BURLINGTON COUNTY

MULTI-JURISDICTIONAL ALL HAZARDS MITIGATION PLAN

2024 Update

Volume I

Prepared for:
Burlington County Department of Public Safety
1 Academy Drive, Westampton, NJ

September 2024

TETRA TECH

TABLE OF CONTENTS

VOLUME I

TETRA TECH

TETRA TECH

SECTION 1. INTRODUCTION

1.1 PURPOSE

Burlington County and its participating jurisdictions (the Planning Partnership) have prepared this Hazard Mitigation Plan (HMP) to better protect residents and property throughout the County from the effects of hazard events. This plan demonstrates the Planning Partnership's commitment to reducing risk from hazards, increasing resilience overall, and helping decision makers integrate mitigation into their day-to-day processes. This plan was also developed to position the Planning Partners for eligibility of pre- and post-disaster Federal Emergency Management Agency (FEMA) grants, including Hazard Mitigation Assistance (HMA) grant programs, which include the Hazard Mitigation Grant Program (HMGP), Building Resilient Infrastructure and Communities (BRIC), and Flood Mitigation Assistance (FMA). This plan also aligns with the planning elements of the National Flood Insurance Program's (NFIP's) Community Rating System (CRS) which provides for lower flood insurance premiums in CRS communities.

1.2 BACKGROUND

An HMP is a living document that communities use to reduce their vulnerability to hazards. It forms the foundation for a community's long-term strategy to reduce disaster losses and creates a framework for decision making to reduce damage to lives, property, and the economy from future disasters. Examples of mitigation projects include home acquisitions or elevations to remove structures from high-risk areas, upgrades to critical public facilities, and infrastructure improvements. Ultimately, these actions reduce vulnerability, and communities are able to recover more quickly from disasters. The Planning Partnership demonstrated its commitment to reducing disaster losses by developing its initial HMP in 2019.

> **Hazard Mitigation** is any sustained action taken to reduce or eliminate the long-term risk and effects that can result from specific hazards.
>
> FEMA defines a **Hazard Mitigation Plan** as the documentation of a state or local government evaluation of natural hazards and the strategies to mitigate such hazards.

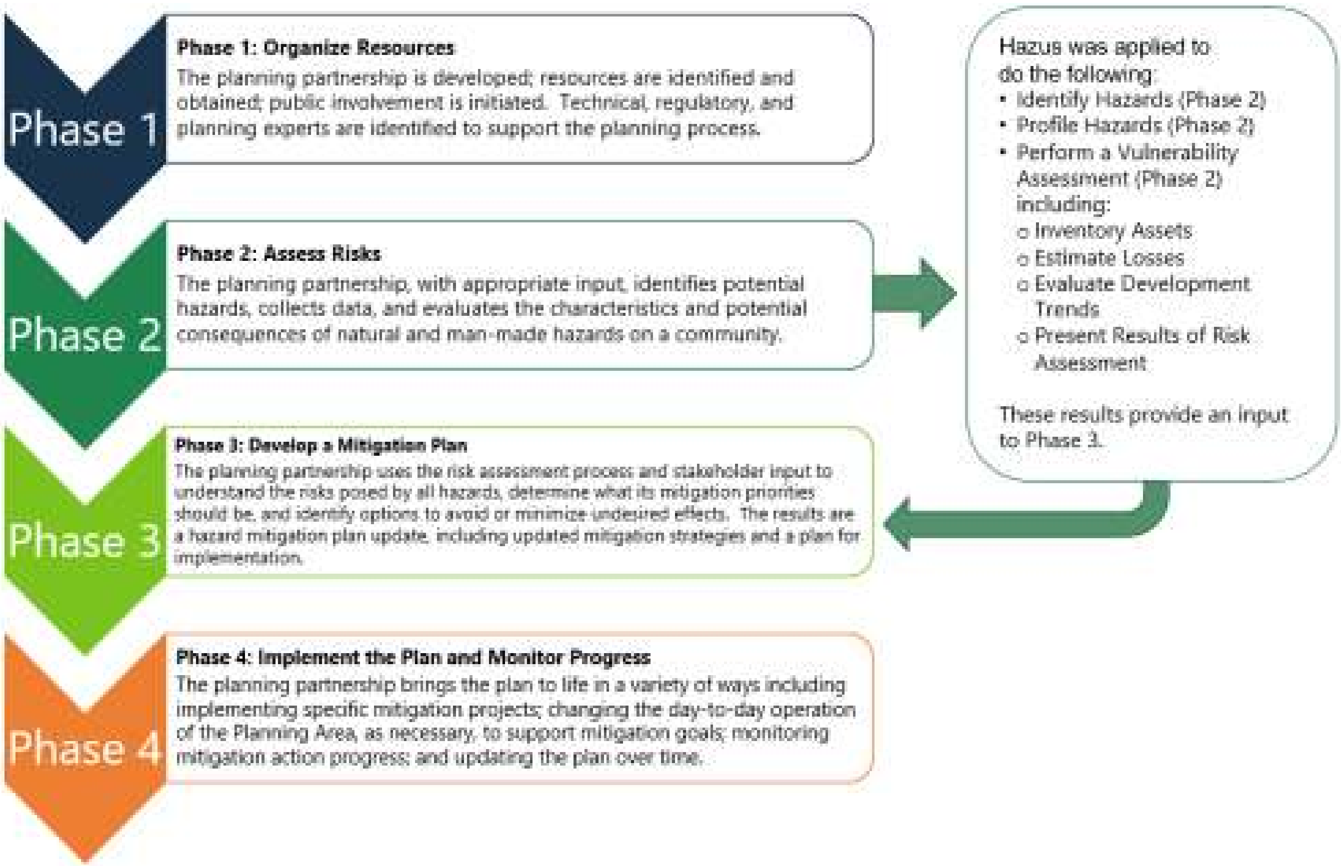
In response to federal requirements that local governmental agencies update their HMP every five years (Code of Federal Regulations Title 44 [44 CFR] Section 201.3) this plan serves as the 2024 update to the 2019 Burlington County Hazard Mitigation Plan. The 2024 update incorporates the newest information upon which to base a successful mitigation strategy that will reduce the impacts of natural disasters and increase the resilience of the Planning Partnership. The plan has been updated with a focus on examining changes in vulnerability due to hazard events, reviewing capabilities and how hazard mitigation is implemented, reviewing the mitigation strategy, and identifying new mitigation actions to increase overall resilience in the Planning Area, which consists of all of Burlington County.

1.3 PLAN ORGANIZATION

The Burlington County HMP 2024 Update is organized as a two-volume plan and is in alignment with New Jersey Office of Emergency Management (NJOEM) planning requirements, the 2023 FEMA Local Mitigation Planning Handbook, the FEMA Local Mitigation Plan Review Tool, and the 2023 FEMA Local Mitigation Planning Policy Guide.

Volume I describes the planning process (see Figure 1-1) and presents hazard profiles and vulnerability assessments that serve as a basis for understanding risk and identifying mitigation actions. It is intended for use as a resource for ongoing mitigation analysis.

Figure 1-1. Burlington County Hazard Mitigation Planning Process



Volume I includes the following sections:

- **Section 1—Introduction:** HMP background and organization; and a summary of key changes from the previous HMP.
- **Section 2—Planning Process:** Description of the HMP development process, Steering Committee and Planning Partnership formation, stakeholder and public involvement efforts, and approach to incorporating this HMP into existing programs.

- **Section 3—County Profile:** Overview of the Planning Area, including physical setting, land use, land use trends, population and demographics, general building stock , critical facilities, and lifelines.
- **Section 4—Risk Assessment:** Documentation of the hazard identification and hazard risk ranking process, hazard profiles, and findings of the vulnerability assessment (estimates of the impact of hazard events on life, safety, health, general building stock, critical facilities, the economy); description of the status of local data; and planned steps to improve local data to support mitigation planning.
- **Section 5—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 Planning Area.
- **Section 6—Mitigation Strategy:** Information regarding mitigation goals and objectives in response to priority hazards of concern and the process by which the Planning Partnership's mitigation strategies have been developed or updated.
- **Section 7—Plan Maintenance:** System to continue to monitor, evaluate, maintain, and update the HMP.

Volume II provides an annex dedicated to each participating jurisdiction. Each annex summarizes the jurisdiction's legal, regulatory, and fiscal capabilities; identifies vulnerabilities to hazards; documents mitigation plan integration with other planning efforts; records status of past mitigation actions; and presents an individualized mitigation strategy. The annexes provide each jurisdiction a resource for implementing mitigation projects and pursuing future grant opportunities, as well as a place for each jurisdiction to record and maintain their local aspect of the multi-jurisdictional plan. Volume II includes the following sections:

- **Section 8—Planning Partnership:** Description of the Planning Partnership, members' responsibilities, and the content of jurisdictional annexes.
- **Section 9—Annexes:** Jurisdiction-specific annexes describing the jurisdiction's hazards of concern, hazard ranking, capability assessment, mitigation actions, action prioritization, progress on prior mitigation activities (as applicable), and prior HMP integration into local planning processes.

Appendices include the following:

- **Appendix A—Plan Adoption:** Resolutions from all participating jurisdictions, included as each formally adopts the HMP update.
- **Appendix B—Participation Documentation:** Matrix to give a broad overview of who attended meetings and when input was provided to the HMP update, along with worksheets submitted during workshops conducted throughout the planning process.
- **Appendix C—Meeting Documentation:** Agendas, attendance sheets, minutes, and other documentation (as available and applicable) of planning meetings convened during the development of the plan.

- **Appendix D—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 process.
- **Appendix E—Mitigation Strategy Supplementary Data:** Documentation of the broad range of actions identified during the mitigation process; types of mitigation actions; the mitigation catalog developed using jurisdiction input, and potential mitigation funding sources.
- **Appendix F—Plan Maintenance Tools:** Examples of plan review tools and templates available to support annual plan review.
- **Appendix G—Critical Facilities Inventory:** A full list of critical facilities identified for the update of the HMP. Due to the sensitive nature of the information, some details have been omitted.
- **Appendix H—Linkage Procedures:** Includes steps to be followed by non-participating local governments and other local jurisdictions within the Planning Area (fire districts, utility districts, school districts, and any other eligible local government as defined in 44 CFR 201.2) to join this plan as a participating jurisdiction and achieve approved status.

1.4 THE PLAN UPDATE – WHAT IS DIFFERENT?

The 2024 HMP update builds on the previous plan and includes the following changes and enhancements:

- Updated data and tools were used for a more detailed and accurate risk assessment.
- The risk assessment was prepared to better support future grant applications by providing risk and vulnerability information that would directly support the measurement of “cost-effectiveness” required under FEMA mitigation grant programs.
- Hazards of concern were reorganized to more accurately reflect risk and mitigation needs within the County.
- Increased outreach to neighboring communities and stakeholders was conducted.
- Increased emphasis was given to the impact of hazards on socially vulnerable and underserved populations and the development of mitigation strategies to protect these groups.

The plan update continues to identify implementable actions, with enough information to serve as the basis for policy and funding decisions and represent measurable impacts on resilience and mitigation progress. The HMP’s strategies provide direction, and its actions are fundable under grant programs.

In accordance with FEMA guiding principles for inclusive participation, the Planning Partnership will place a high priority on an expanded effort on stakeholder participation with local planning committees in future plan updates.

Table 1-1 indicates the major changes between the two plans as they relate to 44 CFR planning requirements.

Table 1-1. Table Title

44 CFR Requirement	2019 HMP	2024 Updated Plan
Requirement §201.6(b): In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include: *(1) An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval;* *(2) An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia, and other private and non-profit interests to be involved in the planning process; and* *(3) Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.*	The 2019 planning effort followed an outreach strategy utilizing multiple media developed and approved by the Steering Committee. This strategy involved the following: ▪ Public participation on an oversight Steering Committee. ▪ Establishment of a plan informational website. ▪ Press releases. ▪ Use of a public information survey. ▪ Using social media. ▪ Web-deployed survey. The 2019 planning process identified key stakeholders and coordinated with them throughout the process. A comprehensive review of relevant plans and programs was performed by the planning team.	Building upon the success of the 2019 plan, the 2024 planning effort deployed the same public engagement methodology. The plan included the following enhancements: ▪ Key County and local department personnel and public stakeholders formed a Steering Committee for the plan. ▪ A standalone project-specific website was developed to keep the public informed of the planning process and how to get involved and allowed for review/comment on the draft plan. ▪ A StoryMap was implemented as another form of public outreach, which provided an interactive way to learn about the planning process and review the HMP. ▪ Draft plan deliverables were made available on the County and multiple municipal websites. ▪ All Steering Committee and Planning Partnership meetings were open to the public. ▪ Outreach and coordination with key stakeholders was expanded. ▪ A comprehensive review of relevant plans and programs was performed.
§201.6(c)(2): The plan shall include a risk assessment that provides the factual basis for activities proposed in the strategy to reduce losses from identified hazards. Local risk assessments must provide sufficient information to enable the jurisdiction to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards.	The 2019 plan included a risk assessment of hazards of concern. The risk assessment included frequency of return, approximate annualized losses, historical occurrences, a description of general vulnerability, climate change impacts, secondary hazards, critical facilities and infrastructure, discussion on vulnerabilities, and future development trends.	The 2024 plan update includes a comprehensive update to the risk assessment. New and updated hazards of concern were included. Jurisdiction-specific risk assessment results are summarized in Section 4 (Risk Assessment) and in each jurisdictional annex (Section 9).

44 CFR Requirement	2019 HMP	2024 Updated Plan
§201.6(c)(2)(i): [The risk assessment] shall include a] description of the … location and extent of all-natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.	The 2019 plan presented a risk assessment of each hazard of concern. Each section included the following: ▪ Hazard profile, including maps of extent and location, previous occurrences, and probability of future events. ▪ Climate change impacts on future probability using the best available data for the State of New Jersey. ▪ Vulnerability assessment including impact on life, safety, and health, general building stock, critical facilities, and the economy, as well as future changes that could impact vulnerability. ▪ A summary of changes in vulnerability since the 2014 plan.	A similar, but adjusted format, using new and updated data, was used for the 2024 plan update. Each section of the risk assessment includes the following: ▪ Hazard profile, including hazard description and types, maps of extent and location, previous occurrences, and probability of future events. ▪ Climate change impacts on future probability ▪ Vulnerability assessment including impact on life, safety, and health, general building stock, critical facilities, and the economy, as well as future changes that could impact vulnerability. ▪ Discussions on how each hazard impacts socially vulnerable populations. ▪ A summary of changes in vulnerability since the 2019 plan.
§201.6(c)(2)(ii): [The risk assessment] shall include a] description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i). This description shall include an overall summary of each hazard and its impact on the community.	A robust, quantitative vulnerability assessment was conducted for the 2019 plan, using new and updated asset and hazard data. Section 5.4 summarizes the planning area's vulnerability for each hazard of concern.	A robust, quantitative vulnerability assessment was conducted for the 2024 plan update, using new and updated asset and hazard data. Section 4.3 summarizes the planning area's vulnerability for each hazard of concern. The jurisdictional annexes include problem statements developed from the risk assessment.
§201.6(c)(2)(ii): [The risk assessment] must also address National Flood Insurance Program insured structures that have been repetitively damaged by floods.	A summary of NFIP insured properties identified as repetitive loss and severe repetitive loss locations was included in each jurisdictional annex.	A summary of NFIP insured properties identified as repetitive loss and severe repetitive loss locations was included in the plan and each annex.
Requirement §201.6(c)(2)(ii)(A): The plan should describe vulnerability in terms of the types and numbers of existing and future buildings, infrastructure and critical facilities located in the identified hazard area.	Quantitative and qualitative analyses were conducted using the updated hazard and inventory data as presented in Section 5 (Risk Assessment). In addition, critical facilities considered lifelines in accordance with FEMA's definition were identified.	Quantitative and qualitative analyses were conducted using the updated hazard and inventory data as presented in Section 4 (Risk Assessment). In addition, critical facilities considered lifelines in accordance with FEMA's updated definitions were identified.

44 CFR Requirement	2019 HMP	2024 Updated Plan
Requirement §201.6(c)(2)(ii)(B): [The plan should describe vulnerability in terms of an] estimate of the potential dollar losses to vulnerable structures identified in paragraph (c)(2)(i)(A) and a description of the methodology used to prepare the estimate.	Loss estimates were generated for all hazards of concern by using readily available information.	Quantitative and qualitative analyses were conducted using the updated hazard and inventory data as presented in Section 4 (Risk Assessment). Estimated potential losses are reported in Section 4.3 and in the annexes for each jurisdiction.
Requirement §201.6(c)(2)(ii)(C): [The plan should describe vulnerability in terms of] providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions.	A spatial analysis using identified growth areas, and potential new development identified by jurisdictions was conducted to determine if located in hazard areas. These results were reported to all participants and summarized in their annexes to discuss mitigation measures. In Section 5.4, projected changes in population and development are discussed in each hazard section and how these projected changes may lead to increased vulnerability or how plans, regulations, and ordinances in place will implement mitigation to protect the development.	A spatial analysis using identified growth areas, and potential new development identified by jurisdictions was conducted to determine if located in hazard areas. These results were reported to all participants and summarized in their annexes to discuss mitigation measures. In Section 4.3, projected changes in population and development are discussed in each hazard section and how these projected changes may lead to increased vulnerability or how plans, regulations, and ordinances in place will implement mitigation to protect the development.
§201.6(c)(3):[The plan shall include a mitigation strategy that provides the jurisdiction's blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs and resources, and its ability to expand on and improve these existing tools.]	The 2019 plan contained goals, objectives, and actions. The identified actions covered multiple hazards and goals.	The Planning Partnership reviewed and updated the goals and created objectives. A mitigation strategy workshop with associated tools and guidance on problem statement development was deployed to inform the identification of mitigation actions. Actions that were completed or no longer considered to be feasible were removed. The balance of the actions was carried over to the 2024 plan, and in some cases, new actions were added to the action plan.
Requirement §201.6(c)(3)(i): [The hazard mitigation strategy shall include a] description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.	The Planning Partnership identified goals targeted specifically for this hazard mitigation plan. The planning component supported the actions identified in the plan.	The Planning Partnership reviewed and updated the goals and objectives. New objectives were identified to align with updated Planning Partnership priorities.

