal constraints, including decreasing revenues, budget constraints, and tax caps. In an effort to overcome these fiscal challenges, jurisdictions have continued to leverage the sharing of resources and combining available funding with grants and other sources. Plans and interjurisdictional cooperation are beneficial in obtaining grants.

HUDSON COUNTY OPEN SPACE, RECREATION AND HISTORIC PRESERVATION TRUST FUND

The Hudson County Open Space, Recreation and Historic Preservation Trust Fund was established in 2003 after approval by a two-to-one majority of County voter participants. The Board of Chosen Freeholders annually approves the property tax rate which funds the Trust Fund.

Recreation and Open Space Trust Fund shall be used for any or all of the following purposes or any combination thereof as determined by the governing body:

- Acquisition of lands for recreation and conservation purposes.
- Development of lands acquired for recreation and conservation purposes.
- Maintenance of lands acquired for recreation and conservation purposes.
- Acquisition of farmland for farmland preservation purposes.
- Historic preservation of historic properties, structures, facilities, sites, areas or objects, and the acquisition of such properties, structures, facilities, sites, areas or objects for historic preservation purposes.
- Payment of debt service on indebtedness issued or incurred by the County of Hudson for any of the above purposes, except for Subsection C above.

TRANSPORTATION ALTERNATIVES SET ASIDE PROGRAM

Funded through the FHWA's Federal Aid Program and administered by the New Jersey DOT, in partnership with the North Jersey Transportation Planning Authority, Transportation Alternatives Set Aside Program (TAP) provides federal



funds for community based “non-traditional” projects designed to strengthen the cultural, aesthetic, and environmental aspects of the nation’s intermodal system. TAP was established by Congress in 2012 under MAP-21 and is funded through a set-aside of the Federal-aid Highway Program.



16. MITIGATION STRATEGY

This chapter presents mitigation strategies for Hudson County to reduce potential vulnerability and losses identified as concerns in the risk assessment portion of this plan. The Steering Committee reviewed the risk assessment and capability assessment to identify and develop these mitigation strategies.

Hazard mitigation reduces the potential impacts of, and costs associated with, emergency and disaster-related events. Mitigation actions address a range of impacts, including impacts on the population, property, the economy, and the environment.

Mitigation actions can include activities such as revisions to land-use planning, training and education, and structural and nonstructural safety measures.

16.1 Past Mitigation Accomplishments

The County, through previous and ongoing hazard mitigation activities, has demonstrated that it is proactive in protecting its physical assets and citizens against losses from natural hazards. Examples of previous and ongoing actions and projects include the following:

- The County facilitated the development of the original Hudson County HMP. The current planning process represents the regulatory five-year plan update process, which includes the participation of 30 jurisdictions in the County, along with key County and regional stakeholders.
- All municipalities participating in this HMP update participate in the National Flood Insurance Program (NFIP), which requires the adoption of FEMA floodplain mapping and certain minimum standards for building within the floodplain.
- Reports, plans, and studies relating to or including information on natural hazards or natural hazard policies affecting Hudson County have been reviewed and incorporated into this plan update as appropriate, as discussed in Chapter 2 (Planning Process) and References.

16.2 Review and Update of Mitigation Goals and Objectives

This section documents describes the process of updating hazard mitigation goals and objectives for reducing or avoiding long-term vulnerabilities to identified hazards. For the purposes of this plan, goals and objectives are defined as follows:

“The hazard mitigation strategy shall include a description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.”

44 CFR 201.6(c)(3)(i)

- **Goals** are general guidelines that explain what is to be achieved. They are usually broad, long-term, policy-type statements and represent global visions. Goals help define the benefits that the plan is trying to achieve. The success of the plan, once implemented, should be measured by the degree to which its goals have been met (that is, by the actual benefits in terms of hazard mitigation).
- **Objectives** are short-term aims that form a strategy or course of action to meet a goal. Unlike goals, objectives are stand-alone measurements of the effectiveness of a mitigation action. The objectives also are used to help



establish priorities. Broadly defined mitigation objectives were eliminated from the updated strategy unless accompanied by discrete actions.

The Steering Committee reviewed the 2020 goals and objectives and made revisions for the 2025 update based on the following considerations:

- Hazard events and losses since the 2020 plan
- The updated hazard profiles and risk assessment
- The goals and objectives established in the New Jersey State 2024 HMP
- The Planning Partnership's interests in integrating this plan with other planning mechanisms, including Hudson County and local risk management plans
- Direct input from the Steering Committee, stakeholders, and the public on how the County and jurisdictions need to move forward to best manage their hazard risk
- Discussions and research on existing authorities, policies, programs, resources
- Support for mitigation through the protection of natural systems

As a result of this review process, the goals and objectives for the 2025 update were updated to the following:

- Goal 1: Protect life.
 - Objective 1.1: Develop, enhance, and protect early warning and emergency communications systems.
 - Objective 1.2: Improve and support Comprehensive Regional Evacuation Plan.
 - Objective 1.3: Strengthen County and local planning, building codes, ordinances, and enforcement.
 - Objective 1.4: Identify the need for, and acquire, any special emergency services, training, and equipment to enhance response capabilities for specific hazards.
 - Objective 1.5: Enhance sheltering capabilities at the local and regional levels.
- Goal 2: Protect property.
 - Objective 2.1: Protect, maintain, and increase resilience of infrastructure, critical facilities, and community lifelines.
 - Objective 2.2: Reduce repetitive and severe repetitive losses.
 - Objective 2.3: Assure coordination between communities and encourage shared services in acquiring, maintaining, and providing emergency services.
 - Objective 2.4: Reduce the risk of utility failure and improve redundancy for utility systems.
 - Objective 2.5: Review existing local laws and ordinances, safety inspection procedures, and applicable rules to help ensure that they employ the most recent and generally accepted standards for the protection of buildings and environmental resources.
- Goal 3: Promote a sustainable economy.
 - Objective 3.1: Identify and pursue funding opportunities to develop and implement local and county mitigation activities.
 - Objective 3.2: Provide/Improve flood protection with flood control structures, and drainage maintenance plans.