44 CFR Requirement	2019 HMP	2024 Updated Plan
Requirement §201.6(c)(3)(ii): [The mitigation strategy shall include a] section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure.	For each identified hazard, mitigation strategies were developed and prioritized using mitigation action worksheets. The mitigation actions were displayed in a table in each jurisdictional annex.	For the 2024 update, a mitigation catalog was developed to provide a comprehensive range of specific mitigation actions to be considered. Each mitigation action has its own action worksheet located in each jurisdictional annex. This action worksheet can be used for FEMA-eligible projects.
Requirement: §201.6(c)(3)(ii): [The mitigation strategy] must also address the jurisdiction's participation in the National Flood Insurance Program, and continued compliance with the program's requirements, as appropriate.	Each jurisdictional annex included a description of how the jurisdiction participates in and implements the NFIP.	For the 2024 update, each jurisdictional annex includes a description on how the jurisdiction participates in and implements the NFIP.
Requirement: §201.6(c)(3)(iii): [The mitigation strategy shall describe] how the actions identified in section (c)(3)(ii) will be prioritized, implemented, and administered by the local jurisdiction. Prioritization shall include a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs.	Each action was prioritized based on FEMA's STAPLEE criteria—the social, technical, administrative, political, legal, economic, and environmental factors necessary for the implementation of each action. The evaluation included a qualitative benefit and cost review. The results of the evaluation were used to identify the actions to include in the plan and assist with the prioritization.	A revised methodology based on the STAPLEE criteria and using new and updated data was used for the 2024 plan update. Fourteen criteria were used to evaluate each potential mitigation action. The evaluation included a qualitative review of benefit and cost. The results of the evaluation were used to identify actions to include in the plan and assist with the prioritization.
Requirement §201.6(c)(4)(i): [The plan maintenance process shall include a] section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle.	The 2019 plan details a plan maintenance strategy, giving a suggested schedule on when to review, revise, and maintain the plan. The 2019 plan maintenance strategy includes the use of the BATool^{SM} to enable municipal and county representatives to directly access mitigation initiatives to easily update the status of each project, document successes or obstacles to implementation, and add or delete projects to maintain mitigation project implementation.	The 2024 plan details a plan maintenance strategy similar to that of the 2019 plan.

TETRA TECH

44 CFR Requirement	2019 HMP	2024 Updated Plan
Requirement §201.6(c)(4)(ii): [The plan shall include a] process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms such as comprehensive or capital improvement plans, when appropriate.	The 2019 plan details recommendations for incorporating the plan into other planning mechanisms.	The 2024 plan details recommendations for incorporating the plan into other planning mechanisms such as the following: ▪ Comprehensive/Master Plan ▪ Emergency Response Plan/ Emergency Operations Plan ▪ Capital Improvement Programs ▪ Municipal Code
Requirement §201.6(c)(4)(iii): [The plan maintenance process shall include a] discussion on how the community will continue public participation in the plan maintenance process.	The 2019 plan details a strategy for continuing public involvement.	The 2019 plan maintenance strategy was carried over to the 2024 plan.
Requirement §201.6(c)(5): [The local hazard mitigation plan shall include] documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval of the plan (e.g., City Council, County Commissioner, Tribal Council).	All the planning partners have adopted the plan.	Resolutions for each partner adopting the plan can be found in Appendix A.

SECTION 2. PLANNING PROCESS

2.1 INTRODUCTION

This section includes a description of the planning process used to update the 2019 Burlington County HMP, including how it was prepared, who was involved in the process, and how the public was involved. To ensure that the plan meets the federal requirements for hazard mitigation planning and that the planning process would have the broad and effective support of the participating jurisdictions, regional and local stakeholders, and the public, an approach to the planning process and plan documentation was developed to achieve the following goals:

- The HMP is multi-jurisdictional and considers natural and human-caused hazards facing the Planning Partners, thereby satisfying the hazard mitigation planning requirements specified in federal regulations (44 CFR 201.6).
- The HMP was developed following the process outlined by FEMA regulations and prevailing FEMA and NJOEM guidance. Following this process ensures that all requirements are met and supports HMP review.

The Burlington County HMP update was written using the best available information obtained from a wide variety of sources. The hazard mitigation strategies identified in this HMP have been developed through an extensive planning process involving local, county, and regional agencies, Planning Area residents, and stakeholders. The HMP Planning Partnership solicited information from local agencies and individuals with specific knowledge of certain hazards and past historical events, as well as reviewing planning and zoning codes, ordinances, and other recent planning decisions.

This section describes all components of the mitigation planning process. This process does not represent the start of hazard risk management in the Planning Area; rather it is part of an ongoing process by various state, county, and local agencies and individuals. A summary of past and ongoing mitigation efforts—provided in Section 6 (Mitigation Strategy) and in the jurisdictional annexes in Volume II—gives a historical perspective of the Planning Area and local activities implemented to reduce vulnerability to hazards.

2.2 ORGANIZATION OF THE PLANNING PROCESS

Many parties supported the preparation of this HMP update: County officials, municipal officials, the Planning Partnership, stakeholders, and a planning consultant. This section of the HMP identifies how the planning process was organized with the many participants involved and outlines the major activities that were conducted in the development of this HMP update.

2.2.1 Planning Consultant

A contract planning consultant (Tetra Tech) was selected to guide Burlington County through the HMP update process. A contract between Tetra Tech and Burlington County was executed in June 2023. Tetra Tech was tasked with the following:

- Assistance with the organization of a Steering Committee and the Planning Partnership
- Assistance with the development and implementation of a public and stakeholder outreach program
- Data collection
- Facilitation and attendance at meetings (Steering Committee, Planning Partnership, stakeholder, public and others)
- Review and update of the hazards of concern, 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

2.2.2 Organization of the Planning Partnership

To facilitate plan development, Burlington County developed a Planning Partnership to provide guidance and direction to the HMP update effort and to ensure the resulting document will be embraced both politically and by the constituency within the Planning Area. Appendix B (Participation Matrix) identifies who represented the Planning Partners during this planning effort and indicates how they contributed to the planning process. Table 2-1 lists the members of the Planning Partnership. The Planning Partnership was charged with the following:

- Attending and participating in Planning Partnership meetings.
- Represent their jurisdiction throughout the planning process and ensure participation expectations are met by their jurisdiction.
- Support and promote the public involvement process.
- Assisting with the development and completion of certain planning elements, including:
  - Reviewing and updating the hazards of concern.
  - Developing a public and stakeholder outreach program.
  - Assuring that the data and information used in the plan update process are the best available.
  - Reviewing and updating the hazard mitigation goals.
  - Report on progress of mitigation actions identified in prior or existing HMPs, as applicable.
  - Identifying and screening of appropriate mitigation strategies and activities.
- Reviewing and commenting on plan documents prior to submission to NJOEM and FEMA.
- Adopt, implement, and maintain the plan update.

Table 2-1. Burlington County Hazard Mitigation Planning Partnership

Organization	Name	Title	Steering Committee Member	Planning Partnership Member	Primary Point of Contact	Alternate Point of Contact	NFIP Administrator
Burlington County	**Division of Emergency Management**						
	Darryl Williams	DEM Coordinator	X	X		X	
	Kristen Carr	DEM Deputy Coordinator	X	X	X		
	Madison Hoff	Assistant Planner	X	X			
	Bob Carr	Fire Marshal	X	X			
	County Administration						
	Todd Wirth	Management Specialist	X	X			
	Department of Health						
	Herbert Conway	Director	X	X			
	Monique Davis	Assistant Health Officer	X	X			
	Holly Funkhouse Cucuzzella	Health Officer	X	X			
	Department of Public Information						
	Dave Levinsky	Public Information Officer	X	X			
	Department of Public Works						
	Joe Brickley	Director	X	X			
	Department of Resource Conservation						
	Mary Pat Robbie	Director	X	X			
	Division of GIS						
	David Rickert	GIS Specialist 2	X	X			
	Merrilee Torres	GIS Specialist 1, GIS Supervisor	X	X			
	Division of Solid Waste						
	Jerome Sheehan	Director	X	X			
	Department of Information Technology						
	Kevin Savage	Director	X	X			
	Michael Patton	Assistant Director	X	X			
	Jalen Singleton	Data Specialist	X	X			
	Division of Engineering						
	Thomas Stanuikynas	County Planner	X	X			
	Joseph Brickley	Public Works Director / County Engineer	X	X			
	Division of Buildings and Grounds						
	Steven Stypinski	Director of Construction Services	X	X			
	Department of Human Services						
	Malikah Morris	Human Services Director	X	X			
	Elfrieda Francis	Division Head for Behavioral Health	X	X			
	Division of Roads and Bridges						
	John Janis	County Supervisor	X	X			

Organization	Name	Title	Steering Committee Member	Planning Partnership Member	Primary Point of Contact	Alternate Point of Contact	NFIP Administrator
	Department of Public Safety						
	Kevin Briggs	Executive Supervisor	X	X			
	Department of Parks						
	Jeremy Hreben	Superintendent of Parks	X	X			
Bass River (Twp)	Sally Bourguignon	OEM Coordinator		X	X		
	Louis Bourguignon	Deputy OEM Coordinator		X		X	
	Barbara Somes	Assistant OEM Coordinator		X			
	Frank Little	Zoning Officer and Engineer		X			X
	Deborah Buzby-Cope	Mayor		X			
	Jim Sceurmon	Construction Official		X			
	Jenny Gleghorn	Municipal Clerk		X			
Beverly (C)	Kevin J. Richards	OEM Coordinator		X	X		
	Rich Wolbert	Public Safety		X		X	
	Rakesh Darji	Floodplain Administrator		X			X
	George K. Meredith	Fire Chief		X			
	William Kirchner	City Engineer		X			
	Cedric Minter	Construction Code Official		X			
	Caitlin D'Alfonso	Municipal Clerk		X			
	Michael Haws	DPW Supervisor		X			
	Mark Remsa	City Planner		X			
Bordentown (C)	James E. Lynch, Jr.	Mayor		X			
	Ryan J Lynch	OEM Coordinator		X	X		
	Brian Maugeri Sr.	OEM Deputy Coordinator		X			
	Margaret Peak	Administrator		X		X	
	Jennifer Smith	Planning Board Secretary		X			X
	Robert Erickson	Public Works Superintendent		X			
	Shaun Lafferty	Police Chief		X			
Bordentown (Twp)	Nichaolas S. Buroczi	OEM Coordinator		X	X		
	Nathan Roohr	Chief of Police		X			
	Eric Holliday	Committeeman/Committee Liaison to OEM		X			
	Robert McFarland	Fire District #2 Chief		X			

Organization	Name	Title	Steering Committee Member	Planning Partnership Member	Primary Point of Contact	Alternate Point of Contact	NFIP Administrator
	Tom Komlosi	Fire District #1 Acting Chief		X			
	Michael Theokas	Township Administrator		X		X	
	Maria S. Carrington	Township Clerk		X			
	Robert Salmons	Township Construction Official		X			
	Adam Spundarelli	Public Works Supervisor		X			
	Mark Siegle	Township Director of Community Development		X			
	Fred Turek	Township Engineer - Turek Consulting LLC		X			X
	Dean Buhrer	Director of Public Works		X			
	Marcie Maute	Zoning Officer		X			
Burlington (C)	Frank S. Caruso	OEM Coordinator		X	X		
	Kenneth Shine	Engineer		X		X	
	William Harris	Director of Housing and Economic Development, CRS Coordinator		X			
	Barry W. Conaway	Mayor		X			
	William Curry	Director of Public Works		X			
	Allison S Iannaccone	Floodplain Administrator		X			X
	Jody Mazeall	Construction Official		X			
	David C. Mudge	OEM Deputy Coordinator		X			
	Craig E. Leshner Sr.	OEM Deputy Coordinator		X			
	Johanna Conyer	Business Administrator		X			
	Zoraida Pagan	Administrative Secretary		X			
	Ryan Elbertson	Police Chief		X			
	Bill Kirschner	Asst. Engineer		X			
	Jody Mazeall	Construction Official		X			
	Cindy Crivaro	Municipal Clerk		X			
Burlington (Twp)	Deborah M. Painter	OEM Deputy Coordinator		X			
	David C. Ekelburg	OEM Coordinator		X	X		
	E.L. Pete Green	Mayor		X			
	George Coolidge	Director of Public Works		X			
	Scott Hatfield	Township Engineer		X		X	
	Jon Lamont	Construction Code Official		X			X

Organization	Name	Title	Steering Committee Member	Planning Partnership Member	Primary Point of Contact	Alternate Point of Contact	NFIP Administrator
	Matthew Tomaszewski	OEM Deputy Coordinator		X			
	Bruce Painter	Public Safety Director		X			
	Mary E. Field	Township Clerk		X			
	Anthoy Tappanese	Housing Inspector		X			
	Joseph S. Augustyn	Planner		X			
	Jodi Botlinger	Mayor's Administrator		X			
Chesterfield (Twp)	Rick Bainbridge	OEM Coordinator		X	X		
	Michael Davison	OEM Deputy Coordinator		X		X	
	Glenn McMahon	Technical Assistant/Code Enforcement		X			
	Thomas A. Sahol	Former Township Administrator		X			
	Troy Ulshafer	Public Works Foreman		X			
	Ryan Lynch	Fire Chief		X			
	Carmela Roberts	Former Township Engineer		X			
	Leah Furey Bruder	Township Planner		X			
	Denise Koetas-Dale	Mayor		X			
	Caryn Hoyer	Municipal Clerk		X			
	Roger Fort	Construction Official		X			
	Joseph R. Hirsh	Township Engineer					X
Cinnaminson (Twp)	Danny Norman	OEM Coordinator		X	X		
	William Obuchowski	OEM Deputy Coordinator		X			
	Kevin Gauntt	Superintendent of Public Works		X			
	Michael Minton	Zoning and Code Enforcement Officer		X			
	Eric Schubiger	Township Administrator		X			
	Joseph Barbadoro	Township Engineer		X		X	X
	Dean Jerginan	OEM Deputy Coordinator		X			
	Julia Edmondson	Chief Financial Officer, Purchasing Agent		X			
	Lisa Passione	Municipal Clerk		X			
	Ernest McGill	Mayor		X			
	Richard Calabrese	Chief of Police		X			
	Edward Fox	Planner		X			
Delanco (Twp)	Robert Viereck	OEM Coordinator		X		X	
	Matthew Bartlett	OEM Deputy Coordinator		X			

Organization	Name	Title	Steering Committee Member	Planning Partnership Member	Primary Point of Contact	Alternate Point of Contact	NFIP Administrator
	Beverly Russell	Municipal Clerk		X	X		
	Richard Schwab	Township Administrator		X			
	John Fenimore	Superintendent of Public Works		X			
	Christopher Noll	Township Engineer		X			
	Michael Lunemann	Construction Official		X			X
	Michael Templeton	Township Committee		X			
	Bill Reutter	OEM Deputy Coordinator		X			
	Ed Ruggiano	Code Enforcement		X			
	Scott Taylor	Township Planner		X			
Delran (Twp)	Joseph Cunningham Jr.	OEM Coordinator/Deputy Fire Chief		X	X		
	William Lunemann	Construction Official		X			
	Bryan Mullen	DPW Superintendent		X			
	Joseph Bellina	Township Administrator		X		X	
	Chris Dochney	Township Engineer		X			X
Eastampton (Twp)	Bob Carr	OEM Coordinator	X	X	X		
	Kim-Marie White	Township Manager	X	X		X	
	Stacey Arcari	Township Engineer		X			X
	Darrin Elbertson	Code Enforcement		X			
	Brad Regn	Construction Official		X			
	Fredrick P. Rodi	Public Works Director		X			
	Joseph Iacovitti	Chief of Police		X			
	Bill Angelaccio	Public Works Foreman		X			
	Mark A. Remsa	Township Planner		X			
	Kathy Newcomb	Zoning Official		X			
	Eugene Oberfrank	OEM Deputy Coordinator		X			
	Dominic F. Santillo	Mayor		X			
	Michael Lunemann	Construction Official		X			
Edgewater Park (Twp)	Joseph T. Pullion	Township Administrator		X	X		
	Alyssa Meredith	Emergency Management Coordinator		X		X	
	Chief Brett Evans	Police Chief		X			
	Harry Moscatiello	Construction Code Official		X			X

Organization	Name	Title	Steering Committee Member	Planning Partnership Member	Primary Point of Contact	Alternate Point of Contact	NFIP Administrator
	Jim Bernard	Public Works Superintendent		X			
	Edward Fox	Township Planner - Environmental Resolutions Inc.		X			
	Rakesh Darji	Township Engineer		X			
	Patricia Clayton	Township Clerk		X			
	Michelle Atzert	Sewerage Authority Administrator		X			
Evesham (Twp)	Carl Bittenbender	OEM Coordinator		X	X		
	Kevin Rijs	Community Development Director		X			
	Eamonn Fitzpatrick-Ruth	Firefighter/Inspector		X			
	Anthony Saccomanno	Construction Official		X			
	Scott Freedman	Deputy Fire Chief, Fire Marshal		X		X	
	Jessica Hauber	Township Engineer		X			X
	David Pfeiffer	Assistant Superintendent Municipal Public Property and Services		X			
	Jaclyn Veasy	Mayor		X			
	Mary Lou Bergh	Township Clerk		X			
	Walt Miller	Chief of Police		X			
	Dave Pfeifer	Public Works Superintendent		X			
Florence (Twp)	Philip Drangula	OEM Coordinator		X	X		
	Albert Jacoby	Deputy OEM Coordinator		X		X	
	James Hoey	Construction Official		X			
	Nancy Earlston	Clerk		X			
	Michael Angelastro	Engineer		X			X
	Ed Fox	Planner		X			
	David Wright	Public Works Assistant Superintendent		X			
	Thomas Sahol	Administrator		X			
	Brian Boldizar	Police Chief		X			
	Robert Tharp	Fire Administrator		X			
Hainesport (Twp)	William Challender	OEM Coordinator		X	X		
	Paula Kosko	Municipal Clerk		X			
	George Myers	Deputy OEM Coordinator		X		X	
	Joe Crain	DPW Foreman		X			
	Ray Holshue	Construction Official		X			X
	Paula Tiver	Joint Land Use Board Secretary		X			

Organization	Name	Title	Steering Committee Member	Planning Partnership Member	Primary Point of Contact	Alternate Point of Contact	NFIP Administrator
	Kathy Newcomb	Zoning Officer		X			
	Janice Ludden	Chair Environmental Commission		X			
	Irene Barry	Code Enforcement Officer		X			
	Gerard Clauss	Mayor		X			
	Scott Taylor	Planner		X			
	Martin Miller	Engineer		X			
Lumberton (Twp)	Ryan Engle	OEM Coordinator		X	X		
	Aaron Morrison	OEM Deputy Coordinator		X		X	
	Bobbie Quinn	Township Administrator		X			
	Meredith Riculfy	Incoming Township Administrator		X			
	Ryan Tuno	OEM Deputy Coordinator		X			
	Thomas Shover	Public Works Foreman		X			
	Rakesh Darji	Township Engineer		X			
	Bradley Regn	Construction Official		X			
	Colleen Ekey	Former OEM Coordinator		X			
	Mike Lunemann	Construction Official		X			X
	Leah Furey	Township Planner		X			
	Anthony Nippins	Police Chief		X			
Mansfield (Twp)	Douglas Borgstrom	OEM Coordinator	X	X	X		
	Matthew Konowicz	Township Fire Department	X				
	George Senf	Assistant OEM Coordinator		X		X	
	Ashley Jolly	Deputy Clerk		X			
	Linda Semus	Municipal Clerk		X			
	Edward Ruggiano	Zoning Official		X			
	Michael Fitzpatrick	Administrator		X			
	Frank Parkerson	Public Works Foreman		X			
	Edward Fox, III	Planner		X			
	Douglas Johnson	Engineer		X			X
	Alexander Belonzi	OEM Deputy Coordinator		X			
	Jef Jones	Construction Code Official		X			
Maple Shade (Twp)	Susan Danson	Township Manager	X	X	X		
	Brian Davis	OEM Coordinator / Police Sgt.	X	X		X	