- Objective 3.3: Enhance stakeholder education and training about hazard risks and mitigation.
- Goal 4: Protect the environment.
 - Objective 4.1: Review and incorporate updated hazard data into the County Hazard Mitigation Plan and other county and local planning mechanisms.
 - Objective 4.2: Increase support for the development of local mitigation planning and projects that provide co-benefits and support a healthy and equitable environment.
 - Objective 4.3: Better characterize flood/stormwater hazard events by conducting additional hazard studies and identify inadequate stormwater facilities and poorly drained areas.
 - Objective 4.4: Prevent (or discourage) new development in hazardous areas or ensure that if building occurs in high-risk areas that it is done in such a way as to minimize risk.
 - Objective 4.5: Strengthen understanding of, and adaptation to, a changing climate.
- Goal 5: Increase public awareness.
 - Objective 5.1: Educate the public on the risk from natural and man-made hazards and increase personal hazard preparation, mitigation, response, and recovery activities for socially vulnerable populations.
 - Objective 5.2: Encourage and support additional related training and education of public officials.
 - Objective 5.3: Integrate the recommendations of this plan into existing local plans/programs.
- Goal 6: Support continuity of operations pre-, during, and post-hazard events
 - Objective 6.1: Ensure continuity of government operations, emergency services and essential facilities during and immediately after disaster and hazard events.
 - Objective 6.2: Increase resiliency by facilitating rapid disaster recovery.
 - Objective 6.3: Support and encourage the implementation of alternative energy sources and more efficient energy use.
 - Objective 6.4: Implement mitigation measures that promote the reliability of lifeline systems.
- Goal 7: Reduce the risk of natural hazards for socially vulnerable populations and underserved communities.
 - Objective 7.1: Promote sustainable and equitable land development practices that direct future development away from vulnerable areas and, when that is not possible, encourage the use of more resilient design, construction, and materials.
 - Objective 7.2: Encourage and support multi-jurisdictional mitigation projects that leverage funding and support from multiple levels of government and community organizations.
 - Objective 7.3: Encourage the establishment of policies to help ensure the prioritization and implementation of mitigation actions and/or projects designed to benefit socially vulnerable populations and underserved communities.
- Goal 8: Address long-term vulnerabilities from High Hazard Dams.
 - Objective 8.1: Ensure that dam infrastructure is maintained.
 - Objective 8.2: Support the identification and access to funding to repair, rehabilitate, or replace dams.
 - Objective 8.3: Ensure Emergency Action Plans are developed and updated.



16.3 Mitigation Strategy Development and Update

16.3.1 Update of Local Jurisdiction Mitigation Strategies

REVIEW OF PREVIOUS ACTIONS

To evaluate progress on local mitigation actions, each planning partner was provided with a Mitigation Action Plan Review Worksheet, pre-populated with the actions identified for their jurisdiction in the prior (2020) plan. The Planning Partners were asked to indicate the status of each action (“No Progress/Unknown,” “In Progress/Not Yet Complete,” “Continuous,” “Completed,” “Discontinued”). They were requested to provide comments to quantify the extent of progress and provide reasons for the level of progress or why actions were discontinued. This information is included in the jurisdictional annexes.

FEMA defines **Mitigation Actions** as specific actions that help to achieve the mitigation goals and objectives.

Mitigation actions identified as “Complete” or “Discontinued” have been removed from the Planning Partners’ updated mitigation strategies. Actions identified as “No Progress/Unknown” or “In Progress/Not Yet Complete” have been carried forward in their local updated mitigation strategies. Planning partners were asked to provide further details on these projects to help better define the projects, identify benefits and costs, and improve implementation.

Certain continuous or ongoing actions (Ongoing Capabilities) from the previous plan that represent programs that are now fully integrated into the normal operational and administrative framework of the community are identified in the capabilities assessment of each annex and removed from the updated mitigation strategy (marked as “Discontinued”).

IDENTIFYING NEW ACTIONS

At the kickoff and during subsequent local level planning meetings, all participating jurisdictions were further surveyed to identify completed mitigation actions, in progress actions, or ongoing capabilities, as well as potential new actions. Communities also were made aware of potential new mitigation actions as such actions became evident during the plan update process (e.g., through the capability assessment, risk assessment, or the public and stakeholder outreach process).

DEVELOPING THE OVERALL STRATEGY

Beginning in February 2024, members of the Steering Committee and contract consultants worked directly with each jurisdiction (by phone, email, or virtual meetings) to update their annex with mitigation strategies that focus on well-defined, implementable projects that meet the definition or characteristics of mitigation. Mitigation actions were selected with a careful consideration of benefits (risk reduction, losses avoided), costs, and possible funding sources (including mitigation grant programs).

Annex support meetings were held for Planning Partners to assist in the development of additional actions, foster collaboration between neighboring jurisdictions for mitigation actions, discuss actions that involve cooperation between the County and jurisdictions, and identify steps needed to complete the jurisdictional annexes.



Addressing Known Vulnerabilities

To help support the selection of an appropriate risk-based mitigation strategy, each annex includes a summary of hazard vulnerabilities. These were identified during the plan update process by planning partner representatives, through review of available plans and reports, or through the hazard profiling and risk assessment process.

A mitigation strategy workshop was conducted on November 2024, for all participating jurisdictions to support the development of focused problem statements based on the impacts of natural hazards in the County and their communities. These problem statements provide a detailed description of a problem area, including its impacts on the jurisdiction; past damage; loss of service; etc. An effort was made to include the street address of the problem location, adjacent streets, water bodies, and well-known structures as well as a brief description of existing conditions (topography, terrain, hydrology) of the site. These problem statements form a bridge between the hazard risk assessment, which quantifies impacts on each community, and the development of actionable mitigation strategies.

Incorporating a Range of Action Types

Concerted efforts were made to ensure that Planning Partners develop updated mitigation strategies that cover the range of mitigation action types described in recent FEMA planning guidance (FEMA “Local Mitigation Planning Handbook” March 2013):

- **Local Plans and Regulations**—These actions include government authorities, policies or codes that influence the way land and buildings are developed and built.
- **Structure and Infrastructure Project**—These actions involve modifying existing structures and infrastructure to protect them from a hazard or remove them from a hazard area. This could apply to public or private structures as well as community lifelines and other critical facilities. This type of action also involves projects to construct structures to reduce the impact of hazards.
- **Natural Systems Protection**—These are actions that minimize damage and losses to natural systems and preserve or restore their functions.
- **Education and Awareness Programs**—These are actions to inform and educate citizens, elected officials, and property owners about hazards and potential ways to mitigate them. These actions may also include participation in national programs, such as the National Flood Insurance Program, Community Rating System, StormReady (NOAA), and Firewise (NFPA) Communities.

Efforts were also made to develop mitigation strategies that cover the range of mitigation action types described in recent CRS guidance (FEMA 2018):

- **Preventative Measures**—Government, administrative or regulatory actions, or processes that influence the way land and buildings are developed and built. Examples include planning and zoning, floodplain local laws, capital improvement programs, open space preservation, and storm water management regulations.
- **Property Protection**—These actions include public activities to reduce hazard losses or actions that involve (1) modification of existing buildings or structures to protect them from a hazard or (2) removal of the structures from the hazard area. Examples include acquisition, elevation, relocation, structural retrofits, storm shutters, and shatter-resistant glass.



- **Public Information**—Actions to inform and educate citizens, elected officials, and property owners about hazards and potential ways to mitigate them. Such actions include outreach projects, real estate disclosure, hazard information centers, and educational programs for school-age children and adults.
- **Natural Resource Protection**—Actions that minimize hazard loss and also preserve or restore the functions of natural systems. These actions include sediment and erosion control, stream corridor restoration, watershed management, forest and vegetation management, and wetland restoration and preservation.
- **Structural Flood Control Projects**—Actions that involve the construction of structures to reduce the impact of a hazard. Such structures include dams, setback levees, floodwalls, retaining walls, and safe rooms.
- **Emergency Services**—Actions that protect people and property during and immediately following a disaster or hazard event. Services include warning systems, emergency response services, and the protection of essential facilities

Protecting Critical Facilities

Planning partner mitigation actions that address vulnerable critical facilities have been proposed in consideration of protection against 500-year events or worst-case scenarios. However, in the case of projects funded through federal mitigation programs, the level of protection may be influenced by cost-effectiveness as determined through a formal benefit-cost analysis. In the case of “self-funded” projects, local jurisdiction discretion must be recognized. Further, it must be recognized that the County and jurisdictions have limited authority with regard to mitigation at any level of protection over privately owned critical facilities.

Accounting for Climate Change

As discussed in Chapter 4 (Risk Assessment Methodology and Tools), the long-term effects of climate change are anticipated to exacerbate the impacts of hazards such as flood, severe storm, severe winter storm, and wildfire. Communities are working to evaluate and recognize these long-term implications and to incorporate their mitigation strategies into planning and capital improvement updates.

16.3.2 Update of County Mitigation Strategy

The update of the County-level mitigation strategies included a review of progress on the actions/initiatives identified in the 2020 HMP using a process similar to that used to review local jurisdiction mitigation strategy progress. The County, through their various department representatives, was provided with a Mitigation Action Plan Review Worksheet identifying all County-level actions and initiatives from the 2020 plan. The County reviewed each action and provided progress. For each action, relevant County representatives were asked to indicate the status of each action (*No Progress/Unknown, In Progress/Not Yet Complete, Ongoing, Completed, or Discontinued*), and provide review comments on each.

Projects/initiatives identified as “*Complete*”, as well as those actions identified as *Discontinued*, have been removed from this plan update. Those actions the County has identified as *No Progress/Unknown, In Progress/Not Yet Complete, or Ongoing* have been carried forward in the County’s updated mitigation strategy. Actions considered ongoing capabilities were marked as *Discontinued* and included in the plan as ongoing capabilities.



Throughout the course of the plan update process, additional regional and County-level mitigation actions were identified by the following processes:

- Review of the results and findings of the updated risk assessment
- Review of available regional and County plans, reports, and studies
- Direct input from County departments and other regional agencies, including:
 - Hudson County Office of Emergency Management
 - Hudson County Regional Health Commission
 - Hudson County Improvement Authority
 - Hudson County Administrator's Office
 - Hudson County Prosecutor's Office
 - Hudson County Division of Engineering
- Input received through the public and stakeholder outreach process

As discussed within the hazard profiles in this HMP, the long-term effects of climate change are anticipated to exacerbate the impacts of weather-related hazards including drought, flood, severe storm, and severe winter storm. The County has included mitigation actions, including continuing and long-term planning and emergency management support, to address these long-term implications and potential impacts.

Various County departments and agencies included mitigation actions to address vulnerable critical facilities. These actions were proposed in consideration of protection against 0.2-percent annual chance (500-year) events, or worst-case scenarios. It is recognized, however, that in the case of projects being funded through federal mitigation programs, the level of protection can be influenced by cost-effectiveness, as determined through a formal benefit-cost analysis. In the case of "self-funded" projects, local government authority can affect the ability to implement. Further, the County has limited authority over privately-owned critical facility owners regarding mitigation at any level of protection.

16.3.3 Mitigation Best Practices

Catalogs of hazard mitigation best practices were developed that present a broad range of alternatives to be considered for use in the mitigation strategies, in compliance with 44 CFR Section 201.6(c)(3)(ii). One catalog was developed for each hazard of concern evaluated in this plan. The catalogs present alternatives that are categorized based on the following considerations:

- Who would have responsibility for implementation:
 - Individuals—personal scale
 - Businesses—corporate scale
 - Government—government scale
- What the alternatives would do:
 - Manipulate the hazard
 - Reduce vulnerability to the hazard
 - Reduce impacts from the hazard



- Build local capacity to respond to or be prepared for the hazard

The alternatives presented include actions that will mitigate current risk from hazards and actions that will help reduce risk from changes in the impacts of these hazards resulting from climate change. Hazard mitigation actions recommended in this plan were selected from among the alternatives presented in the catalogs. The catalogs provide a baseline of mitigation alternatives that are backed by a planning process, are consistent with the established goals and objectives, and are within the capabilities of the Planning Partners to implement. Some of these actions may not be feasible based on the selection criteria identified for this plan. The purpose of the catalogs was to provide a list of what could be considered to reduce risk from natural hazards within the planning area. Actions in the catalog that are not included for the partnership's mitigation strategy were not selected for one or more of the following reasons:

- The action is not feasible
- The action is already being implemented
- There is an apparently more cost-effective alternative
- The action does not have public or political support.

The catalogs are included in **Appendix X**.

16.3.4 Mitigation Strategy Evaluation and Prioritization

Section 201.c.3.iii of 44 CFR establishes how mitigation strategies are to be prioritized, implemented, and administered by local jurisdictions. For this plan update, each mitigation strategy was prioritized using criteria suitable for evaluating hazard mitigation strategies. This method provided a systematic approach that considered the opportunities and constraints of implementing each mitigation action. The Steering Committee chose a set of 14 evaluation criteria for this process:

- Life Safety—How effective will the action be at protecting lives and preventing injuries? Will the proposed action adversely affect one segment of the population?
- Property Protection—How significant will the action be at eliminating or reducing damage to structures and infrastructure? For example: development in the floodplain or high-risk areas?
- Cost-Effectiveness—Are the costs to implement the action commensurate with the benefits achieved?
- Political—Is there overall public support for the action? Is there the political will to support it? Is the action at odds with development pressures?
- Legal—Does the jurisdiction have the authority to implement the action?
- Fiscal—Can the action be funded under existing program budgets (i.e., is this action currently budgeted for)? Or would it require a new budget authorization or funding from another source such as grants?
- Environmental—What are the potential environmental impacts of the action? Will it comply with environmental regulations? Are there co-benefits of this action?
- Social Vulnerability—Does the action benefit socially vulnerable populations and underserved communities? Additional considerations can include appropriate numerical measures of social vulnerability.