TETRA TECH

Organization	Name	Title	Steering Committee Member	Planning Partnership Member	Primary Point of Contact	Alternate Point of Contact	NFIP Administrator
	Ed Toussaint	Construction Official	X	X			X
	Christopher Fletcher	Police Chief		X			
	Patrick Lyons	Director of Public Works		X			
	Andrea McVeigh	Township Clerk/Registrar		X			
Medford (Twp)	Robert Dovi	OEM Coordinator		X	X		
	Clifford Rickards	OEM Deputy Coordinator		X		X	
	William Dunleavy	OEM Deputy Coordinator		X			
	Jeffrey Wagner	OEM Deputy Coordinator		X			
	Beth Portocalis	Executive Assistant to the Manager and Open Space Coordinator		X			
	Katherine Burger	Former Municipal Clerk		X			
	Charles Watson	Mayor		X			
	Ronnie Fowler	Director of Public Works		X			
	Scott Taylor	Township Planner		X			
	Chris Noll	Township Engineer		X			
	Richard Falasco	Construction Official		X			X
	Ryan Hofmann	OEM Deputy Coordinator		X			
	George Jackson	OEM Deputy Coordinator		X			
	Arthur Waterman	Police Chief		X			
	Thomas Czerniecki	Township Manager		X			
	Dawn Bielec	Municipal Clerk		X			
Medford Lakes (B)	Dr. Robert Burton	Borough Manager		X	X		
	Franis J. Babinchock	OEM Coordinator		X			
	Mark J. McIntosh	OEM Deputy Coordinator		X		X	
	Tom Boyd	Construction Official		X			X
	Dayna Welsh	Assistant Clerk		X			
	Dr. Gary A. Miller	Mayor		X			
	Jeremy Noll	Engineer		X			
	Joseph Augustyn	Planner		X			
	David Crane	Code Enforcement Official		X			
	Mark Witczack	Public Works Manager		X			
Moorestown (Twp)	James Carruthers	OEM Coordinator	X	X	X		
	Kevin Abernant	Township Manager		X		X	

TETRA TECH

Organization	Name	Title	Steering Committee Member	Planning Partnership Member	Primary Point of Contact	Alternate Point of Contact	NFIP Administrator
	Don Lloyd	Director of Public Works		X			
	Jordan Webster	Deputy Director of Public Works		X			
	Joseph LaRocca	Construction Official		X			X
	Hugh Dougherty	Township Engineer		X			
	Nicole Gillespie	Mayor		X			
	Patricia Hunt	Township Clerk		X			
	Joan Ponessa	Environmental Advisory Committee Chair		X			
Mount Laurel (Twp)	Christopher Burnett	OEM Deputy Coordinator		X			
	Stephen Riedener	OEM Deputy Coordinator		X			
	Jay Appleton	OEM Coordinator		X	X		
	Douglass Dickel	OEM Deputy Coordinator		X		X	
	William Long	Township Engineer		X			X
	Chris Dochney	Township Planning Consultant		X			
	Kevin Bagnell	Assistant Construction Official, Building Subcode Official		X			
	Pamela Carolan	Executive Director, Mount Laurel Township MUA		X			
	Alan Pine	Fire Chief		X			
	Jerry Mascia	Deputy Manager/DPW Superintendent		X			
	Meredith Riculfy	Township Manager/Township Clerk		X			
	Judy Lynn Schiavone	Police Chief		X			
	Robert Gates	Construction Official		X			
New Hanover (Twp)	Patrick Murphy	OEM Deputy Coordinator		X			
	Kyle Tuliano	OEM Deputy Coordinator		X	X		
	Joe Hirsh	Engineer		X		X	X
	Dena Kaiser	Technical Assistant to the Construction Official		X			
	Paul Peterla	Mayor					
	Susan Jackson	Township Clerk					
North Hanover (Twp)	Richard Mellor	EMC/Police		X	X		
	Brendan O'Donnell	Deputy Mayor		X			
	Mary Picariello	Township Clerk		X			
	Jef Jones	Construction Official		X			
	Ronald DeBaecke	Mayor		X			
	Joseph Hirsh	Township Planner		X			
	Joseph Hirsh	Township Engineer		X			

TETRA TECH

Organization	Name	Title	Steering Committee Member	Planning Partnership Member	Primary Point of Contact	Alternate Point of Contact	NFIP Administrator
	Benjamin Palombi	Deputy EMC		X		X	
	Alexandra DeGood	Zoning Officer		X			X
Palmyra (B)	Ronald Lindemuth	OEM Coordinator		X	X		
	Tracy Kilmer	OEM Deputy Coordinator, Construction Official		X		X	X
	John Skowronski	OEM Deputy Coordinator		X			
	Richard Dreby	OEM Deputy Coordinator		X			
	William Kirchner	Municipal Engineer		X			
	Dave Gerkens	Municipal Planner		X			
	Al Berg	Public Works Foreman		X			
	John Gural	Administrator		X			
	Frank Billingiere	Code Enforcement Officer		X			
	Doretha R. Jackson	Municipal Clerk		X			
	Joe Murphy	Police Lieutenant		X			
	Gina Ragomo Tait	Mayor		X			
Pemberton (B)	Chad Bozoski	OEM Coordinator		X	X		
	Matthew Wilson	OEM Deputy Coordinator		X			
	Kathy Smick	Municipal Clerk		X		X	
	Edward Hunter	Chief of Police		X			
	Terry Jerome	Councilman		X			
	Herold Griffin	Mayor		X			
	Steve Phillips	Public Works Superintendent		X			
	Jim Mullan	Engineer/Planner		X			
	Hugh Dougherty	Engineer		X			
	Harry Case	Construction Official		X			X
Pemberton (Twp)	Craig L. Augustoni	OEM Coordinator		X	X		
	Michele Brown	Assistant to Mayor		X		X	
	Amy Cosnoski	Township Clerk		X			
	Rosemary Flaherty	Community Development Director		X			X
	Daniel Hornickel	Township Business Administrator		X			
	Tom McNaughton	Director of Public Works		X			
	Adam Gee	Construction Official		X			

Organization	Name	Title	Steering Committee Member	Planning Partnership Member	Primary Point of Contact	Alternate Point of Contact	NFIP Administrator
	Mark Herrmann	Township Engineer		X			
	Mark Remsa	Township Planner		X			
Riverside (Twp)	George Conard Jr.	OEM Coordinator		X			
	Meghan Jack	Township Administrator		X	X		X
	Susan Dydek	Clerk		X		X	
	Hugh McCurley	Construction Code Official/Building Subcode Official, Building Inspector, Zoning Officer		X			
	Andrew Holt	Public Works Coordinator		X			
	Hugh Dougherty	Township Engineer		X			
	Kenneth Shine	Assistant Engineer		X			
	Kevin Johnson	Code Enforcement		X			
	Ed Fox	Township Planner		X			
	Rakesh Darji	Assistant Planner		X			
	Corey Kimble	Mayor		X			
	Dave Jaensch	Police Chief		X			
Riverton (B)	Andrew Beuschel	OEM Coordinator		X	X		
	Keith Adams	Public Works Manager		X		X	
	Bill Long	Borough Engineer		X			
	Michelle Taylor	Borough Planner		X			
	Jim Quinn	Mayor		X			
	Roger Fort	Construction Official		X			X
	Michelle Hack	Municipal Clerk		X			
	Vincent Coniglione	Code Enforcement/Police Department		X			
Shamong (Twp)	John Lyons	OEM Coordinator		X	X		
	William Carrig	OEM Deputy Coordinator		X			
	Joseph Reinhart	OEM Deputy Coordinator		X			
	Ed Toussaint	Code Official		X			
	Mike DiCroce	Mayor		X			
	Gary Welsh	DPW Supervisor		X			
	Susan Onorato	Twp Administrator		X		X	
	Joe Hirsh	Engineer		X			X
	Anthony R. Lopez	Assistant Engineer		X			
Southampton (Twp)	Eamonn Fitzpatrick-Ruth	OEM Coordinator		X	X		
	Donna Fascenda	Administrative Assistant, Grant Writer		X		X	
	Michael Mikulski	Mayor		X			
	Cliff Spencer	Code Enforcement		X			

Organization	Name	Title	Steering Committee Member	Planning Partnership Member	Primary Point of Contact	Alternate Point of Contact	NFIP Administrator
	Kathleen D. Hoffman	Administrator/Clerk		X			
	Ryan Hagerthey	Public Works Supervisor		X			
	Ed Fox	Engineer		X			
	William Long	Township Engineer		X			
	Joseph Collis	OEM Deputy Coordinator		X			
	Keith Harrison	OEM Deputy Coordinator		X			
	Scott Mitchell	Fire Chief		X			
	Tom Boyd	Construction Official		X			X
Springfield (Twp)	Eric Trout	OEM Coordinator	X	X			
	Brandy C. Boyington	Acting Township Clerk		X	X		
	James Mazzo	Construction Official		X			X
	Kristen Lippencott	Deputy Manager		X		X	
	Chris Noll	Township Engineer		X			
	Leah Furey Bruder	Township Planner		X			
	David Frank	Mayor	X	X			
	Andrew Eaton	Deputy Mayor	X	X			
Tabernacle (Twp)	John T. Harbourt	OEM Coordinator		X	X		
	Phyllis Worrel	Deputy OEM Coordinator		X			
	Kevin Worrell	Director of Public Works		X			
	Thomas Leisse	Township Engineer		X			
	Tom Boyd	Construction Code Official		X			X
	Maryalice Brown	Clerk		X		X	
Washington (Twp)	David Simpson	OEM Coordinator		X	X		
	Craig Farnsworth	OEM Deputy Coordinator		X			
	Ebb Alexander	OEM Deputy Coordinator		X		X	
	Kevin Dixon	Engineer/Floodplain Manager		X			X
	Marie Reese	Construction Official		X			
	Larry Priest	Road Supervisor		X			
	Leigh Gadd	Mayor		X			
	Robert Henchy	Code Enforcement		X			
	Lisa Hand	Township Clerk		X			
	Karen Bacon	Deputy Township Clerk		X			
Willingboro (Twp)	Wayne J Comegno	OEM Deputy Coordinator		X			
	John T. Carroll Jr	OEM Coordinator		X			
	Brian D. Wood Sr.	OEM Deputy Coordinator		X			

Organization	Name	Title	Steering Committee Member	Planning Partnership Member	Primary Point of Contact	Alternate Point of Contact	NFIP Administrator
	John T. Carroll III	OEM Deputy Coordinator		X			
	Rose A. Lunstead	OEM Deputy Coordinator		X			
	Jim Anderson	OEM Deputy Coordinator		X			
	Richard Wilson III	DPW Asst. Supervisor		X	X		
	Richard Brevogel	DPW Consultant		X		X	
	Hugh J. Dougherty	Township Engineer		X			
	Kenneth Shine	Assistant Engineer		X			
	Steve Buchhofer	Construction Official		X			
	Dwayne Harris	Township Manager		X			X
	Dennis Tunstall	Inspections Director		X			
	Marvin Harris	Public Works Director		X			
	Everett Falt	Township Clerk		X			
Woodland (Twp)	Michael Huber	OEM Coordinator		X	X		
	William DeGroff	Mayor		X			
	Tom Leisse	Engineer		X			X
	Maryalice Brown	Clerk		X		X	
	Tom Boyd	Construction Official		X			
	Fred Arnwine	Supervisor of Roads		X			
Wrightstown (B)	Donald Cottrell	OEM Coordinator		X		X	
	James Ingling	OEM Deputy Coordinator		X	X		
	Freda Gorman	Municipal Clerk		X			
	Dave Smith	Borough Maintenance Department		X			
	Malvika Apte	Joint Land Use Board Planner		X			
	Kris Kluk	Borough Engineer		X			
	Harry Case	Construction Official		X			X
	Kittina Wallrath	Wrightstown MUA Certifying Officer		X			
	Elizabeth MacLennan	Technical Assistant to the Construction Official		X			
American Water	Gary Gehringer	Environmental Program Lead	X	X			
Bordentown Regional School District	Dr. Trudy Atkins	Superintendent	X	X			
Burlington City Public Schools	Dr. James Flynn	Director of Planning/Research and Evaluation, Operations, and State & Federal	X	X			

TETRA TECH

Organization	Name	Title	Steering Committee Member	Planning Partnership Member	Primary Point of Contact	Alternate Point of Contact	NFIP Administrator
		Programs, School Safety Specialist					
Burlington County Bridge Commission	Mike Ott	Project Manager / Engineer	X	X			
Burlington Township School District	Lauren Riedinger	Vice Principal	X	X			
Holy Cross Preparatory Academy	David Moffa	Principal	X	X			
Northern Burlington County Regular School District	Matthew Konowicz	Director of Instruction for Agriscience, Applied Technology, Business & Technology, Visual & Performing Arts	X	X			
Rowan College Burlington County Public Safety	Andrew Eaton	Director of Public Safety	X	X			
Burlington County Institute of Technology	Joe Venuto	Principal, Westampton Campus	X	X			

Note: Organization codes: (B) = Borough; (C) = City; (Twp) = Township

2.2.3 Steering Committee

A Steering Committee was formed 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. They attended regular meetings and assisted in elements of the HMP planning process such as identifying hazards of concern, developing a public outreach program, reviewing plan goals and objectives, and screening mitigation strategies. Table 2-1 lists the members of the Steering Committee.

2.2.4 Planning Activities

Members of the Planning Partnership, as well as key stakeholders, convened or communicated regularly to share information and participate in workshops to identify hazards, assess risks, review existing inventories of critical facilities, identify new critical facilities, assist in updating mitigation goals and strategies, and provide continuity through the process to ensure that hazard vulnerability information and appropriate mitigation strategies were incorporated. All members of the Planning Partnership and

Steering Committee had the opportunity to review the draft plan, support interaction with other stakeholders, and assist with public involvement efforts.

A summary of meetings held and key milestones met during the development of the HMP update is included in Table 2-2, which also identifies which federal requirements for hazard mitigation planning each activity satisfied. Documentation of meetings (e.g., agendas, sign-in sheets, meeting notes) are in Appendix C (Meeting Documentation). Table 2-2 identifies only the formal meetings held during plan development and does not reflect all planning activities conducted by individuals and groups throughout the planning process. In addition to these meetings, there was a great deal of communication between Burlington County, committee members, and the contract consultant through individual local meetings, email, and phone.

Table 2-2. Summary of Mitigation Planning Activities / Efforts

Date	44 CFR 201 Requirement	Description of Activity	Participants
June 20, 2023	2	Pre-Kickoff Meeting with Burlington County: Discuss plan timing and administration, data needs and sharing, hazards of concern, dates, and next steps	Burlington County Division of Emergency Management, Tetra Tech
August 22, 2023	2	Steering Committee Meeting #1: Introduce the Steering Committee members and contract consultant, provide an overview of the hazard mitigation planning process, identify the 2024 hazards of concern, discuss potential changes to the plan's goals and objectives, identify socially vulnerable populations/ underserved communities, and begin the information gathering processes.	Burlington County Division of Emergency Management, Burlington County Administration, Burlington County Department of Health, Burlington County Department of Public Information, Burlington County Department of Public Works, Burlington County Department of Resource Conservation, Burlington County Division of GIS, Burlington County Division of Solid Waste, Burlington County Department of Information Technology, Eastampton (Twp), Mansfield (Twp), Maple Shade (Twp), Moorestown (Twp), Springfield (Twp), American Water, Bordentown Regional School District, Burlington City Public Schools, Burlington Township School District, Holy Cross Preparatory Academy, Northern Burlington County Regular School District, Rowan College Burlington County Public Safety, New Jersey Office of Emergency Management, Tetra Tech
August 29, 2023	2, 3c, 4a	Planning Partnership Meeting #1: Introduce the Planning Partnership and contract consultant, provide an overview of the hazard mitigation planning process, and begin the information gathering processes and update of the hazards of concern. The Partnership was also asked to identify socially vulnerable populations/ underserved communities.	Burlington County Division of Emergency Management, Burlington County Administration, Burlington County Department of Public Information, Beverly (C), Bordentown (C), Bordentown (Twp), Burlington (C), Burlington (Twp), Chesterfield (Twp), Cinnaminson (Twp), Delanco (Twp), Eastampton (Twp), Edgewater Park (Twp), Evesham (Twp), Florence (Twp), Hainesport (Twp), Lumberton (Twp), Medford Lakes (B), Moorestown (Twp), Mt. Laurel (Twp), Palmyra (B), Pemberton (Twp), Riverside (Twp), Riverton (B), Shamong (Twp), Southampton (Twp), Tabernacle (Twp), Westampton (Twp), Willingboro (Twp), Wrightstown (B), New Jersey Office of Emergency Management, Tetra Tech

Date	44 CFR 201 Requirement	Description of Activity	Participants
October 24, 2023	2, 3b, 3c, 3d, 3e, 4b	Steering Committee Meeting #3: Provide an overview of the hazard mitigation planning process, discuss public and stakeholder outreach efforts, review the risk assessment results, including the hazard ranking, and introduce the SWOO exercise (strengths, weaknesses, obstacles, and opportunities) to the Steering Committee. Instructions were given to consider socially vulnerable populations and underserved communities when completing the SWOO.	Burlington County Division of Emergency Management, Burlington County Department of Health, Burlington County Department of Public Information, Burlington County Department of Public Works, Burlington County Division of GIS, Burlington County Division of Solid Waste, Eastampton (Twp,) Mansfield (Twp), Moorestown (Twp), Springfield (Twp), American Water, Bordentown Regional School District, Holy Cross Preparatory Academy, FEMA Region 2, New Jersey Office of Emergency Management, Northern Burlington County Regular School District, Rowan College Burlington County Public Safety, Burlington County Institute of Technology, Tetra Tech
October 30, 2023	2, 3c, 3d, 3e, 4a, 4b	Planning Partnership Risk Assessment Meeting: Discuss in-kind tracking, project report and status review, public and stakeholder outreach, risk assessment overview, schedule, next steps	Burlington County Division of Emergency Management, FEMA Region 2, Beverly (C), Bordentown (C), Burlington (C), Burlington (Twp), Chesterfield (Twp), Delanco (Twp), Delran (Twp), Eastampton (Twp), Edgewater Park (Twp), Evesham (Twp), Florence (Twp), Lumberton (Twp), Medford (Twp), Moorestown (Twp), Mount Holly (Twp), Mount Laurel (Twp), New Hanover (Twp), Palmyra (B), Pemberton (Twp), Riverton (B), Shamong (Twp), Southampton (Twp), Woodland (Twp), Wrightstown (Twp), Tetra Tech
October 30, 2023	2, 3c, 3d, 3e, 4a, 4b	Mitigation Strategy Workshop: Discuss in-kind tracking, project report and status review, mitigation strategy, schedule, next steps	Burlington County Division of Emergency Management, FEMA Region 2, Beverly (C), Bordentown (C), Burlington (C), Burlington (Twp), Chesterfield (Twp), Delanco (Twp), Delran (Twp), Eastampton (Twp), Edgewater Park (Twp), Evesham (Twp), Florence (Twp), Lumberton (Twp), Medford (Twp), Moorestown (Twp), Mount Holly (Twp), Mount Laurel (Twp), New Hanover (Twp), Palmyra (B), Pemberton (Twp), Riverton (B), Shamong (Twp), Southampton (Twp), Woodland (Twp), Wrightstown (Twp), Tetra Tech
November 9, 2023	1b, 2	Public Risk Assessment Meeting: Provide the public with an overview of the hazard mitigation planning process, present the preliminary results of the risk assessment, and encourage public input and participation. The meeting was recorded and posted on the public project website for those that were unable to attend.	Burlington County Division of Emergency Management, members of the public, Tetra Tech
February 15, 2024	2	Draft Plan Review Presentation: Present an overview of entire plan and sections; confirm plan maintenance schedule	Burlington County Division of Emergency Management, Burlington County Department of Health, Burlington County Division of GIS, Mansfield (Twp), Moorestown (Twp), Springfield (Twp), Burlington County High School, New Jersey Office of Emergency Management, Northern Burlington County Regular School District, Rowan College Burlington County Public Safety, Tetra Tech

Date	44 CFR 201 Requirement	Description of Activity	Participants
February 20, 2024	1b, 2	Public Draft Plan Review Presentation: Provide an opportunity for the public to comment on the draft 2024 Burlington County HMP, review the FEMA Approval Process, and address any questions or comments.	Burlington County Division of Emergency Management, Public and Stakeholders, Bordentown (C), Burlington (C), Chesterfield (Twp), Cinnaminson (Twp), Delanco (Twp), Lumberton (Twp), Mansfield (Twp), Medford (Twp), Medford Lakes (B), Moorestown (Twp), Palmyra (B), Riverside (Twp), Shamong (Twp), Southampton (Twp), Westampton (Twp), Willingboro (Twp), Wrightstown (B), New Jersey Office of Emergency Management, Tetra Tech
February 20, 2024	1b, 2	Draft HMP posted to public project website; all Planning Partners were notified and asked to assist with the public outreach including social media. Neighboring communities and stakeholders were notified of the posting as well.	Burlington County Division of Emergency Management, Public and Stakeholders, Planning Partnership
April 2024	2	HMP submitted to NJOEM	NJOEM
July 2024	2	HMP submitted to FEMA Region 2	FEMA Region 2
Upon plan approval by FEMA	1a	Plan adoption by resolution by the governing bodies of all participating jurisdictions	All Planning Partners

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

2.3 STAKEHOLDER OUTREACH AND INVOLVEMENT

Stakeholders are the individuals, agencies, and jurisdictions that have a vested interest in the recommendations of the HMP, including all Planning Partners. Diligent efforts were made to ensure broad regional, county, and local representation in this planning process. To that end, a comprehensive list of stakeholders was developed with the support of the Planning Partnership. Stakeholder outreach began early in the planning process, and formal and informal outreach efforts by the many Planning Partners involved in the effort continued throughout the process:

- All Planning Partnership meetings were open to the public and advertised via the Planning Partnership's HMP website (https://www.burlingtoncountynjhmp.com).
- The Planning Partners were provided with outreach materials to post on their websites and social media platforms, along with printed materials to distribute.
- A stakeholder survey and neighbor survey collected input regarding vulnerabilities, capabilities, and mitigation projects.
- The draft plan was posted on the Burlington County HMP website and advertised using social media platforms.
- Email correspondence was sent to regional stakeholders and neighboring communities asking them to review the draft HMP and provide input.

This HMP update includes information and input provided by these stakeholders where appropriate, as identified in the references. This subsection lists stakeholders that were invited to participate in the development of this HMP update, and how these stakeholders participated and contributed. This is only a summary of the many stakeholders that were aware of and/or contributed to this HMP update, demonstrating the breadth of the stakeholder outreach efforts made during the plan update process.

2.3.1 Federal, State, and County Agencies

The following describes the various departments and agencies that were involved during the planning process. Appendix B (Participation Documentation) provides further details regarding government agency participation. All responses to the stakeholder surveys may be found in Appendix D (Outreach).

Federal Agencies

FEMA Region 2: Provided updated planning guidance and conducted plan review.

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

- National Climatic Data Center (NCDC)
- National Hurricane Center (NHC)
- National Oceanic and Atmospheric Administration (NOAA)
- National Weather Service (NWS)
- Storm Prediction Center (SPC)
- U.S. Army Corps of Engineers (USACE)
- U.S. Census Bureau
- U.S. Department of Agriculture (USDA)
- U.S. Department of Health and Human Services
- U.S. Environmental Protection Agency (EPA)
- U.S. Geological Survey (USGS)

State Agencies

New Jersey Office of Emergency Management (NJOEM): Administered the planning grant, provided updated planning guidance, and provided review of the draft HMP update.

The following state agencies were invited to take the stakeholder survey and provide input to the planning process:

- New Jersey Pinelands Commission
- New Jersey Department of Environmental Protection
  - Watershed and Land Management
    - Dam Safety
    - Flood
- State Park Service

County Agencies and Departments

Several Burlington County agencies and departments were represented in the Planning Partnership and involved in the HMP update planning process:

- Burlington County Administration
- Burlington County Agriculture Development Board
- Burlington County Department of Health
- Burlington County Department of Public Information
- Burlington County Department of Public Works
- Burlington County Department of Resource Conservation
- Burlington County Division of Emergency Management
- Burlington County Division of GIS
- Burlington County Division of Solid Waste
- Burlington County Department of Information Technology
- Burlington County Planning Board
- Burlington County Stormwater Management Committee

Refer to Section 5 (Capability Assessment) for details on each department, their roles during the HMP update, and their overall responsibilities in the Planning Area.

2.3.2 Regional and Local Stakeholders

All Planning Partnership meetings were announced on the HMP project website and posted on social media to invite residents and stakeholders. In addition, Planning Partnership representatives emailed regional and local stakeholders requesting their participation in stakeholder sector-specific surveys to provide input on vulnerable assets, capabilities, and current/potential future mitigation projects. These stakeholders also were invited to provide input on the draft HMP.

Appendix C (Participation Documentation) provides further details regarding regional and local stakeholder agency attendance at meetings. Appendix D includes details on the public and stakeholder outreach, including responses received to the surveys.

Academia

Schools, universities, and other academic institutions were invited to attend planning process meetings and asked to complete the stakeholder survey:

- Bordentown Regional School District
- Burlington City Public Schools
- Burlington Township School District
- Holy Cross Preparatory Academy
- Northern Burlington County Regular School District
- Rowan College at Burlington County
- Burlington County Institute of Technology

The following provided input during the process:

- Burlington County Superintendent of Schools: Completed the stakeholder survey

Business, Commercial, and Non-Profit Interests

The following businesses, commercial industries, and non-profits in the Planning Area were invited to take the stakeholder survey and provide input to the planning process:

- AECOM
- American Legion
- American Red Cross of Southern New Jersey
- Boy Scouts of America, Garden State Council
- Burlington County Regional Chamber of Commerce
- Cross County Connections
- Delaware River Basin Commission
- Delaware Valley Regional Planning Commission (DVRPC)
- Food Bank of South Jersey
- Girl Scouts of Central & Southern NJ (GSCSNJ)
- Jacques Cousteau National Estuarine Research Reserve (JC NERR)
- McCollister's Transportation Group Inc.
- NJ Future
- Sustainable Jersey

The American Red Cross of Southern New Jersey completed the stakeholder survey. The American Red Cross of Southern New Jersey provides support during disasters by providing assistance to those in need.

Emergency Services

All municipalities invited their local emergency service providers (police, fire, and EMS) to take the stakeholder survey and provide input to the planning process. In addition, the following county and regional emergency service providers were invited to take the stakeholder survey and provide input to the planning process:

- American Red Cross of Southern New Jersey
- Burlington County Animal Response Team
- Burlington County Community Emergency Response Team
- Burlington County Volunteer Organizations Active in Disasters (VOAD)/Community Organizations Active in Disasters (COAD)

The following emergency service providers completed the stakeholder survey:

- Beverly City Fire District
- Beverly City Public Safety
- Delanco Township Fire Department
- Delanco Township Police Department
- Evesham Township Fire District
- Evesham Township Office of Emergency Services
- Mount Laurel Fire Department
- Vincent Fire Company

The following emergency service providers provided input during the annex development:

- Mansfield Township Fire Department
- Riverton Borough Police Department
- Delran Township Fire Department
- Edgewater Park Township Police Department
- Evesham Township Fire District
- Evesham Township EMS
- Mansfield Township Fire Department
- New Hanover Township Police Department
- North Hanover Township Police Department
- Pemberton Borough Fire Department
- Pemberton Township Fire Department
- Westampton Township Police Department

Healthcare

Healthcare facilities and providers located in the Planning Area were invited to take the stakeholder survey and provide input to the planning process, including:

- Buttonwood Behavioral Health Hospital
- Kessler Institute for Rehabilitation
- Virtua Health – Virtua Marlton

- Virtua Health – Virtua Willingboro Hospital
- Virtua Memorial Hospital of Burlington County

Transportation

County and local highway and public works departments were notified of the stakeholder survey and invited to provide input on the draft HMP. Additional transportation stakeholders invited to take the stakeholder survey and provide input included the following:

- Burlington County Bridge Commission
- BurLINK Bus System
- Delaware Valley Regional Planning Commission
- NJ DOT
- NJ TRANSIT
- SEN HAN Transit
- South Jersey Transportation Authority

Responses were received from the following agencies and incorporated into municipal annexes:

- Beverly City Public Safety
- Delanco Township Public Works
- Medford Township Public Works

Utilities

Utility providers in the Planning Area were invited to take the stakeholder survey and provide input to the planning process, including the following:

- NJ American Water
- PSE&G
- Municipal utility providers

Wrightstown Municipal Utilities Authority noted support for socially vulnerable communities. Edgewater Park Sewerage noted prior impacts from Superstorm Sandy and concerns with lightning from severe weather events impacting services. This input was incorporated into the corresponding municipal annexes.

Adjacent Counties and Municipalities

Burlington County conducted outreach to keep the counties and surrounding municipalities apprised of the project, invite jurisdictions to take the neighboring community survey, and allow the opportunity to provide input to this planning process. This included direct outreach to every municipality bordering Burlington County (including those across the Delaware River in Pennsylvania) and the following:

- Atlantic County (NJ) Office of Emergency Management

- Bucks County (PA) Emergency Management Agency
- Camden County (NJ) Office of Emergency Management
- Mercer County (NJ) Office of Emergency Management
- Monmouth County (NJ) Division of Emergency Management
- Ocean County (NJ) Office of Emergency Management
- Philadelphia County (PA) Office of Emergency Management

Other Stakeholders

Dam Operators

Agencies that were identified as the owner of one or more high hazard potential dams located in Burlington County were requested to assist in the development of the HMP by answering the following questions:

- Do you have information, data, or resources you would like to provide the County regarding concerns with your dam's risk of failure as a result of deficiencies or exposure to hazards such as flooding, geologic impacts, and severe storms?
- Do you have concerns with the safety of your dam due to changing climate conditions?
- Are there any concerns with your emergency action plan including warning time, evacuation needs, etc.?
- Have you recently started/completed any repairs/improvements to your dam?
- Do you have any potential mitigation actions (planning, structure and infrastructure, education and outreach, natural system, etc.) that would involve your dam that should be considered for inclusion in the HMP mitigation strategy?

One response was received from the Burlington County Parks Department regarding the Smithville Dam. The Parks Department noted that there are no current concerns surrounding the dam's risk of failure, dam safety, warning time, or evacuation needs. There have been no repairs made to the dam, just minor maintenance. No mitigation actions were identified by the Parks Department for the Smithville Dam.

Military Installations

Burlington County asked representatives of Joint Base McGuire-Dix-Lakehurst to take the stakeholder survey and provide input to the planning process.

Socially Vulnerable Populations and Underserved Communities

The Steering Committee and Planning Partnership were asked to consider socially vulnerable populations and underserved communities throughout the planning process. During the kickoff meetings for the Steering Committee and Planning Partnership, the following populations and communities were identified:

- Individuals 65 years of age or older

- Individuals 5 years of age or younger
- Non-English speaking individuals
- Individuals with a disability
- Individuals below the poverty level

Noting that households can still struggle financially despite being above the poverty threshold, the Steering Committee identified households that are above the federal poverty level but earn less than the cost of living as socially vulnerable as well.

Each Burlington County Department was asked to identify personnel who interact with the above mentioned socially vulnerable populations and underserved communities in the County. Information was requested to identify the needs of these communities, how information is distributed to the populations, and any actions which could be taken to help socially vulnerable populations become more resilient to natural hazards. County Departments that work closely with socially vulnerable populations and underserved communities include:

- Burlington County Animal Response Team
- Burlington County Community Emergency Response Team
- Burlington County Health Department
- Burlington County Human Services
- Burlington County Sheriff's Department
- Burlington County Volunteer Organizations Active in Disasters (VOAD)/Community Organizations Active in Disasters (COAD)

Municipal departments such as emergency management and public works were also asked if and how they support socially vulnerable populations and underserved communities. In addition, the following non-governmental 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:

- American Legion
- American Red Cross of Southern New Jersey
- Boy Scouts of America, Garden State Council
- Catholic Charities
- Food Bank of South Jersey
- Girl Scouts of Central & Southern NJ (GSCSNJ)

All of the above departments, agencies, and organizations were asked how they support socially vulnerable populations and underserved communities and what potential risks to these groups should be considered in the HMP and potentially addressed through mitigation actions. The following input was received from groups that work with socially vulnerable populations and underserved communities.

- Beverly City Public Safety noted that it supports an overburdened community with a large senior population, limited English proficiency, and economically disadvantaged individuals and families. Support includes providing resources for information and providing assistance for the most vulnerable and those impacted during and after hazard events.
- Medford Township Public Works noted that it supports neighborhoods that house senior citizens, apartments, and townhouses that have been identified as needing additional assistance during and after hazard events.
- The Wrightstown Municipal Utilities Authority noted that it helps customers contact the state to apply for assistance programs and support water testing for underserved communities.
- The Mount Laurel Fire Department noted that it provides emergency services and community outreach services for socially vulnerable populations.
- The American Red Cross of Southern New Jersey noted it is trained to assist all individuals, especially those who are considered vulnerable during and after disasters.
- The Vincent Fire Company, which services the Township of Southampton, noted it is aware of the location of socially vulnerable populations that would need additional assistance during disaster events.

All members of the Planning Partnership were provided with a brochure on the HMP update and asked to post it in facilities with high traffic of the public, including socially vulnerable populations, in an attempt to conduct outreach to individuals that do not have access to online surveys.

When the HMP was posted for public review, all of the aforementioned groups that work with socially vulnerable populations and underserved communities were notified of the public posting and opportunities for public input and asked to help publicize the public review period with their constituents and socially vulnerable populations and underserved communities that they work with.

Stakeholder Survey

The survey was designed to help identify general needs for hazard mitigation and resiliency within Burlington County from stakeholders' perspective, as well as to identify specific projects that may be included in the mitigation plan. It was distributed beginning in October 2023 to identified stakeholders, including county and municipal departments and agencies. As of May 3, 2024, 16 stakeholders completed the survey, representing the following sectors: academic/research, community-based organizations, emergency services, hospitals/medical services, non-profit organizations, public works, and utility providers. A large homeowners association also completed the survey. The following provides a summary of responses. For complete survey results, refer to Appendix D (Public and Stakeholder Outreach).

A majority of respondents (47 percent) indicated that they provide emergency services within the County, followed by public works and utility providers (13 percent each), then academia, community-based organizations, and non-profit organizations (7 percent each).

Fifty-seven percent of respondents indicated that they work with or help support socially vulnerable populations. This includes interacting with senior citizens, those with limited English proficiency, and those with financial challenges. Support includes education and outreach, assistance with applying to support programs, and emergency response.

Sixty-seven percent of respondents stated that their buildings/facilities/structures have been impacted by a hazard event, including flooding, high winds, and lightning.

A majority of respondents (82 percent) stated that response capabilities are their primary concern regarding hazards, followed by likelihood of specific hazard events (55 percent), and vulnerability of specific facilities (45 percent). Respondents identified different capabilities they have to help Burlington County and its residents address hazards, primarily focused on disaster and emergency response services.

Neighbor Survey

The neighbor survey was sent to municipalities and counties surrounding Burlington County. Due to their proximity, effects of hazard events that impact the Planning Area would be similar to those of their neighbors. As of May 3, 2024, eight responses were received, representing Bristol Township and Fall Township in Bucks County, PA; Berlin Township and Cherry Hill Township in Camden County, NJ; Lacey Township and Manchester Township in Ocean County, NJ; and the City of Philadelphia, PA. The following provides a summary of responses.

- Fifty percent of respondents noted that shared service or mutual aid agreements are in place between their jurisdiction and Burlington County municipalities for emergency staff for evacuations/disaster response.
- The majority of respondents (80 percent) noted that their jurisdiction has access to contact information for Burlington County's emergency operation centers.
- Respondents noted that information on emergency response operations are shared between their jurisdiction and Burlington County.
- Respondents noted the potential for future collaboration on emergency management operations and hazard mitigation, including a potential regional hazard mitigation workshop and establishing communication avenues for fire, EMS, and police across county and state boundaries.

For complete survey results, refer to Appendix D (Public and Stakeholder Outreach).