- Administrative—Does the jurisdiction have the personnel and administrative capabilities to implement the action and maintain it or will outside help be necessary? Does the scale and scope of the action align with the jurisdiction’s capabilities?
- Hazards of Concern—Does the action address one or more of the jurisdiction’s high-ranked hazards?
- Climate Change—Does the action incorporate climate change projections? Is the action designed to withstand/address long-term conditions?
- Timeline—Can the action be completed in less than five years?
- Community Lifelines—Does this action benefit community lifelines?
- Other Local Objectives—Does the action advance other local objectives, such as capital improvements, economic development, environmental quality, or open space preservation? Does it support the policies of other plans and programs?

Participating jurisdictions were asked to use these criteria to prioritize their identified mitigation actions. For each mitigation action, the jurisdictions assigned a numeric score for each of the 14 evaluation criteria:

- 1 = Highly effective or feasible
- 0 = Neutral
- -1 = Ineffective or not feasible

Jurisdictions were asked to provide a brief summary of the rationale behind the numeric rankings assigned. The numerical results were totaled and then used by each jurisdiction to help prioritize the action or strategy as *low*, *medium*, or *high*. Actions that had a numerical value between 0 and 6 were categorized as *low priority*; actions with numerical values between 7 and 10 were categorized as *medium priority*; and actions with numerical values between 11 and 14 were categorized as *high priority*. While this provided a consistent, systematic methodology to support the evaluation and prioritization of mitigation actions, jurisdictions may have additional considerations that could influence their overall prioritization of mitigation actions.

It is noted that jurisdictions may be carrying forward mitigation actions from prior mitigation strategies that were prioritized using a different, but not inherently contrary, approach. Mitigation actions in the 2020 Hudson County HMP were “qualitatively evaluated against the mitigation goals and objectives and other evaluation criteria. They were then prioritized into three categories: high, medium, and low.” At their discretion, jurisdictions carrying forward prior actions were encouraged to re-evaluate their priority, particularly if conditions that would affect the prioritization criteria had changed.

For the plan update there has been an effort to develop more clearly defined and action-oriented mitigation strategies. These local strategies include actions that are seen by the community as the most effective approaches to advance their local mitigation goals and objectives within their capabilities. In addition, each planning partner was asked to develop problem statements. With active support from NJOEM planning staff, the partners were able to develop action-oriented and achievable mitigation strategies. For that reason, many of the actions in the updated mitigation strategy were ranked as *high* or *medium* priority, as reflective of the community’s clear intent to implement them, available resources notwithstanding. In general, actions that would have had *low* priority rankings were appropriately screened out during the local action evaluation process.



16.3.5 Benefit/Cost Review

Section 201.6.c.3iii of 44 CFR requires the prioritization of the mitigation strategy to emphasize the extent to which benefits are maximized according to a benefit/cost review of the proposed projects. For all actions identified in the local strategies, jurisdictions identified the associated costs and benefits as follows:

- **Costs** presented include the total project estimation. This can include administrative, construction (engineering, design, and permitting), and maintenance costs.
- **Benefits** are the savings from losses avoided attributed to project implementation. These can include life safety, structure and infrastructure damages, loss of service or function, and economic and environmental damage and losses.

When possible, jurisdictions were asked to identify the actual or estimated dollar costs and associated benefits. Where estimates of costs and benefits were available, the ratings were defined follows:

Low <= \$10,000

Medium = \$10,000 to \$100,000

High >= \$100,000

Often numerical costs and/or benefits were not identified and may be impossible to quantify. In this case, jurisdictions were asked to evaluate project cost-effectiveness using qualitative *high*, *medium*, and *low* ratings based on the definitions in Table 16-1.

Table 16-1 Qualitative Cost and Benefit Ratings

Costs	
High	Existing funding levels are not adequate to cover the costs of the proposed project, and implementation would require an increase in revenue through an alternative source (e.g., bonds, grants, and fee increases).
Medium	The project could be implemented with existing funding but would require a re-apportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.
Low	The project could be funded under the existing budget. The project is part of or can be part of an existing, ongoing program.
Benefits	
High	Project will have an immediate impact on the reduction of risk exposure to life and property.
Medium	Project will have a long-term impact on the reduction of risk exposure to life and property or will provide an immediate reduction in the risk exposure to property.
Low	Long-term benefits of the project are difficult to quantify in the short-term.

Using this approach, projects with positive benefit versus cost ratios (such as high over high, high over medium, medium over low, etc.) are considered cost-effective.

For some of the Hudson County actions identified, the Planning Partnership may seek financial assistance under FEMA's Hazard Mitigation Assistance (HMA) programs. These programs require detailed benefit/cost analysis as part of the application process. The benefit/cost review applied for the prioritization of actions in this update did not include the level of detail required by FEMA for project grant eligibility under HMA grant programs. These analyses will be performed when funding applications are prepared, using FEMA's Benefit-Cost Analysis model.



The Planning Partnership is committed to implementing mitigation strategies with benefits that exceed costs. For projects not seeking financial assistance from grant programs that require this sort of analysis, the Planning Partnership reserves the right to define benefits according to parameters that meet its needs and the goals and objectives of this plan.



17. PLAN MAINTENANCE AND IMPLEMENTATION PROCEDURES

This chapter details the formal process that will ensure that the Hazard Mitigation Plan remains an active and relevant document and that the Planning Partnership maintains its eligibility for applicable funding sources. The plan maintenance process includes a schedule for monitoring and evaluating the plan annually and producing an updated plan every five years. In addition, this chapter describes how public participation will be integrated throughout the plan maintenance and implementation process. It explains how the mitigation strategies outlined in this plan update will be incorporated into existing planning mechanisms and programs, such as comprehensive land use planning processes, capital improvement planning, and building code enforcement and implementation.

17.1 HMP Coordinator and Jurisdiction Points of Contact

The HMP Coordinator is assigned to manage the maintenance and update of the plan during its approval period (the five-year period between FEMA's approval of the plan and its expiration), with the following responsibilities:

- Convene the Planning Partnership
- Be the prime point of contact for questions regarding the plan and its implementation
- Coordinate the incorporation of additional information into the plan.
- Manage the monitoring, evaluation, and updating responsibilities identified in this section.

Currently, the Hudson County HMP Coordinator is designated as:

James Woods, Emergency Management Coordinator
Hudson County Department of Public Safety
110 S. Hackensack Avenue
Kearny, NJ 07032
(201) 369-5200
Email: jwoods@hcnj.us

As of the date of this plan, primary and secondary mitigation planning representatives (points of contact) are identified in each jurisdictional annex in Volume II. It will be the responsibility of each jurisdiction and its representatives to inform the HMP Coordinator of any changes in representation.

17.2 Maintenance and Implementation Tasks

The procedures for monitoring, evaluating, and updating the plan are provided below. The plan maintenance matrix shown in Table 17-1 provides a synopsis of responsibilities for plan monitoring, integration, evaluation, and update, which are discussed in further detail in the sections below.



**Table 17-1. Plan Maintenance Matrix**

Task	Approach	Timeline	Lead Responsibility	Support Responsibility
Monitoring	Planning partners to recommend update of mitigation strategies, progress toward implementation of actions, identification of new actions, and update of information on funding opportunities.	Each June or after the occurrence of a presidentially declared disaster	Jurisdictional points of contact identified in Volume II	Jurisdictional implementation lead identified in Volume II
Integrating	Distribute the safe growth worksheet (see Table 17-2) for annual review and update by all participating jurisdictions.	June each year with interim email reminders to address integration in county and municipal activities	HMP Coordinator and jurisdictional points of contact identified in Volume II	HMP Coordinator
Evaluating	Review the status of previous actions, as submitted by the monitoring task lead, and assess the effectiveness of the plan; compile and finalize update of mitigation strategy.	Updated progress report completed by September 30 of each year	Jurisdictional points of contact identified in Volume II	Alternate jurisdictional points of contact
Updating	Reconvene the Planning Partners to guide a comprehensive update to review and revise the plan.	Every 5 years or upon major update to Comprehensive Plan or after the occurrence of a major disaster	HMP Coordinator	Jurisdictional points of contacts identified in Volume II
Grant Monitoring	Notify Planning Partners about impending grant opportunities and priorities for the fiscal year to assist the Planning Partners in the selection of appropriate projects.	Continuously through the performance period	HMP Coordinator	Jurisdictional points of contacts identified in Volume II
Public Involvement	Use the internet and social media to distribute information about the HMP, make Planning Partnership meetings open to the public, accept and track public comments on the HMP and its progress and incorporate them as appropriate	Continuously through the performance period	HMP Coordinator	Jurisdictional points of contact identified in Volume II

17.2.1 Monitoring

The Planning Partnership will be responsible for monitoring and documenting annual progress on the plan. Each year, beginning one year after plan development, Hudson County and local Planning Partnership representatives will collect and process information from the persons responsible for initiating or overseeing the mitigation projects in each department, agency, and organization involved in implementing mitigation actions identified in their jurisdictional annexes. In the first year of the approval period, this will be accomplished using an online performance progress reporting system (the BAToolSM), which will enable each planning partner to:

- Directly access mitigation actions
- Easily update the status of each project
- Document successes or obstacles to implementation
- Add or delete projects to maintain mitigation strategy implementation

Participating partners will be prompted by the tool to update progress on a quarterly basis, providing an incentive for them to refresh their mitigation strategies and to continue implementation of actions. This reporting system facilitates



the sorting and prioritization of projects and will support the submittal of an increased number of project grant fund applications. Planning Partnership representatives will be expected to document the following:

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

Plan monitoring for years 2 through 4 of the approval period will be addressed via the BAToolSM or manually.

17.2.2 Integrating the HMP into Municipal Planning Mechanisms

Hazard mitigation is sustained action taken to reduce or eliminate the long-term risk to human life and property from natural hazards. Integrating hazard mitigation into a community's existing plans, policies, codes, and programs leads to development patterns or redevelopment that reduce risk from known hazards. The Planning Partnership was tasked with identifying how hazard mitigation is integrated into existing planning mechanisms. The jurisdictional annexes in Volume II describe how this is done for each planning partner. During this process, many partners recognized the importance and benefits of incorporating hazard mitigation into future local planning and regulatory processes.

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

The Capability Assessment (Chapter 15) provides a summary and description of the existing plans, programs, and regulatory mechanisms at all levels of government (federal, state, county, and local) that support hazard mitigation within the County. In the jurisdictional annexes in Volume II, each planning partner identified how it has integrated hazard risk management into its existing planning, regulatory, and administrative framework ("existing integration") and how they intend to promote this integration further ("opportunities for future integration").

It is the intention of Planning Partnership representatives to incorporate mitigation planning as an integral component of daily government operations. Planning Partnership representatives will work with local government officials to integrate the newly adopted hazard mitigation goals and actions into the general operations of government and partner organizations. The sample adoption resolution (Appendix A – Adoption Resolution) includes a resolution item stating the intent of the local governing body to incorporate mitigation planning as an integral component of government and partner operations. By doing so, the Planning Partnership anticipates that:

- Hazard mitigation planning will be formally recognized as an integral part of overall emergency management efforts.
- The HMP, comprehensive plans, emergency management plans and other relevant planning mechanisms will become mutually supportive documents that work in concert to meet the goals and needs of county residents.



Other planning processes and programs to be coordinated with the recommendations of the HMP include the following:

- Emergency response plans
- Training and exercise of emergency response plans
- Debris management plans
- Recovery plans
- Capital improvement programs
- Municipal codes
- Community design guidelines
- Water-efficient landscape design guidelines
- Stormwater management programs
- Water system vulnerability assessments
- Community wildfire protection plans
- Comprehensive flood hazard management plans
- Resiliency plans
- Community Development Block Grant Disaster Recovery action plans
- Public information and improved public participation
- Educational programs
- Continued interagency coordination

During the HMP annual review process, each participating jurisdiction will be asked to document how they are utilizing and incorporating the HMP into their day-to-day operations and planning and regulatory processes. Each municipality will also identify additional policies, programs, practices, and procedures that could be modified to accommodate hazard mitigation actions and include these findings and recommendations in the annual HMP progress report. The checklist presents in Table 17-2, adapted from FEMA's 2013 Local Mitigation Handbook, will help a community analyze how hazard mitigation is integrated into local plans, ordinances, regulations, and policies. Completing the checklist will help jurisdictions identify areas that currently integrate hazard mitigation and where to make improvements and reduce vulnerability to future development.