2.4 PUBLIC PARTICIPATION – PUBLIC INVOLVEMENT

2.4.1 Public Outreach Activities

Community input on the HMP will increase the likelihood of hazard mitigation becoming one of the standard considerations in the evolution and growth of the Planning Area. In order to facilitate better coordination and communication between the Planning Partnership and citizens and to involve the public in the planning process, meeting dates and locations were made available to the public via the Burlington

County HMP website (https://www.burlingtoncountynjhmp.com) and social media. The draft HMP also was made available on the Burlington County HMP website. The Planning Partnership made the following efforts toward public participation in the development and review of the HMP:

- A dedicated website was created for this project (https://www.burlingtoncountynjhmp.com). The website went live in August 2023 and was continuously updated throughout the planning process. The public website contains a project overview, meeting announcements, draft documents for review and comment, and a link to the public and stakeholder surveys.
- An online StoryMap was developed to provide information regarding the hazard mitigation planning process and an opportunity for virtual public participation. (https://bit.ly/49BPC8o).
- All hazard mitigation Planning Partnership meetings that were open to the public were advertised on the Burlington HMP website and social media accounts (Facebook, Instagram, and Twitter).
- An online hazard preparedness public survey was developed to gauge household preparedness for hazards that may impact the Planning Area and to assess the level of knowledge of tools and techniques to assist in reducing risk and loss associated with those hazards. The survey asked quantifiable questions about citizen perception of risk, knowledge of mitigation, and support of community programs. It also asked demographic questions to help analyze trends. The survey was available on the HMP website from January 2023 through December 2023, and further advertised on additional Planning Partnership websites and on printed materials. Reponses were collected and provided to Planning Partners for consideration in developing mitigation action (99 responses in total).
- Results from the hazard preparedness survey were used to inform the action plans of the Planning Partners. To address the most requested types of projects that residents wanted local and county agencies to be doing, many Planning Partners included actions to improve and strengthen infrastructure, improve the damage resistance of utilities, buy out flood-prone properties, improve protective structures, and provide greater control over development in high hazard areas.
- All Planning Partners were encouraged to advertise the availability of the project website, citizen survey and stakeholder surveys via local homepage links and other available public announcement methods (e.g., Facebook, Twitter, email blasts).
- A public meeting was held on November 9, 2023, to introduce the planning process, present the public with the results of the risk assessment, and ask for input on the plan. The meeting was recorded and posted on the planning project website for those that were unable to attend.
- Residents of the Planning Area were provided opportunity to comment on the draft HMP before submittal to FEMA. A public meeting was held on February 20, 2024, to present the draft plan, announce the draft plan review period, and ask for input from the public. The HMP was posted for review on the HMP public website on February 21, 2023. All Planning Partners were requested to assist with advertising the availability of the plan via their websites and social media. Public comments received through March 25, 2023, were distributed to the Planning Partners for their consideration.

Additional examples of public outreach efforts, and results of surveys distributed, are presented in Appendix D (Public and Stakeholder Outreach Documentation).

2.4.2 Public Survey Responses

The following is a summary of key responses to the online hazard preparedness public survey.

- Survey respondents indicated they were from the City of Beverly, Township of Bordentown, City of Burlington, Township of Burlington, Township of Cinnaminson, Township of Delanco, Township of Eastampton, Township of Edgewater Park, Township of Evesham, Township of Mansfield, Township of Maple Shade, Township of Medford, Township of Moorestown, Township of Mount Holly, Township of Mount Laurel, Township of Mount Holly, Township of Pemberton, Township of Shamong, and Township of Southampton.
- The majority of respondents have lived in Burlington County for over 20 years (54 percent), own their residence (94 percent), and live in a single-family home (85 percent).
- The majority of residents were over the age of 61 (47 percent).
- Three of the eight respondents who indicated their home is located in a floodplain reported that they do not have flood insurance.
- Most respondents (70 percent) indicated that they receive emergency information through the internet, followed by television news (67 percent) and then mass notification systems (61 percent).
- Twenty-two percent of respondents said their home has been damaged from a hazard event. Damage reported was related to hail, wind, flooding, and extreme temperature (heat and cold).

Information on problem areas and potential mitigation actions identified by respondents was provided to the applicable jurisdiction for consideration in mitigation strategy development. For complete survey results, refer to Appendix D (Public and Stakeholder Outreach).

2.4.3 Public Review Period

Burlington County hosted a public meeting on February 20, 2024, to provide the public with an update on the status of the planning process, discuss the structure of the updated HMP, and announce that the draft of the HMP was available for public review. Members of the Planning Partnership were asked to share information about the draft review period on their municipal websites and social media. The draft HMP was available on the project website for 35 days. No members of the public submitted comments.

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

The Burlington County HMP uses the best available technical information, plans, studies, and reports to support hazard profiling; risk and vulnerability assessment; review and evaluation of mitigation capabilities; and the identification, development, and prioritization of mitigation strategies.

The asset and inventory data used for the risk and vulnerability assessments is presented in the County Profile (Section 3). Details of the source of this data, along with technical information on how the data was used to develop the risk and vulnerability assessment, is presented in Section 4.2 (Methodology and Tools) and throughout the hazard profiles in Section 4.3. Sources of technical data and information used are listed in the References section.

Plans, reports, and other technical information were identified and provided directly by the Planning Partnership or by stakeholders involved in the planning effort, as well as through independent research by the planning consultant. The Planning Partners were tasked with updating the inventory of their planning and regulatory capabilities in their jurisdictional annexes and providing relevant planning and regulatory documents, as applicable. Relevant documents, including plans, reports, and ordinances were reviewed to identify the following:

- Existing local and regional capabilities
- Needs and opportunities to develop or enhance capabilities, which may be identified as actions in the mitigation strategies
- Mitigation-related goals or objectives considered in the review and update of the overall goals and objectives in Section 6
- Proposed, in-progress, or potential mitigation projects, actions, and initiatives to be incorporated into the updated County and local mitigation strategies

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

- Master/comprehensive plans
- Building codes
- Zoning and subdivision ordinances
- NFIP flood damage prevention ordinances
- Site plan requirements
- Stormwater management plans
- Emergency management and response plans
- Land use and open space plans
- Capital plans
- State of New Jersey Hazard Mitigation Plan (2019)
- Burlington County Hazard Mitigation Plan Update (2019)

2.6 INTEGRATION WITH EXISTING PLANNING MECHANISMS AND PROGRAMS

Effective mitigation is achieved when hazard awareness and risk management approaches and strategies become an integral part of public activities and decision-making. Within the Planning Area, there are many existing plans and programs that support hazard risk management, so it is critical that this HMP integrate, coordinate with, and complement those mechanisms.

Section 5 (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 within the Planning Area. Within each annex in Volume II, the Planning Partners identified how they integrate hazard mitigation into their existing planning, regulatory, and operational/administrative framework (integration capabilities) and how they intend to promote this integration further (integration actions). A summary of the plan reviews indicating relevant goals and mitigation actions is provided in Appendix E. This information provided input to identify integration of mitigation concepts into the operations of the Planning Partners.

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

2.7 CONTINUED PUBLIC INVOLVEMENT

Burlington County is committed to the continued involvement of the public in the hazard mitigation process. This HMP update will be made available for review on the HMP public website. Each jurisdiction's elected official shall be responsible for receiving, tracking, and filing public comments regarding this HMP update. Further details regarding continued public involvement are provided in Section 7 (Plan Maintenance).

After completion of this HMP update, 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 designated HMP Coordinator will be responsible for coordinating an annual plan evaluation meeting, soliciting feedback, collecting, and reviewing comments, and ensuring their incorporation in the 5-year plan update as appropriate. Members of the Planning Partnership will assist the HMP Coordinator. Additional meetings may be held as deemed necessary to provide the public an opportunity to express concerns, opinions, and ideas about the HMP.

The public will have an opportunity to comment on the HMP update as a part of the annual mitigation planning evaluation process and the next five-year mitigation plan update. A notice regarding annual updates of the plan and the location of plan copies will be publicized after the annual plan evaluation meeting (refer to Section 7 – Plan Maintenance) and posted on the Burlington County HMP website at https://co.burlington.nj.us/462/All-Hazards-Mitigation-Plan.

Kristen Carr (Burlington County Deputy Emergency Management Coordinator) has been identified as the ongoing HMP Coordinator and is responsible for receiving, tracking, and filing public comments regarding this HMP update. Contact information is:

Mailing Address:	Burlington County Division of Emergency Management 1 Academy Drive, Westampton, New Jersey 08060
Contact Name:	Kristen Carr

Email Address: krcarr@co.burlington.nj.us
Phone Number: (609) 738-5139

SECTION 3. COUNTY PROFILE

2024 HMP Update Changes

- The County Profile contains updated information regarding the County's physical setting, population and demographics and trends, general building stock, land use and trends, and critical facilities.
- Critical facilities are organized under FEMA's updated lifelines definitions.

3.1 GENERAL DESCRIPTION AND HISTORY

Burlington County is located in the center of New Jersey (see Figure 3-1). With a total area of 827 square miles, Burlington County is the largest of New Jersey's 21 counties. According to the most recent U.S. decennial census, the County's 2020 population was 461,860, making it the 11th most populated county in New Jersey (U.S. Census 2021).

The Lenni-Lenape Indians were the original aboriginal owners of the land that is now Burlington County. In October 1677, a group of English debarked from the ship Kent and founded the Town of Burlington. Burlington County was later incorporated on May 17, 1694. The American Indians sold more and more of their lands to the new settlers until, in 1801, there remained fewer than 100 adult American Indians on the Indian Mills reservation, which was the first American Indian reservation in the United States and the American Indian's last dwelling place in Burlington County (Burlington County 2019).

The County's waterways were a principal factor in the early and successful settling of Burlington County. These transportation systems were vital at the time to trade and travel. Consequently, the earliest homes and the earliest settlements were on the waterways. Burlington, thriving at its river location, was the port of entry. Several of its early inhabitants moved on to establish farms in the fertile valleys, being generally careful to choose creek-valleys where a landing and a waterway ensured easy transport to Burlington or Philadelphia (Burlington County 2019).

3.2 MAJOR PAST HAZARD EVENTS

Federal disaster declarations are typically issued for hazard events that cause more damage than state and local governments can handle without assistance from the federal government, although no specific dollar loss threshold has been established for these declarations. A federal disaster declaration puts federal recovery programs into motion to help disaster victims, businesses, and public entities. Some of the programs are matched by state programs. Review of federal disaster declarations helps establish the probability of reoccurrence for each hazard and identify targets for risk reduction. Table 3-1 shows federal disaster declarations that included Burlington County through 2023 (records date back to 1954).

Figure 3-1. Burlington County

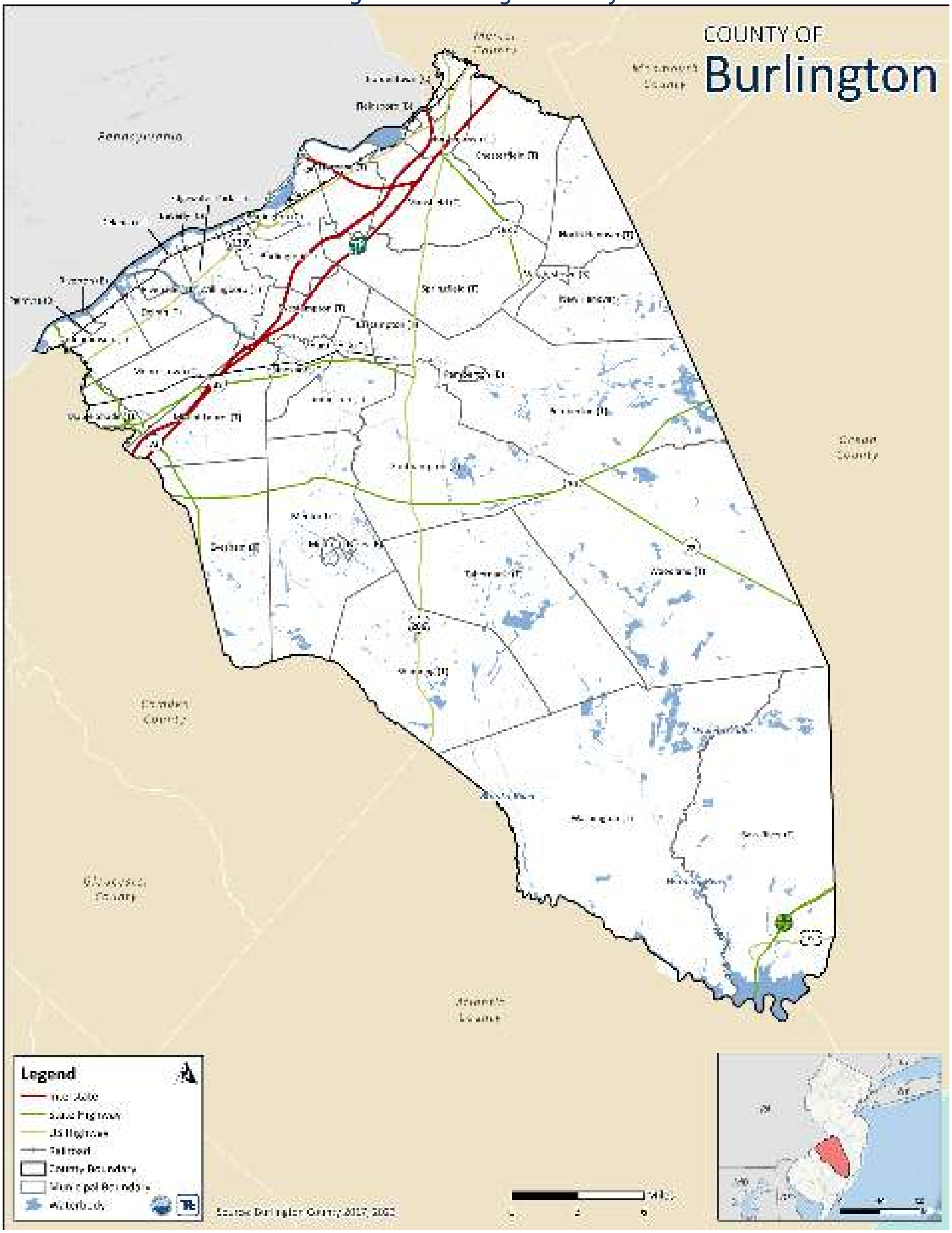


Table 3-1. History of FEMA Declarations in Burlington County

Disaster Number	Event Date	Declaration Date	Incident Type	Title
DR-205	August 18, 1965	August 18, 1965	Drought	Water Shortage
DR-310	September 4, 1971	September 4, 1971	Flood	Heavy Rains & Flooding
DR-477	July 23, 1975	July 23, 1975	Flood	Heavy Rains, High Winds, Hail & Tornadoes
DR-528	February 8, 1977	February 8, 1977	Severe Ice Storm	Ice Conditions
EM-3083	October 19, 1980	October 19, 1980	Drought	Water Shortage
EM-3106	March 13-17, 1993	March 17, 1993	Snow	Severe Blizzard
DR-1088	January 7-12, 1996	January 13, 1996	Snow	Blizzard of 96 (Severe Snow Storm)
EM-3148	September 16-18, 1999	September 17, 1999	Hurricane	Hurricane Floyd Emergency Declarations
EM-3156	May 30-November 1, 2000	November 1, 2000	Other	West Nile Virus
EM-3169	September 11, 2001	September 19, 2001	Fire	Fires and Explosions
EM-3181	February 16-17, 2003	March 20, 2003	Snow	Snow
DR-1530	July 12-23, 2004	July 16, 2004	Severe Storm	Severe Storms and Flooding
EM-3257	August 29-October 1, 2005	September 19, 2005	Hurricane	Hurricane Katrina Evacuation
DR-1694	April 14-20, 2007	April 26, 2007	Severe Storm	Severe Storms and Inland and Coastal Flooding
FM-2695	May 15, 2007	May 16, 2007	Fire	Warren Grove Fire
DR-1873	December 19-20, 2009	February 5, 2010	Snow	Snowstorm
DR-1889	February 5-6, 2010	March 23, 2010	Snow	Severe Winter Storm and Snowstorm
DR-1897	March 12-April 15, 2010	April 2, 2010	Severe Storm	Severe Storms and Flooding
DR-1954	December 26-27, 2010	February 4, 2011	Snow	Severe Winter Storm and Snowstorm
DR-4021	August 27-September 5, 2011	August 31, 2011	Hurricane	Hurricane Irene
DR-4086	October 26-November 8, 2012	October 30, 2012	Hurricane	Hurricane Irene
DR-4231	June 23, 2015	July 22, 2015	Hurricane	Hurricane Sandy
DR-4264	January 22-24, 2016	March 14, 2016	Hurricane	Hurricane Sandy
DR-4368	March 6-7, 2018	June 8, 2018	Severe Storm	Severe Storm
EM-3451	January 20, 2020 – May 11, 2023	March 13, 2020	Biological	COVID-19 Pandemic
DR-4488	January 20, 2020 – May 11, 2023	March 25, 2020	Biological	COVID-19 Pandemic
DR-4574	August 4, 2020	December 11, 2020	Hurricane	Tropical Storm Isaias
EM-3573	September 1-3, 2021	September 2, 2021	Hurricane	Remnants of Hurricane Ida
DR-4614	September 1-3, 2021	September 5, 2021	Hurricane	Remnants of Hurricane Ida

Source: FEMA 2023

3.3 PHYSICAL SETTING

3.3.1 Location

Burlington County extends from the Delaware River to Great Bay at the mouth of the Mullica River. The County is bordered to the north by Mercer and Monmouth Counties, to the east by Ocean County, to the south by Atlantic County, to the southwest by Camden County, and to the northwest by the Delaware River and Pennsylvania. The County is located within the Philadelphia-Camden-Wilmington Metropolitan Statistical Area (MSA). The 40 municipalities in the County consist of three cities, six boroughs and 31 townships. The county seat is Mount Holly (Burlington County 2023).

3.3.2 Water Resources

This section describes Burlington County's major water bodies and watersheds. A watershed is the area that drains into a body of water such as a river, lake, stream, or bay. It is separated from other systems by high points such as hills or slopes. It includes the water body and all land that drains to it. Drainage basins generally are large watersheds that encompass the watersheds of many smaller rivers and streams.

Waterways

Burlington County's total area of 529,351 acres includes 5,191 acres of water (Burlington County 2019). The major bodies of water and waterways are the Delaware River, the Oswego River, the Bass River, the Batsto River, the Mullica River, the Wading River, the West Branch Wading River, Rancocas Creek, North Branch Rancocas Creek, South Branch Rancocas Creek, Southwest Branch Rancocas Creek, Crosswicks Creek, Big Timber Creek, South Branch Mount Misery Brook, Shoal Branch, Greenwood Branch, and Great Bay (FEMA 2019). The County has numerous manmade small lakes and ponds created through modifying streams and creeks, including Oswego Lake, Harrisville Lake, and Lake Absegami. Figure 3-2 shows the waterways of Burlington County.

Watershed Management Areas

In New Jersey, mapping has been developed of HUC 11 drainage basins as defined by the U.S. Geological Survey (USGS), grouped into 20 watershed management areas (WMAs), which are in turn grouped into five watershed regions (WRs). All of these areas are shown on Figure 3-3.

Five of New Jersey's WMAs are at least partially within Burlington County, as described in the sections below. There are over 25 HUC 11 drainage basins that are contained within or partially located within Burlington County. These watersheds are shown in Figure 3-4.

WMA 13, Barnegat Bay

WMA 13, Barnegat Bay, includes watersheds in the central Atlantic drainage of New Jersey. The Barnegat Bay WMA is a 660 square mile area encompassing all of the land and water in Ocean County, as well as parts of Monmouth County and Burlington County. The area includes Barnegat Bay as well as the following surface waters: Metedeconk River, Toms River, Forked River, Cedar Creek (NJDEP 2021, State of New Jersey 2014).

WMA 14, Mullica

WMA 14, Mullica, includes watersheds draining portions of the Pinelands. It is approximately 561 square miles in size and approximately 80 percent of this area consists of state parks and forests. Major rivers include the Mullica, Wading River, Nochescatauxin Brook, Atsion Creek, Bass River, Batsto River, Nescochaque Creek, Landing Creek, Hammonton Creek, and the Oswego River. This WMA lies in Burlington, Atlantic, and Ocean Counties and includes the watersheds of Mullica River, Mechescatauxin Creek, Wading River, Atsion Creek, Batsto River, and Doughty Creek. The Mullica River and its tributaries are considered the primary drainage system for the Pinelands (NJDEP 2021, State of New Jersey 2014).