Table 17-2. Safe Growth Check List

Planning Mechanisms	Yes	No	How is it being done or how will this be utilized in the future?
Operating, Municipal, and Capital Improvement Program Budgets			
When constructing upcoming budgets, are hazard mitigation actions funded as budget allows?			
Are construction projects evaluated to see if they meet the hazard mitigation goals?			
Does the municipality review mitigation actions when allocating funding during annual budget adoption processes?			
Do budgets limit expenditures on projects that would encourage development in areas vulnerable to natural hazards?			
Do infrastructure policies limit extension of existing facilities and services that would encourage development in areas vulnerable to natural hazards?			
Do budgets provide funding for hazard mitigation projects identified in the HMP?			
Human Resource Manual			
Do any job descriptions specifically include identifying and/or implementing mitigation projects/actions or other efforts to reduce natural hazard risk?			
Building and Zoning Ordinances			
Prior to zoning changes or development permitting, does the municipality review the HMP and other hazard analyses to ensure consistent and compatible land use?			
Does the zoning ordinance discourage development or redevelopment within natural areas, including wetlands, floodways, and floodplains?			
Does the zoning ordinance contain natural overlay zones that set conditions			
Does the zoning ordinance require developers to take additional actions to mitigate natural hazard risk?			
Do rezoning procedures recognize natural hazard areas as limits on zoning changes that allow greater intensity or density of use?			
Does the zoning ordinance prohibit development within or filling of wetlands, floodways, and floodplains?			
Subdivision Regulations			
Do the subdivision regulations restrict the subdivision of land within or adjacent to natural hazard areas?			
Do the regulations provide for conservation subdivisions or cluster subdivisions in order to conserve environmental resources?			
Do the regulations allow density transfers where hazard areas exist?			





Planning Mechanisms	Yes	No	How is it being done or how will this be utilized in the future?
Comprehensive Plan			
Are the goals and policies of the plan related to those of the HMP?			
Does the future land use map clearly identify natural hazard areas?			
Does the plan provide adequate space for expected future growth in areas located outside natural hazard areas?			
Land Use			
Does the future land use map clearly identify natural hazard areas?			
Do the land use policies discourage development or redevelopment in natural hazard areas?			
Transportation Plan			
Does the transportation plan limit access to hazard areas?			
Is transportation policy used to guide growth to safe locations?			
Are transportation systems designed to function under disaster conditions (e.g., evacuation)?			
Environmental Management			
Are environmental systems that protect development from hazards identified and mapped?			
Do environmental policies maintain and restore protective ecosystems?			
Do environmental policies provide incentives to development located outside protective ecosystems?			
Grant Applications			
Are data and maps used as supporting documentation in grant applications?			
Municipal Ordinances			
Is hazard mitigation a priority when updating municipal ordinances?			
Economic Development			
Does the local economic development group take into account information regarding identified hazard areas when assisting new businesses in finding a location?			
Public Education and Outreach			
Does the municipality have any public outreach mechanisms/ programs in place to inform citizens on natural hazards, risk, and ways to protect themselves during such events?			

17.2.3 Evaluating

Evaluation of the mitigation plan is an assessment of whether the planning process and actions have been effective, whether the HMP goals are being achieved, and whether changes are needed. The HMP Coordinator will consult with the Planning Partnership members to evaluate the effectiveness of the plan implementation and to reflect changes that could affect mitigation priorities or available funding.



The status of the HMP will be discussed and documented at an annual plan review meeting of the Planning Partnership to be held either in person or via teleconference approximately one year from the date of local adoption of this update and successively thereafter. The HMP Coordinator will be responsible for calling participants, coordinating the annual plan review meeting, and soliciting input regarding progress toward meeting plan goals and objectives. At least two weeks before the annual plan review meeting, the HMP Coordinator will advise Planning Partnership members of the meeting date, agenda, and expectations of the members. These evaluations will assess whether:

- Goals and objectives address current and expected conditions
- The nature or magnitude of the risks has changed
- Current resources are appropriate for implementing the HMP and if different or additional resources are now available
- Actions were cost effective
- Schedules and budgets are feasible
- Implementation problems are present, such as technical, political, legal, or coordination issues with other agencies
- Outcomes have occurred as expected
- Changes in local resources impacted plan implementation (e.g., funding, personnel, and equipment)
- New agencies, departments, and staff are included, involving other local governments as defined under 44 CFR 201.6.

Specifically, the Planning Partnership will review the mitigation goals, objectives, and activities using performance-based indicators, including:

- New agencies/departments
- Project completion
- Underspensing/overspending
- Achievement of the goals and objectives
- Resource allocation
- Timeframes
- Budgets
- Lead/support agency commitment
- Resources
- Feasibility

Finally, the Planning Partnership will evaluate how other programs and policies have conflicted with or augmented planned or implemented mitigation actions and will identify policies, programs, practices, and procedures that could be modified to accommodate hazard mitigation actions ("Implementation of Mitigation Plan through Existing Programs" subsection below discusses this process). Other programs and policies can include those that address:

- Economic development
- Environmental preservation



- Historic preservation
- Redevelopment
- Health and safety
- Recreation
- Land use and zoning
- Public education and outreach
- Transportation

The Planning Partnership should refer to evaluation forms in the FEMA 386-4 guidance document to assist in the evaluation process (Worksheets #2 and #4; see Appendix X – Plan Review Tools). Further, the Planning Partnership should refer to any process and plan review deliverables developed by the County or participating jurisdictions as a part of the plan review processes established for prior or existing local HMPs within the county.

The HMP Coordinator will be responsible for preparing an annual HMP progress report for each year of the approval period based on the information provided by the Planning Partners and other information as appropriate. These annual reports will provide data for the five-year update of this HMP and will assist in pinpointing any implementation challenges. By monitoring the implementation of the HMP, the Planning Partnership will be able to assess which actions are completed, which are no longer feasible, and which require additional funding.

Following any major disasters, the HMP will be evaluated and revised to determine if the recommended actions remain relevant and appropriate. The risk assessment will also be revisited to see if any changes are necessary based on the pattern of disaster damage or if data listed in the hazard profiles of this plan has been collected to facilitate the risk assessment. This is an opportunity to increase the community's disaster resistance and build a better and stronger community.

17.2.4 Updating

44 CFR 201.6.d.3 requires that local hazard mitigation plans be reviewed, revised as appropriate, and resubmitted for approval to remain eligible for benefits awarded under DMA 2000. It is the intent of the Hudson County HMP Planning Partnership to update this plan on a five-year cycle from the date of initial plan adoption.

To facilitate the update process, the HMP Coordinator, with support of the Planning Partnership, will use the second annual Planning Partnership meeting to develop and commence the implementation of a detailed plan update program. Prior to the five-year update, the HMP Coordinator will invite representatives from the New Jersey Office of Emergency Management to provide guidance on plan update procedures. At a minimum, this will establish who will be responsible for managing and completing the plan update effort, items that need to be included in the updated plan, and a detailed timeline with milestones to ensure that the update is completed according to regulatory requirements. At this meeting, the project team will determine what resources will be needed to complete the update and seek to secure these resources.