Figure 3-2. Burlington County Waterways

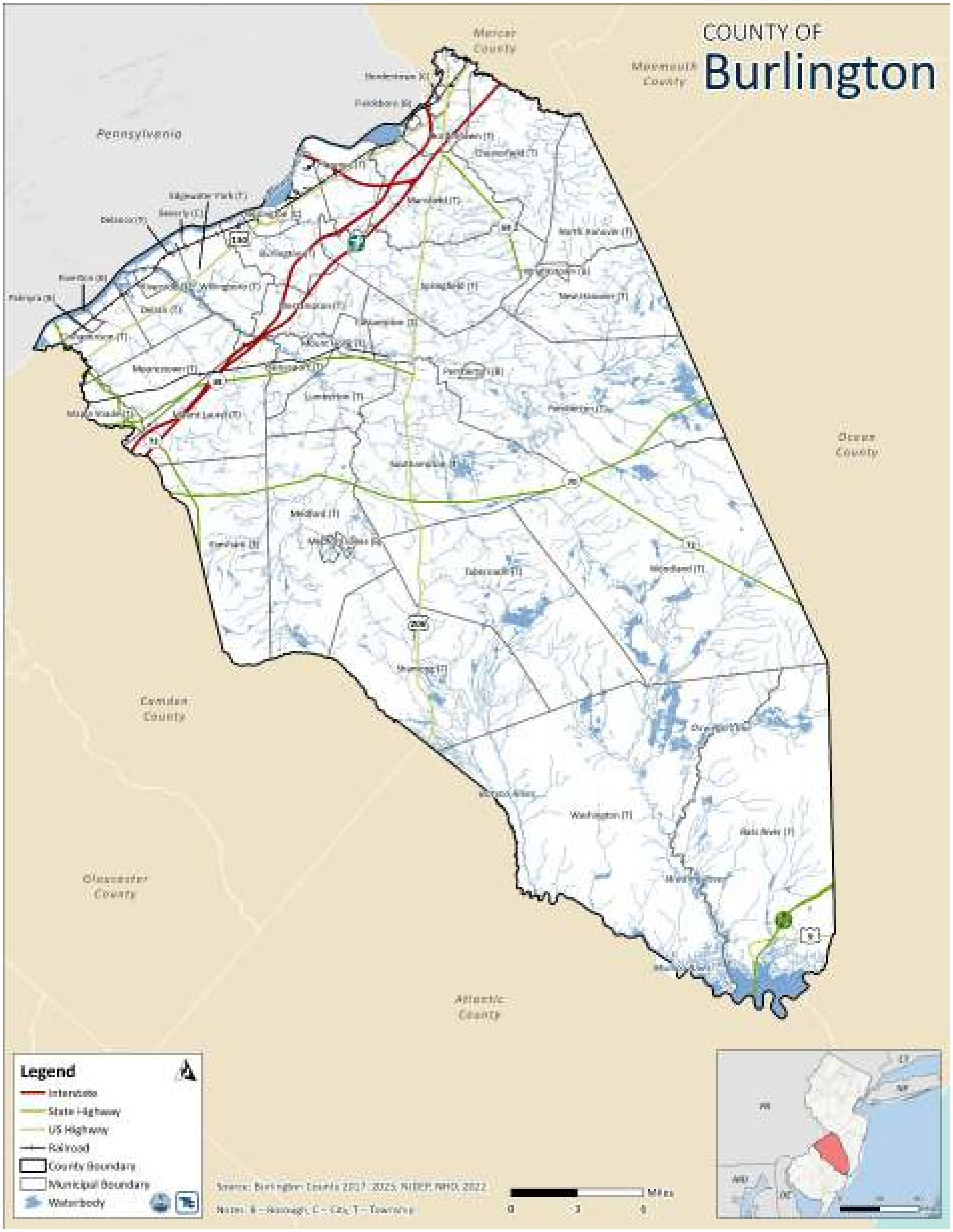
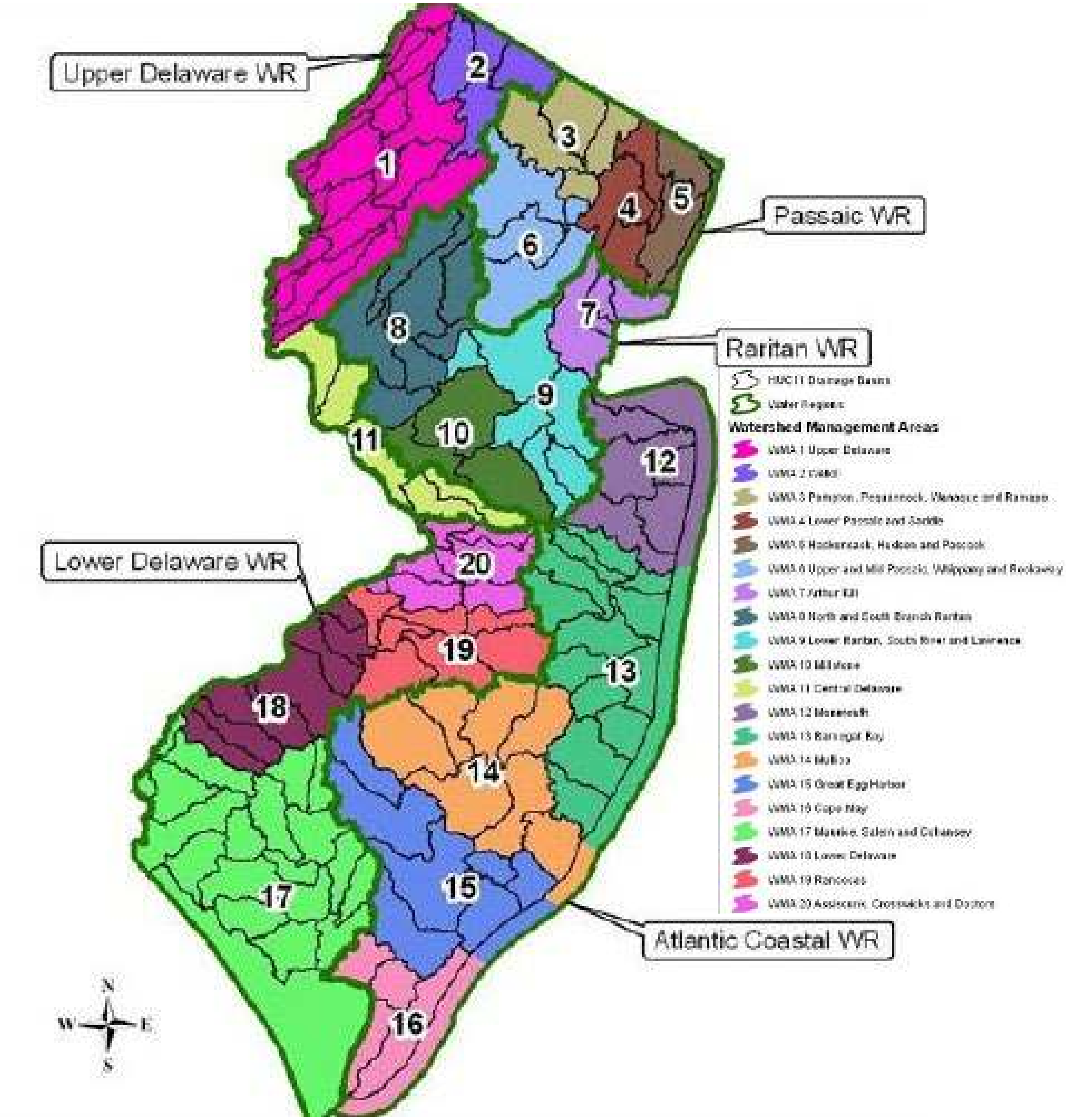
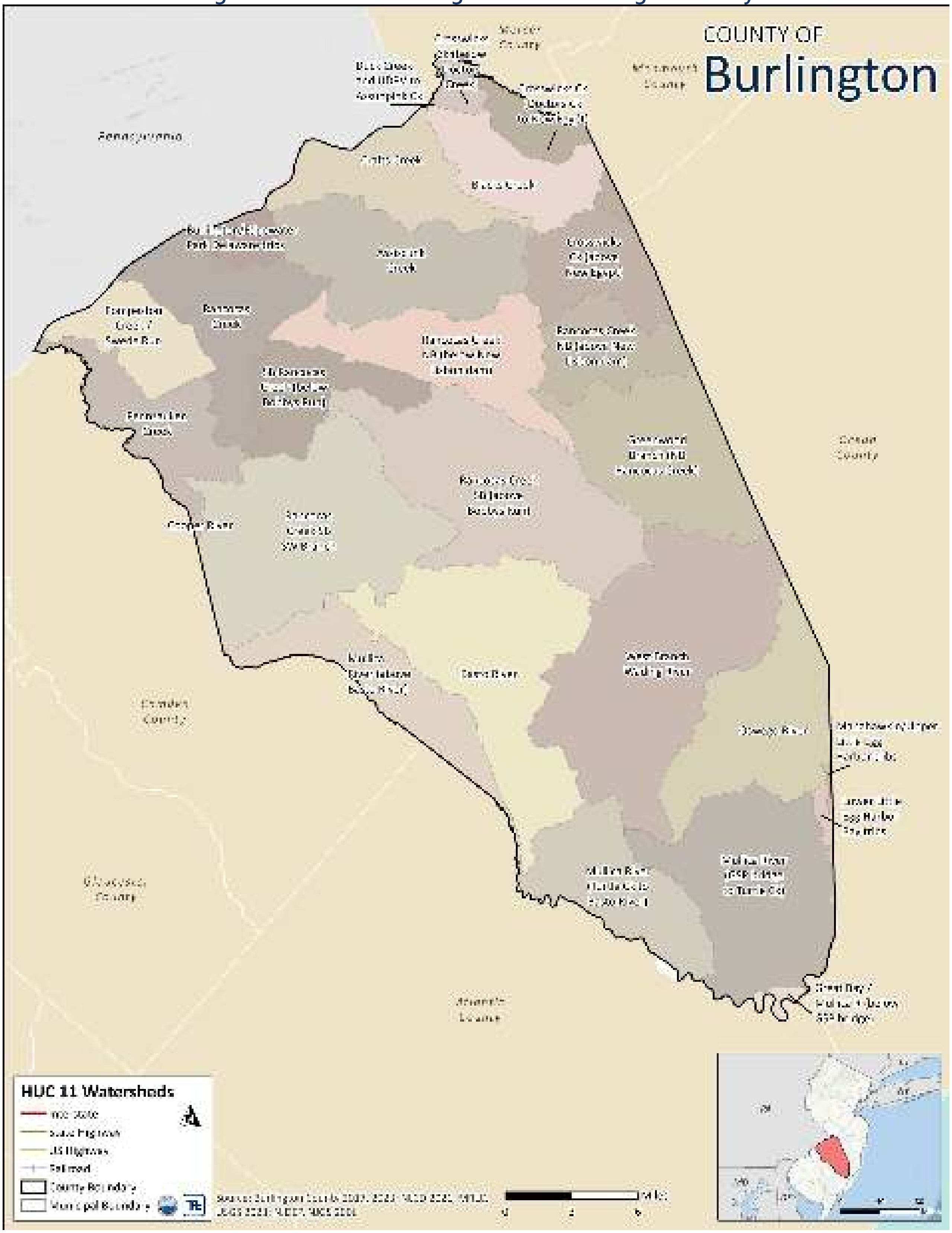


Figure 3-3. Watershed Management Areas of New Jersey



Source: *New Jersey Geological and Water Survey 2007*

Figure 3-4. HUC 11 Drainage Basins of Burlington County



WMA 18, Lower Delaware

WMA 18, Lower Delaware, includes the Cooper River, Big Timber, Mantua, Newton, Oldmans, Pennsauken, Pompeston, Raccoon, Repaupo, and Woodbury Creeks, as well as Baldwin Run, Swede Run, and Maple Swamps. This WMA covers all or parts of Burlington, Camden, and Gloucester counties, including 68 municipalities encompassing 391 square miles (NJDEP 2021, State of New Jersey 2014).

WMA 19, Rancocas

WMA 19, Rancocas, is the drainage area of the North and South Branch and the Main stem of Rancocas Creek, including Mill Creek. It covers portions of Burlington, Camden, and Ocean Counties. Approximately 33 municipalities make up this WMA, which covers an area of 360 square miles. The North Branch drains 167 square miles and the South Branch drains 144 square miles. The North Branch is 31 miles long and is fed by the Greenwood Branch, McDonalds Branch, and Mount Misery Brook. The major tributaries to the South Branch include the Southwest Branch Rancocas Creek, Stop the Jade Run, Haynes Creek, and Friendship Creek (NJDEP 2021, State of New Jersey 2014).

WMA 20, Assiscunk, Crosswicks, Doctors

WMA 20, Assiscunk, Crosswicks, Doctors, includes Assiscunk, Blacks, Crafts, Crosswicks, Doctors, Duck, and Mill Creeks. This WMA includes 26 municipalities spanning four counties: Burlington, Mercer, Monmouth, and Ocean, encompassing 253 square miles. Crosswicks Creek is 25 miles long and drains an area of 146 square miles to the Delaware River at Bordentown. Major tributaries include Jumping Brook, Lahaway Creek, North Run, and Doctors Creek. Tides affect this stream up to the Crosswicks Mill Dam. Allentown Lake, Oakford Lake, Prospertown Lake, and Imlaystown Lake are major impoundments in the Crosswicks Creek Watershed (NJDEP 2021, State of New Jersey 2014).

Delaware River Basin

The northern half of Burlington County lies within the Delaware River Basin (see Figure 3-5). The Delaware River is the longest un-dammed river in the United States east of the Mississippi River. The Delaware extends 330 miles from the confluence of its East and West branches at Hancock, New York to the mouth of the Delaware Bay where it meets with the Atlantic Ocean. The Delaware River is fed by 216 tributaries, with the largest being the Schuylkill and Lehigh Rivers in Pennsylvania. Overall, the Delaware River Basin contains over 13,000 square miles and drains portions of Pennsylvania, New York State, New Jersey, and Delaware. Over 15 million people rely on the waters of the Delaware River Basin for drinking, agricultural use, and industrial use (Delaware River Basin Commission 2023).

Three reaches of the Delaware River are included in the National Wild and Scenic Rivers System. The lower of these reaches is near the north end of Burlington County. The Lower Delaware Wild and Scenic Rivers Act, signed into law on November 1, 2000, added this 38.9-mile section of the main stem Delaware (and about 28 miles of selected tributaries) to the national system, linking the Delaware Water Gap and Washington Crossing, Pennsylvania, just upstream of Trenton, New Jersey (Delaware River Basin Commission 2023).

Figure 3-5. The Portion of the Delaware River Basin in New Jersey (shaded dark green)

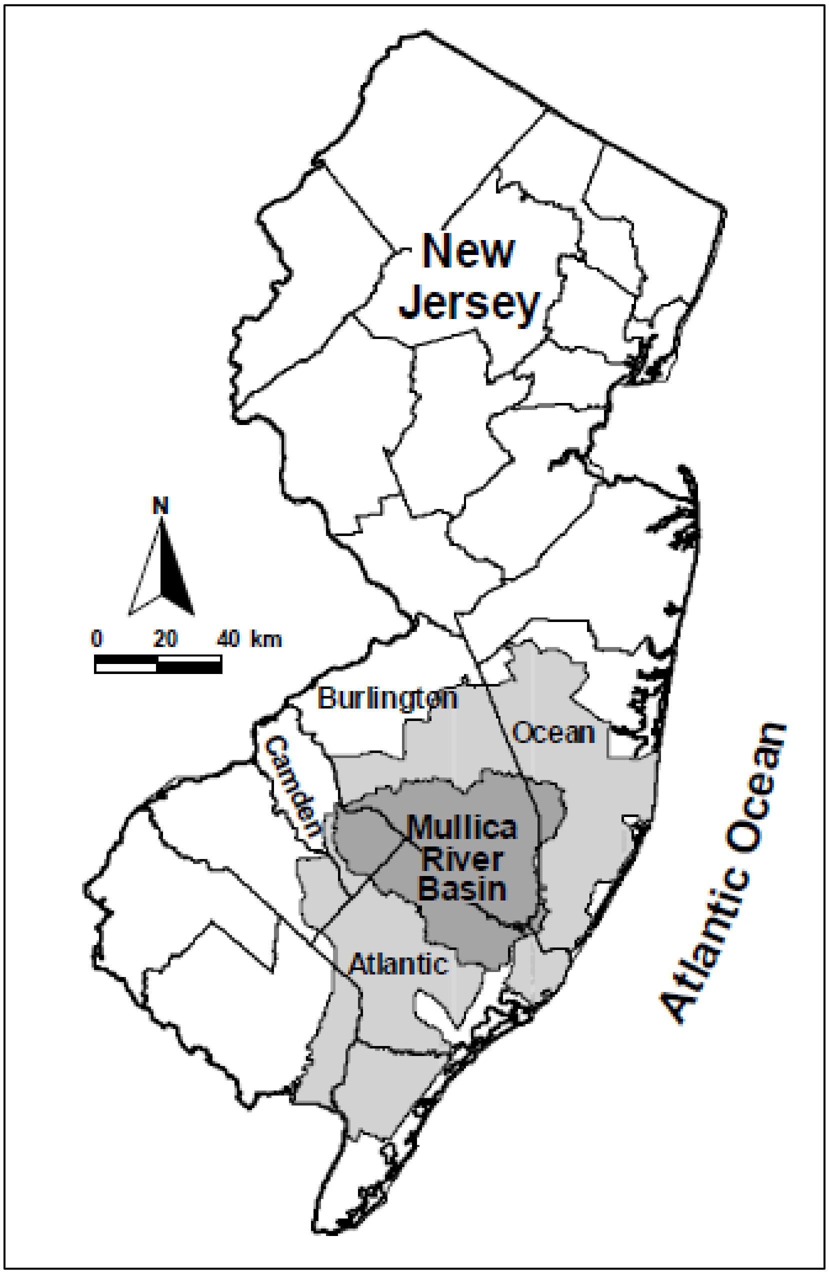
Source: (DRBC 2024)

TETRA TECH

Mullica River Basin

The 570-square-mile Mullica River Basin drains 23 municipalities in Atlantic, Burlington, Camden, and Ocean Counties. The unconfined Kirkwood-Cohanset aquifer system underlies the basin. The basin is dominated by undeveloped forest land, much of which is designated as state owned or wildlife management areas. The entire basin lies within the Pinelands National Reserve (see Figure 3-6). The Mullica River and its tributaries are renowned for their high-water quality and largely undisturbed ecosystems (Zampella and Bunnel 2000).

Figure 3-6. Regional Location of the Mullica River Basin in the Pinelands National Reserve

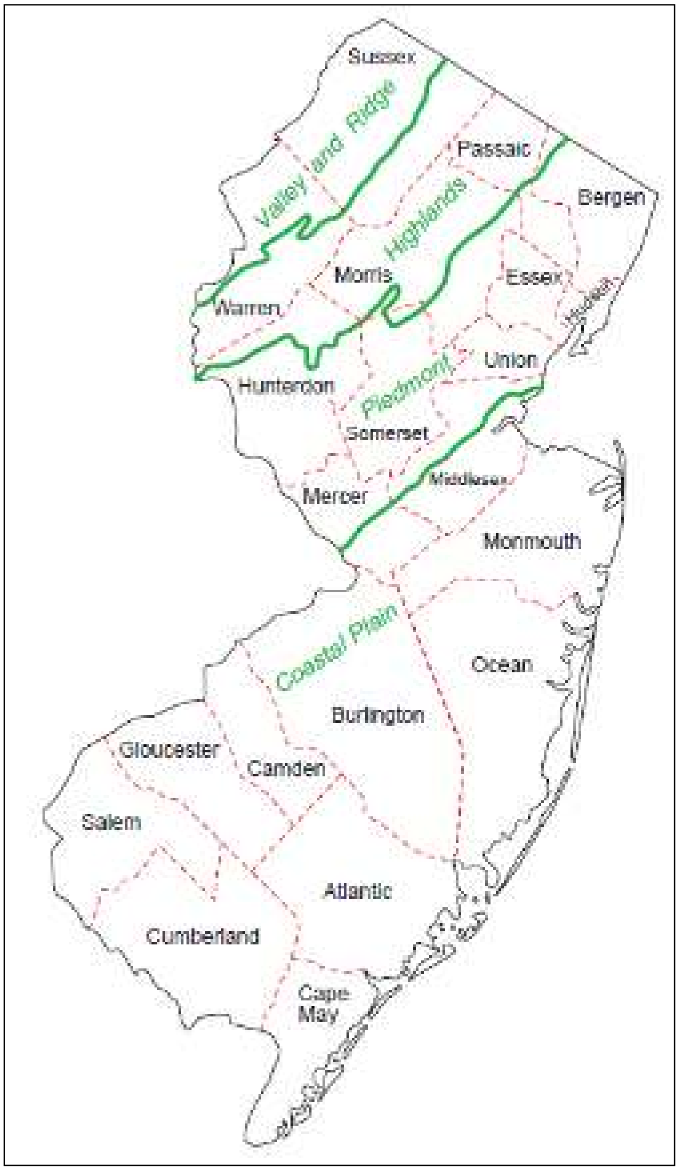


Source: Zampella and Bunnel 2000

3.3.3 Topography and Geology

Burlington County lies within the Atlantic Coastal Plain, one of the four major physiographic regions of New Jersey (Figure 3-7). The lowest parts of the County are at sea level along the Delaware River and the County's southeastern border along the Mullica River. The highest point is Arneys Mount, located in the Township of Springfield, at an elevation of approximately 260 feet above sea level (FEMA 2019). The unconsolidated deposits of the Coastal Plain dip gently to the southeast and range in age from the upper Cretaceous to Minocene (90 to 10 million years old) (Dalton 2003).

Figure 3-7. Physiographic Provinces in Burlington County



Source: Dalton 2003

According to the New Jersey Geological Survey (NJGS), the Coastal Plain begins with a broad trough that extends along the southern border of the Piedmont Province from Raritan Bay to Trenton. The streams that flow northwest to the Delaware have narrow valleys. They are shorter and have steeper gradients than the streams that flow southeast (Dalton 2003). The Coastal Plain is divided into the three subdivisions, whose appearance in Burlington County is as follows (Lucey 2001):

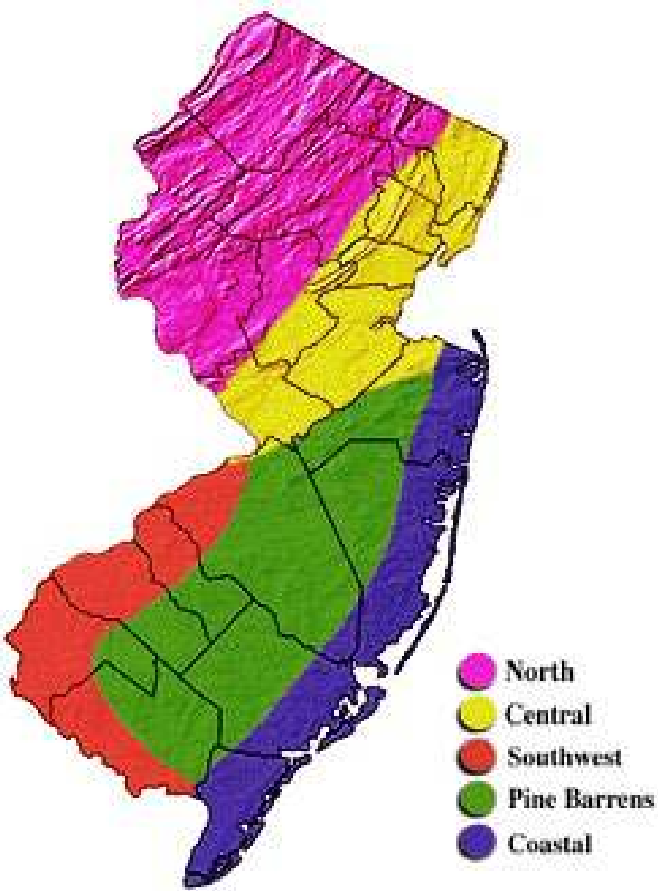
- The inner lowland is the area bordering the Delaware River, where elevations rarely exceed 100 feet above sea level. Streams in this inner lowland area drain to the Delaware River.
- The inner upland forms the drainage divide in the County and is a narrow, slightly dissected cuesta with some elevations up to 200 feet. Erosional remnants form the prominent hills of Mount Holly, Juliustown, and Arney's Mount. The sands and gravel in these hills, in addition to having been protected by capping gravels, have frequently been partially cemented by iron-oxide precipitated by water percolating down through the ground.
- Southern Burlington County lies within the outer lowland where elevations rarely exceed 50 feet. Streams within this subprovince empty into the Atlantic Ocean. Sloping gently toward the sea, the flat terrain of this area has been slightly modified by the Mullica, Wading, and Bass Rivers.

3.3.4 Climate

Due to its geographic location, New Jersey is influenced by wet, dry, hot, and cold airstreams, creating a highly variable climate. Burlington County has a temperate climate with warm summers and moderate winters. The annual precipitation averages approximately 43 inches, which is generally distributed evenly throughout the year (FEMA 2019). Five climate zones make up New Jersey. As shown of Figure 3-8, Burlington County includes portions of four of the state's five zones (ONJSC 1983):

- Pine Barrens Climate Zone—Scrub pine and oak forests dominate this zone, which covers the largest part of Burlington County. Sandy soils, which are porous and not very fertile, have a major effect on the climate of this region. On clear nights, solar radiation absorbed during the day is quickly radiated back into space, resulting in low minimum temperatures. Atlantic City Airport, which is surrounded by sandy soil, can be 15 to 20 °F cooler than the Atlantic City Marina on the bay, which is only about 13 miles away. The porous soil permits any precipitation to rapidly infiltrate and leave surfaces dry. Drier conditions allow for a wider range between daily maximum and minimum temperatures and make the area vulnerable to forest fires.
- Coastal Climate Zone—In autumn and early winter, when the ocean is warmer than the land surface, the Coastal Zone, which covers the southeast corner of Burlington County, experiences warmer temperatures than interior regions of the state. In spring, ocean breezes keep temperatures along the coast cooler. Being adjacent to the Atlantic Ocean, with its high heat capacity, seasonal temperature fluctuations tend to be more gradual and less prone to extremes. When the land is warmed by the sun, heated air rises, allowing cooler air at the ocean surface to spread inland. Sea breezes often penetrate 5 to 10 miles inland, but under more favorable conditions, can affect locations 25 to 40 miles inland. They are most common in spring and summer.

Figure 3-8. Climate Zones in New Jersey



Source: ONJSC 1983

- Southwest Climate Zone—This zone, which includes the northwest corner of Burlington County, lies between sea level and approximately 100 feet above sea level. The proximity of Delaware Bay results in a maritime influence on the climate of this region. The Southwest has the highest average daily temperatures in the state. Without sandy soils, it tends to have higher nighttime minimum temperatures than the neighboring Pine Barrens Zone. This region receives less precipitation than the Northern and Central zones, as there are no orographic features and it is farther away from the Great Lakes-St. Lawrence storm track. It is also far enough inland to be away from the heavier rains from some coastal storms, thus it receives less precipitation than the Coastal Zone. Prevailing winds are from the southwest, except in winter when west to northwest winds dominate. High humidity and moderate temperatures prevail when winds flow from the south or east. The moderating effect of the water allows for a longer growing season. Autumn frosts usually occur about four weeks later here than in the North and the last spring frosts are about four weeks earlier, giving this region the longest growing season in New Jersey.
- Central Climate Zone—This zone covers only a small area at the northern tip of Burlington County. Its northern edge is often the boundary between freezing and non-freezing precipitation in the state.

3.3.5 Land Use and Land Cover

Land Use Trends

Land uses in Burlington County range from densely populated urban development to preserved open space and military use. The New Jersey Municipal Land Use Law gives municipalities zoning and planning authority to guide land uses and development within their communities.

Development Trends and New Development

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

This plan provides a general overview of population and land use, and types of development occurring within the study area. An understanding of these development trends can assist in planning for future development and ensuring that appropriate mitigation, planning, and preparedness measures are in place to protect human health and community infrastructure. For municipal identified new development, refer to the municipal annexes in Section 9.

Land Cover

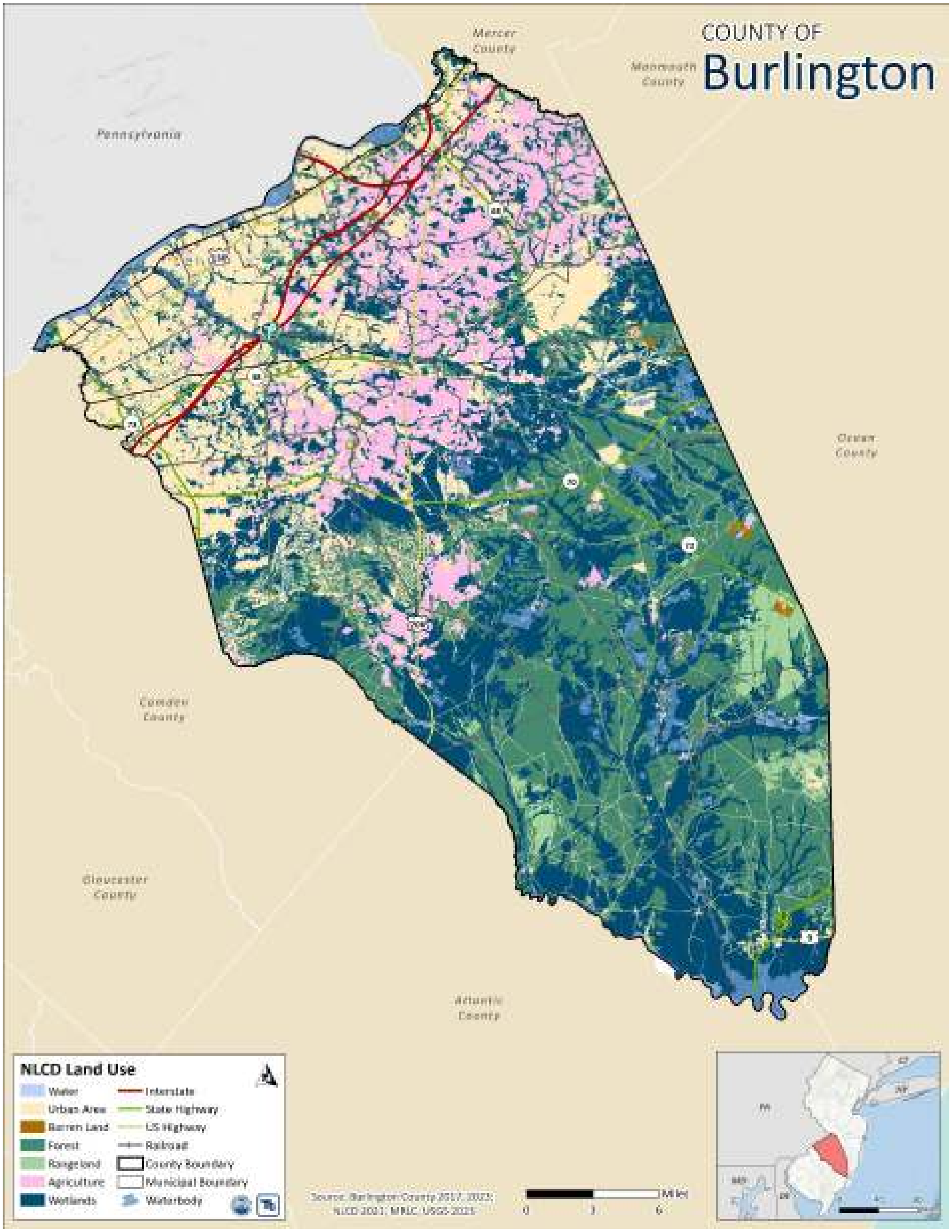
Land cover in Burlington County includes agricultural land, barren land, forested land, urban land, and wetlands. Table 3-2 and Figure 3-9 show the distribution of land cover in Burlington County.

Table 3-2. Land Cover Summary for Burlington County, 2021

	2021 Data	
Land Cover Category	Acreage	Percent of Burlington County
Agriculture	65,559	12.5%
Barren	1,886	0.4%
Forest	145,131	27.7%
Rangeland	16,233	3.1%
Urban	117,342	22.4%
Water	9,923	1.9%
Wetlands	168,130	32.1%
Burlington County Total	**524,204**	**100.0%**

Source: NLCD 2021, MRLC, USGS 2023

Figure 3-9. 2021 Land Use Land Cover for Burlington County



Agriculture

Agriculture in Burlington County predates the arrival of European settlers. Native Americans were farming in the region, which they called Matinicunk, at the time British Quakers arrived in the early 1600s. The Native Americans cultivated several crops and, understanding the limitations of soils, rotated fields in order to prevent the depletion of soils. As early European settlers arrived, they were able to begin cultivation on small fields utilized by Native Americans immediately rather than having to clear forested lands. An abundance of good agricultural soils and, later, proximity to major urban centers contributed significantly to the development of the County's early agricultural industry (Burlington County Resource Conservation 2022).

With active agriculture extending from the Pinelands throughout northern Burlington County, the County has always been one of the leading agricultural counties in the nation. The largest blueberries in the world were developed and raised in Burlington County and the County is ranked as the second largest blueberry-producing and third largest cranberry-producing county in the U.S. There are more acres devoted to farming than any county in the state, primarily in vegetable, fruit, and timber production (Burlington County 2019).

Agricultural land in the County today is used primarily for the production of food and fiber. This includes cropland, pastureland, and orchards. Agricultural land includes pasturelands and grazing lands associated with horse or cattle raising operations, orchards, vineyards, nurseries, and other horticultural areas. Other lands used in support of agricultural activities, such as farmsteads with barns, stables, and corrals, are also present throughout the County (NJDEP 2012).

Agriculture is an integral part of the natural landscapes that comprise the County. According to the U.S. Department of Agriculture (USDA) 2017 Census of Agriculture, there were 96,256 acres of farmland in the County at that time. This is slightly more than the 2012 survey, which indicated that there were 95,899 acres of farmland. In 2017, there were 915 active farms in the County, and increase of 9 percent from 2012. Table 3-3 outlines the number of farms, average farm size and total acreage of farms in Burlington County from 1900 to 2017 (USDA 2019).

Table 3-4 outlines the top crop items grown in Burlington County, along with the number of acres devoted to these crops. The table indicates that soybeans for beans are the predominant crop in the County. Burlington County ranks second in the state for total acres of soybeans.

Burlington County has adopted a Comprehensive Farmland Preservation Plan that lays out a strategy for preservation of this vital resource. Over 26,500 acres have been permanently protected from conversion to nonagricultural uses through deed-restrictions. In addition, roughly 23,000 acres of land in agricultural planning areas of the state-regulated New Jersey Pinelands have been deed-restricted through the Pinelands Development Credit Program. In total, nearly 50,000 acres (roughly 45 percent of the existing agricultural land base) have been protected from conversion to non-agricultural uses (Burlington County Resource Conservation 2022).

Table 3-3. Farms in Burlington County, 1900 to 2017

Year	Number of Farms	Average Farm Size (acres)	Total Area in Farms (acres)
1900	2,549	135	343,096
1910	2,389	121	287,816
1920	2,172	125	271,235
1925	2,132	86	183,940
1930	1,948	94	182,740
1935	2,122	103	219,273
1940	1,847	171	314,825
1945	1,629	108	176,242
1950	1,905	111	211,588
1954	1,835	113	207,618
1959	1,351	137	184,727
1964	1,070	154	164,835
1969	857	166	142,132
1974	708	202	142,751
1978	717	181	129,747
1982	743	152	112,689
1987	834	124	103,224
1992	816	119	97,186
1997	857	121	103,667
2002	906	123	111,237
2007	922	93	85,790
2012	838	114	95,899
2017	915	105	96,256

Source: USDA 2019.

Table 3-4. Burlington County Farmland by Crop (Acres): 2012 and 2017

	Acres Planted	
Crop	2012	2017
Soybeans for beans	19,288	18,822
Corn for grain	7,557	5,522
Forage - land used for all hay and haylage, grass silage, and green chop	4,663	4,910
Land in berries	4,974	4,832
Vegetables harvested for sale	5,071	3,845

Source: USDA 2019

Pinelands National Reserve

The Pinelands National Reserve (PNR) was created by Congress under the National Parks and Recreation Act of 1978. The PNR was the first National Reserve in the nation. The PNR encompasses approximately 1.1 million acres covering portions of seven counties and all or parts of 56 municipalities as shown in Figure 3-10. This internationally important ecological region occupies 22 percent of New Jersey's land area. It is the largest body of open space on the Mid-Atlantic seaboard between Richmond and Boston and is underlain by aquifers containing 17 trillion gallons of some of the purest water in the land (New Jersey Pinelands Commission 2022).

Figure 3-10. Municipalities Within the New Jersey Pinelands

Source: New Jersey Pinelands Commission 2018

Approximately 64 percent of Burlington County's land area is under the jurisdiction of the New Jersey Pinelands Commission. Fourteen of Burlington County's 40 municipalities have area within the Pinelands. In its 2017 long-term economic monitoring report, the Pinelands Commission estimated that 21.5 percent of the County's population lived within the Pinelands (New Jersey Pinelands Commission 2018).

Open Space and Parkland

Open space is defined as a portion of a site that is permanently set aside for public or private use and will not be developed. The space may be used for passive or active recreation or may be reserved to protect or buffer natural areas.