Following each 5-year update of the HMP, the updated plan will be distributed for public comment. After all comments are addressed, the HMP will be revised and distributed to all Planning Partners.



17.2.5 Grant Monitoring and Coordination

Hudson County intends to be a resource to the Planning Partnership in the support of project grant writing and development. The degree of this support will depend on the level of assistance requested by the Planning Partners during openings for grant applications. As part of grant monitoring and coordination, Hudson County intends to provide the following:

- Notification to Planning Partners about impending grant opportunities
- A current list of eligible, jurisdiction-specific projects for funding pursuit consideration
- Notification about mitigation priorities for the fiscal year to assist the Planning Partners in the selection of appropriate projects.

17.2.6 Continued Public Involvement

The Planning Partners are committed to the continued involvement of the public in the hazard mitigation process. This HMP update will continue to be posted online at the following link: <https://hudsoncountynjhmp.com/>. In addition, public outreach and dissemination of the HMP will include the following:

- Links to the plan on local websites of each jurisdiction with capability
- Continued utilization of existing social media outlets (Facebook, Twitter) to inform the public of natural hazard events, such as floods and severe storms; the public can be educated via the jurisdictional websites on how these applications can be used in an emergency situation
- Promotion of articles or workshops on hazards to educate the public and keep them aware of the dangers of hazards

The HMP Coordinator will be responsible for receiving, tracking, and filing public comments regarding this HMP. The public will have an opportunity to comment on the plan via the hazard mitigation website at any time. The HMP Coordinator will ensure that:

- Public and stakeholder comments and input on the plan, and hazard mitigation in general, are collected, recorded, and addressed as appropriate.
- The Hudson County HMP website is maintained and updated as appropriate.
- Copies of the latest approved plan are available for review at appropriate county facilities, along with instructions to facilitate public input and comment on the plan.
- Public notices, including media releases, are made (as appropriate) to inform the public of the availability of the plan, particularly during plan update cycles.



ACRONYMS

Acronym	Definition
ACS	American Community Survey
ADRC	Aging and Disability Resource Connection
ALICE	Asset Limited, Income Constrained, Employed
B	Borough
BFE	Base Flood Elevation
BMP	Best Management Practices
BPU	Board of Public Utilities
C	City
CAC	Community Assistance Contacts
CAFRA	Coastal Area Facility Review Act
CAV	Community Assistance Visit
CDBG	Community Development Block Grant
CDMS	Comprehensive Data Management System
CDRZ	Community Disaster Resilience Zone
CEDS	Comprehensive Economic Development Strategy
CEHA	Coastal Erosion Hazard Area
CERCLIS	Comprehensive Economic Response, Compensation, and Liability Information System
CFR	Code of Federal Regulations
CIP	Capital Improvement Plan
CoC	Continuum of Care
COG	Continuity of Government
COOP	Continuity of Operations Plan
CRS	Community Rating System
CTP	Cooperating Technical Partnership
DCA	Department of Community Affairs
DEM	Digital Elevation Model
DFE	Design Flood Elevation
DFIRM	Digital Flood Insurance Rate Map
DMA	Disaster Mitigation Assistance
DR	Major Disaster Declarations
EAP	Emergency Action Plan
EDA	Economic Development Administration
EF	Enhanced Fujita
EM	Emergency Declaration
EMPG	Emergency Management Program Grant
EMPG	Emergency Management Performance Grant



Acronym	Definition
EOC	Emergency Operations Center
EPA	Environmental Protection Agency
ESF	Emergency Support Function
EWP	Emergency Watershed Protection
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulation Commission
FHWA	Federal Highway Administration
FIMA	Federal Insurance and Mitigation Administration
FIRM	Flood Insurance Rate Map
FMA	Flood Mitigation Assistance
FTA	Federal Transit Administration
GDRO	Governor's Disaster Recovery Office
GIS	Geographic Information System
GPS	Global Positioning System
HATS	Harbor and Tributaries Focus Area Feasibility Study
HCOBO	Hudson County Office of Business Opportunity
HHPD	High Hazard Potential Dam
HIFLD	Homeland Infrastructure Foundation-Level Data
HMGP	Hazard Mitigation Grant Program
HMP	Hazard Mitigation Plan
HOME	Home Investment Partnership
HSGP	Homeland Security Grant Program
HUD	Housing and Urban Development
HVAC	Heating, Ventilation, and Air Conditioning
IA	Individual Assistance
InSAR	Interferometric Synthetic Aperture Radar
IPCC	Intergovernmental Panel on Climate Change
JACC	Jersey Assistance for Community Caregiving
LEPC	Local Emergency Planning Committee
LOIP	Letter of Intent to Participate
LWCF	Land and Water Conservation Fund
MAI	Minority AIDS Initiative
MAP	Mapping, Assessment, and Planning
MLUL	Municipal Land Use Law
MMI	Modified-Mercalli Intensity
MPH	Miles Per Hour
MRP	Mean Return Period
MS4	Municipal Separate Storm Sewer



Acronym	Definition
MSA	Metropolitan Statistical Area
MSWMP	Municipal Stormwater Management Plan
NASA	National Aeronautics and Space Administration
NCDC	National Climatic Data Center
NCEI	National Center for Environmental Information
NCHH	National Center for Healthy Housing
NDMC	National Drought Mitigation Center
NEHRP	National Earthquake Hazard Reduction Program
NFIP	National Flood Insurance Program
NFPA	National Fire Protection Association
NGO	Non-Governmental Organizations
NHC	National Hurricane Center
NIHHIS	National Integrated Heat Health Information System
NJ	New Jersey
NJAC	New Jersey Administrative Code
NJADAPT	New Jersey Climate Adaptation Alliance
NJCEP	New Jersey Clean Energy Program
NJDCA	New Jersey Department of Community Affairs
NJDEP	New Jersey Department of Environmental Protection
NJDOT	New Jersey Department of Transportation
NJFFS	New Jersey Forest Fire Service
NJGS	New Jersey Geological Survey
NJHC	New Jersey
NJOEM	New Jersey Office of Emergency Management
NJPDES	New Jersey Pollutant Discharge Elimination System
NJSA	New Jersey Statutes Annotated
NJSA	New Jersey Soil Erosion and Sediment Control Act
NJSEA	New Jersey Sports and Exposition Authority
NJTPA	North Jersey Transportation Planning Authority
NOAA	National Oceanic and Atmospheric Administration
NPS	National Park Service
NRCS	Natural Resources Conservation Service
NSIDC	National Snow and Ice Data Center
NSSL	National Severe Storm Laboratory
NWS	National Weather Service
ODI	Office of Digital Information
OMB	Office of Management and Budget
OSHA	Occupational Safety and Health Administration



Acronym	Definition
PA	Public Assistance
PATH	Port Authority Trans-Hudson
PDM	Pre Disaster Mitigation
PGA	Peak Ground Acceleration
PVSC	Passaic Valley Sewerage Commission
RAISE	Rebuilding American Infrastructure with Sustainability and Equity
RCV	Replacement Cost Value
RL	Repetitive Loss
RSI	Regional Snowfall Index
RTP	Recreational Trails Program
SERC	State Emergency Response Commission
SFHA	Special Flood Hazard Area
SHIP	State Health Insurance Program
SHMT	State Hazard Mitigation Team
SLOSH	Sea Level Overland Surge from Hurricane
SPC	Storm Prediction Center
SRL	Severe Repetitive Loss
T	Township
TAP	Transportation Alternatives Set Aside Program
THIRA	Threat Hazard Identification and Risk Assessment
UCC	Uniform Construction Code
UHI	Urban Heat Island
UNDRR	United Nations
US	United States
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USEDA	United States Economic Development Administration
USEPA	United States Environmental Protection Agency
USFS	United States Forest Service
USGS	United States Geological Survey
WFO	Weather Forecast Office
WHP	Wildfire Hazard Potential



EXECUTIVE SUMMARY

Hazard Mitigation Overview

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

Hudson County has developed a hazard mitigation plan (HMP) to reduce risks from disasters to the people, property, economy, and environment within the County's planning area. The County and 17 participating local jurisdictions (the Planning Partners) prepared this plan as an update to the 2020 Hudson County HMP. The updated 2025 HMP (also referred to as "the plan") includes countywide analysis and assessment of hazards, risk, and capabilities.

The plan complies with federal and state hazard mitigation planning requirements to establish the Planning Partners' eligibility for funding under Federal Emergency Management Agency (FEMA) grant programs. FEMA has issued guidelines for the development of multi-jurisdictional hazard mitigation plans. The federal Disaster Mitigation Act of 2000 requires state and local entities to implement pre-disaster mitigation planning and develop HMPs. The New Jersey Office of Emergency Management (NJOEM) supports plan development for jurisdictions in New Jersey.

The Planning Process

This HMP update documents the process and outcomes of the Planning Partners' mitigation planning efforts. To support the planning process, the Planning Partners accomplished the following:

- Developed a Steering Committee consisting of key stakeholders and a countywide Planning Partnership made up of the Steering Committee members, the Planning Partners, and other regional stakeholders
- Reviewed the 2020 Hudson County Hazard Mitigation Plan
- Identified hazards of concern to the County to be included in the update
- Profiled the hazards of concern
- Estimated the inventory at risk and potential losses associated with these hazards
- Reviewed and updated the mitigation goals and objectives
- Reviewed mitigation strategy and actions outlined in the 2020 HMP to indicate progress
- Developed new mitigation actions to reduce the vulnerability of assets from hazards of concern
- Involved a wide range of stakeholders and the public in the plan update process
- Developed mitigation plan maintenance procedures to be executed after obtaining approval of the plan from NJOEM and FEMA





- Hudson County Office of Emergency Management
- Hudson County Department of Planning & Business Opportunity
- Hudson County Planning Board
- Hudson County Department of Roads and Public Property
- Hudson County Improvement Authority
- Hudson County Office of the County Administrator
- Hudson County Office of Digital Information
- Hudson Regional Health Commission
- Hudson County Prosecutor's Office
- Town of Kearny
- New Jersey Office of Emergency Management
- Township of North Bergen
- Rutgers University

Risk Assessment for Local Hazards of Concern

The Planning Partners evaluated each jurisdiction's risk and vulnerability due to each of the hazards of concern, based on past events, past and predicted future losses, and the expected probability of future occurrence. From these evaluations, hazards were ranked as high, medium, or low risk to each jurisdiction. The hazard rankings were used to focus and prioritize individual jurisdictional mitigation strategies. Summary overall hazard rankings for all of Hudson County are presented in Table ES-1.

Table ES-1. Countywide Ranking for Hudson County Hazards of Concern

Hazard of Concern	Hazard Ranking
Dam and Levee Failure	Medium
Drought	Medium
Extreme Temperature	Medium
Flood	High
Geological Hazards	Low
Severe Weather	High
Severe Winter Storm	Medium
Wildfire	Low

Capability Assessment and Plan Integration into Other Local Mechanisms

Effective mitigation is achieved when hazard awareness and risk management approaches and strategies become an integral part of public activities and decision-making. Within the County, there are many existing plans and programs



that support hazard risk management. It is critical that this HMP integrate, complement, and reference those plans and programs to the extent practical in order for it to be a comprehensive resource for hazard mitigation.

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

Mitigation Strategy

Hazard Mitigation Plan Goals and Objectives

It is a federal requirement for hazard mitigation plans to include a description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards of concern.

The Hudson County HMP planning process included a review and update of mitigation goals and objectives that were previously established to guide the selection of mitigation actions addressing all hazards of concern. Mitigation goals were updated based on the updated risk assessment, discussions, research, and input from plan participants and stakeholders. The goal development process considered the goals expressed in the New Jersey State Hazard Mitigation Plan, as well as other relevant county and local planning documents.

2025 Hudson County HMP Goals

Goal 1: Protect life.

Goal 2: Protect property.

Goal 3: Promote a sustainable economy.

Goal 4: Protect the environment.

Goal 5: Increase public awareness.

Goal 6: Support continuity of operations pre-, during, and post-hazard events.

Goal 7: Reduce the risk of natural hazards for socially vulnerable populations and underserved communities.

Goal 8: Address long-term vulnerabilities from High Hazard Dams.

Implementation of the 2020 Plan

The status of the mitigation projects identified in the 2020 HMP was reviewed for this HMP. Numerous projects and programs have been implemented that have reduced hazard vulnerability to assets in the planning area. Uncompleted projects have been reevaluated, modified as necessary, and incorporated into this plan. The Planning Partners' annexes describe these mitigation activities in more detail, and plan maintenance procedures have been developed to encourage thorough integration with local decisions and processes and regular review of implementation progress.



2025 Mitigation Strategy

Hudson County included a variety of actions within each jurisdiction's annex, including updates to local flood damage prevention ordinances to be congruent with state regulations, outreach to socially vulnerable populations, backup power for critical facilities, and flood mitigation along flood-prone roads. The 2025 Mitigation Strategy identifies how many total actions were developed by all participants.