Federal and State Parks and Management Areas

Burlington County has extensive areas that have been preserved as open space by state and federal agencies:

- Bass River State Forest
- Brendan T. Byrne State Forest
- Edwin B. Forsythe Wildlife Refuge
- Penn State Forest
- Rancocas State Park - Westampton
- Swan Bay Wildlife Management Area
- Wharton State Forest

The Jacques Cousteau National Estuarine Research Reserve (JC NERR) includes portions of southeastern Burlington County found within the Wharton State Forest, Swan Bay Wildlife Management Area, Bass River State Forest, and the Edwin B. Forsythe Wildlife Refuge (JC NERR 2017).

Burlington County Park System

The Burlington County Park System has more than 1,000 acres of developed parkland, 3,500 acres of land slated for park development, and a regional trail system that will provide a link between parks in the future (Burlington County Parks 2023).

Table 3-5 lists the 13 County parks within the Burlington County Park System and their acreage. These parks range from small to large and feature aquatic features and hiking trails.

Table 3-5. County Parks in Burlington County

Park	Total Acreage
Amico Island Park	55
Amphitheater	Unknown
Arneys Mount Park	Unknown
Boundary Creek Natural Resource Area	34
Burlington County Community Agricultural Center	Unknown
County Fairgrounds	61
Crystal Lake Park	370+
Rainbow Meadow Park (formerly Laurel Run Park)	120
Long Bridge Park	115
Pennington Park	140
Smithville Park	312
Rancocas Nature Center	210
Willingboro Lakes Park	105

Source: Burlington County n.d.

Burlington County Commissioners have focused on expanding the parks system to include the following:

- Natural resource areas
- Regional parks
- Recreation areas
- Special use areas

Connectivity will be a high priority in park planning and design. Pathway facilities and linkages in the Burlington County Parks System will include the following:

- All terrain bike trails
- Bikeways
- Connector trails
- Cross-country ski trails
- Equestrian trails
- Park trails
- Water or canoe trails

Water

Numerous ponds, lakes, creeks, and rivers make up the waterscape of Burlington County. Section 3.3.2 describes the water bodies, watersheds, and drainage basins that make up the County.

Wetlands

Wetlands are lands that are inundated or saturated by surface or ground waters at a frequency and duration sufficient to support vegetation. Included in this category are natural vegetation swamps, marshes, bogs, and savannas. Wetlands make up a significant portion of Burlington County (~30 percent) and are found along many of the County's rivers, streams, and creeks, as shown in Figure 3-12. In classifying land cover, wetlands are defined as all freshwater wetlands larger than 1 acre and all linear freshwater wetlands wider than 10 feet.

Metropolitan/Urban Area

The Census Bureau classifies "urban" as all territory, population, and housing units within an urbanized area or an urban cluster. It delineates boundaries for these areas to encompass core census block groups or blocks that have a population density of at least 1,000 people per square mile and surrounding census blocks that over an overall density of at least 500 people per square mile. With a population density of approximately 580 people per square mile, Burlington County is not considered an urban area.

Burlington County is one of 12 counties within the Philadelphia-Camden-Wilmington Metropolitan Statistical Area (MSA), which is the sixth most populous metropolitan area in the United States. The MSA has a 2022 American Community Survey 1-Year Estimate population of 6,241,164, which includes Burlington County. The MSA covers 4,377 square miles and is made up of divisions as indicated in Figure 3-11 (American Community Survey 2022)

Figure 3-11. Wetlands in Burlington County

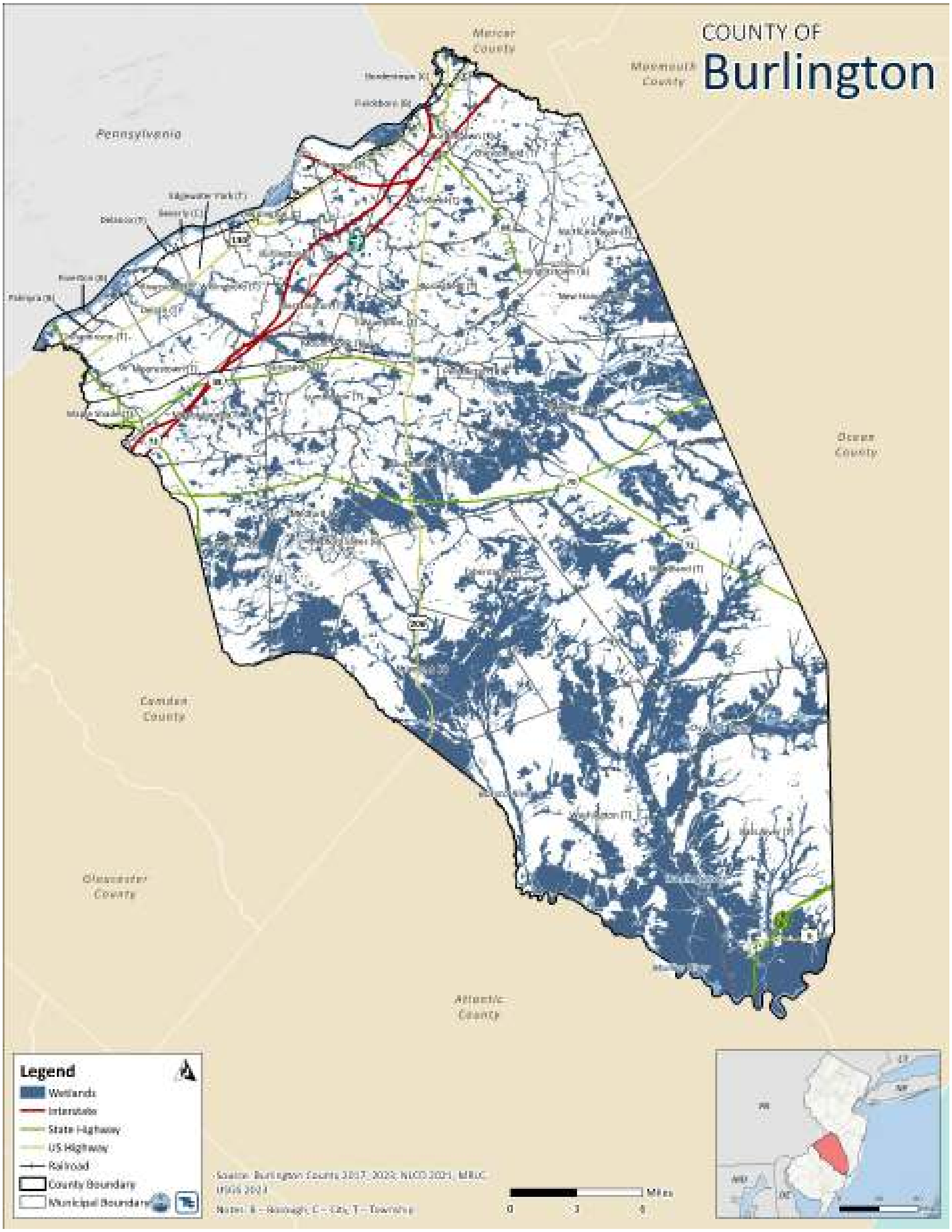
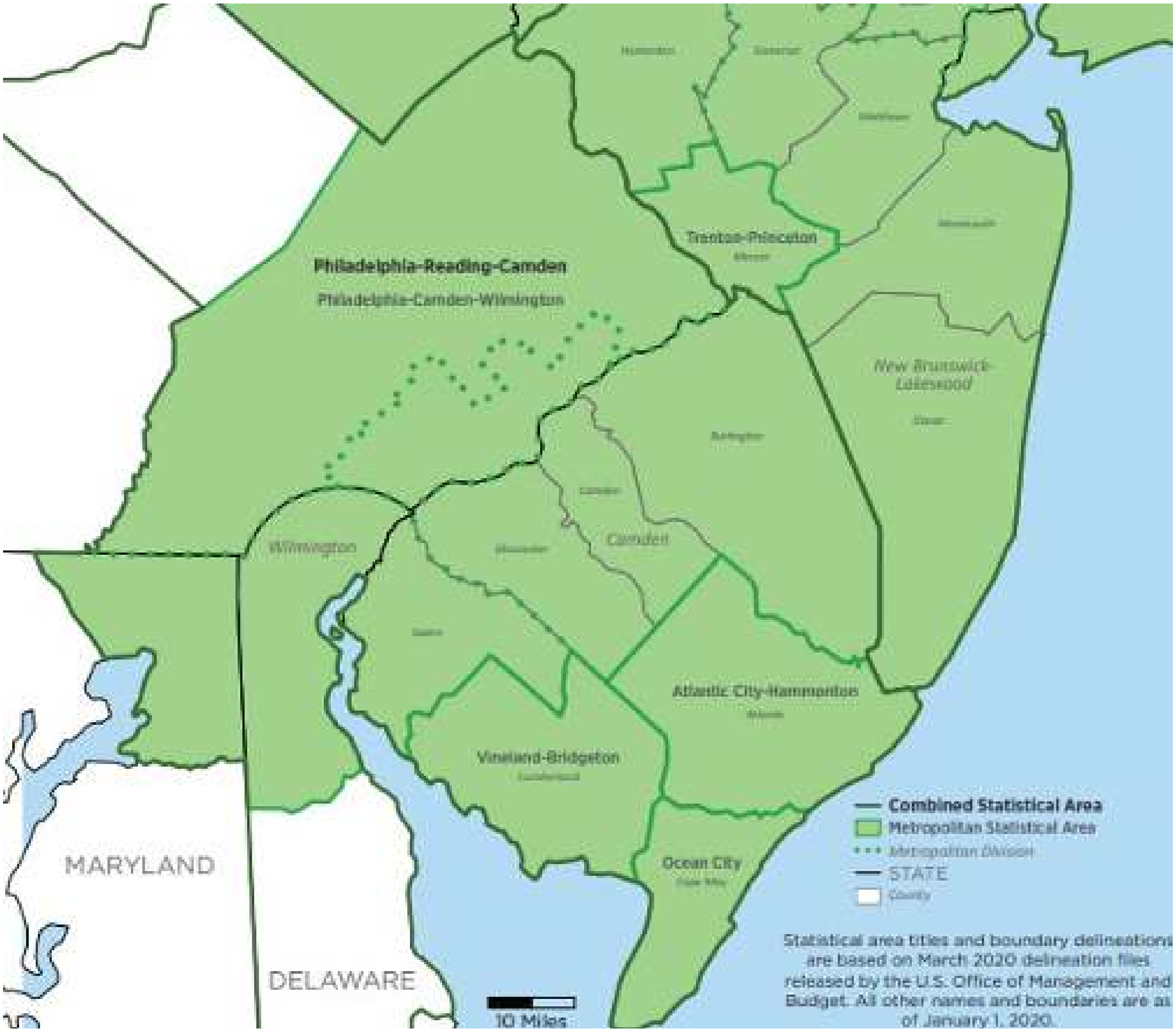


Figure 3-12. Philadelphia-Camden-Wilmington Metropolitan Statistical Area, PA-NJ-DE-MD Metropolitan Statistical Area



Source: U.S. Census Bureau 2020

Barren Land

Barren land is composed of rock or rock faces or lacks vegetation for other reasons. Burlington County has very limited barren land, amounting to less than 1 percent of the County's land cover.

3.4 POPULATION AND DEMOGRAPHICS

Knowledge of the population composition, how it has changed in the past, and how it may change in the future is needed to make informed decisions for hazard mitigation planning. Information about population directly relates to needs such as housing, industry, stores, public facilities and services, and transportation. The following sections discuss general population characteristics, vulnerable populations, and population trends in Burlington County.

3.4.1 General Population Characteristics

The risk assessment in this plan update uses 2020 Census data available in the Hazus risk modeling software. According to the 2020 U.S. Census, Burlington County had a population of 461,860 people. Table 3-6 presents the 2010 and 2020 U.S. Census population statistics for Burlington County by municipality. Figure 3-13 shows the distribution of the general population density (persons per square mile) by Census block.

3.4.2 Vulnerable Populations

Identifying concentrations of vulnerable populations can assist communities in targeting preparedness, response, and mitigation actions. Populations with a higher level of vulnerability may be more seriously affected during the course of an emergency or disaster. Vulnerable populations have unique needs which need to be taken into consideration by public officials to help ensure the safety of people with a higher level of risk. The members of the Steering Committee and Planning Partnership were asked to identify potentially socially vulnerable populations and underserved communities during the HMP kickoff meetings. For the purposes of this planning process, vulnerable populations in Burlington County include children, elderly, low-income, the physically or mentally disabled, non-English speakers, and the medically or chemically dependent. Statistics on the medically or chemically dependent were not available for this HMP update but these populations were considered during the development of mitigation strategies. Plan participants used the available information on vulnerable populations to consider vulnerabilities and potential mitigation actions that could be used to reduce risk.

Table 3-7 shows the total amount of socially vulnerable populations in Burlington County by jurisdiction. Figure 3-14 displays the locations of socially vulnerable populations in Burlington County. The following sections describe socially vulnerable groups.

Table 3-6. Burlington County Population Statistics (2010 and 2020 U.S. Census)

	Census 2010 Total Population	Census 2020 Total Population	Change in Population
Bass River (T)	1,443	1,355	-88
Beverly (C)	2,577	2,499	-78
Bordentown (C)	3,924	3,993	+69
Bordentown (T)	11,367	11,791	+424
Burlington (C)	9,920	9,743	-177
Burlington (T)	22,594	23,983	+1,389
Chesterfield (T)	7,699	9,422	+1,723
Cinnaminson (T)	15,569	17,064	+1,495
Delanco (T)	4,283	4,824	+541
Delran (T)	16,896	17,882	+986
Eastampton (T)	6,069	6,191	+122
Edgewater Park (T)	8,881	8,930	+49
Evesham (T)	45,538	46,826	+1,288
Fieldsboro (B)	540	526	-14
Florence (T)	12,109	12,812	+703
Hainesport (T)	6,110	6,035	-75
Lumberton (T)	12,559	12,803	+244
Mansfield (T)	8,544	8,897	+353
Maple Shade (T)	19,131	19,980	+849
Medford Lakes (B)	4,146	24,497	+20,351
Medford (T)	23,033	4,264	-18,769
Moorestown (T)	20,726	21,355	+629
Mount Laurel (T)	41,864	9,981	-31,883
Mt. Holly (T)	9,536	44,633	+35,097
New Hanover (T)	7,385	6,367	-1,018
North Hanover (T)	7,678	7,963	+285
Palmyra (B)	7,398	7,438	+40
Pemberton (B)	1,409	1,371	-38
Pemberton (T)	27,912	26,903	-1,009
Riverside (T)	8,079	8,003	-76
Riverton (B)	2,779	2,764	-15
Shamong (T)	6,490	6,460	-30
Southampton (T)	10,464	10,317	-147
Springfield (T)	3,414	3,245	-169
Tabernacle (T)	6,949	6,776	-173
Washington (T)	687	693	+6
Westampton (T)	8,813	9,121	+308
Willingboro (T)	31,629	31,889	+260
Woodland (T)	1,788	1,544	-244
Wrightstown (B)	802	720	-82
Burlington County	**448,734**	**461,860**	**+13,126**

Source: U.S. Census Bureau 2020, 2021

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

Figure 3-13. Distribution of General Population for Burlington County

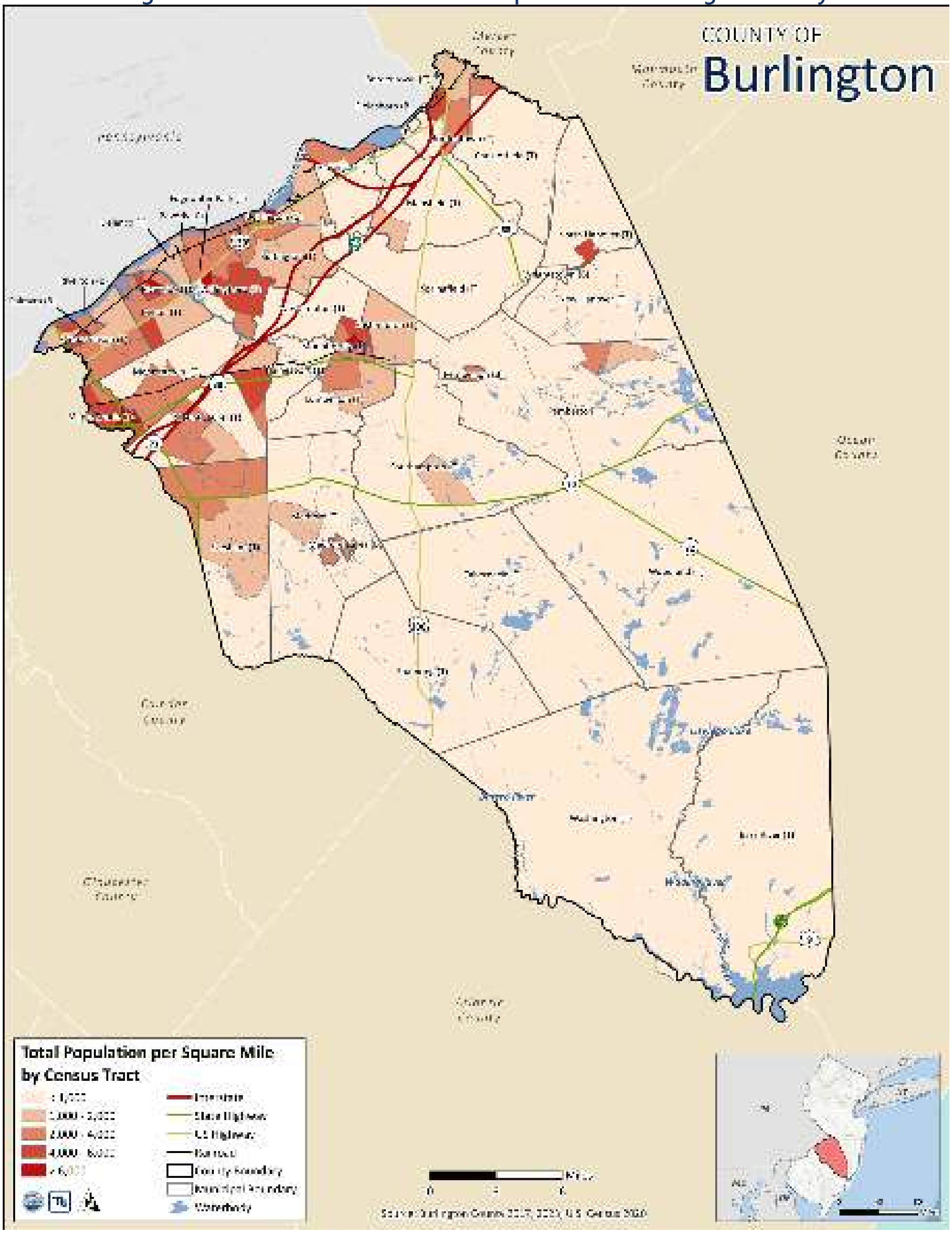


Table 3-7. Socially Vulnerable Populations in Burlington County

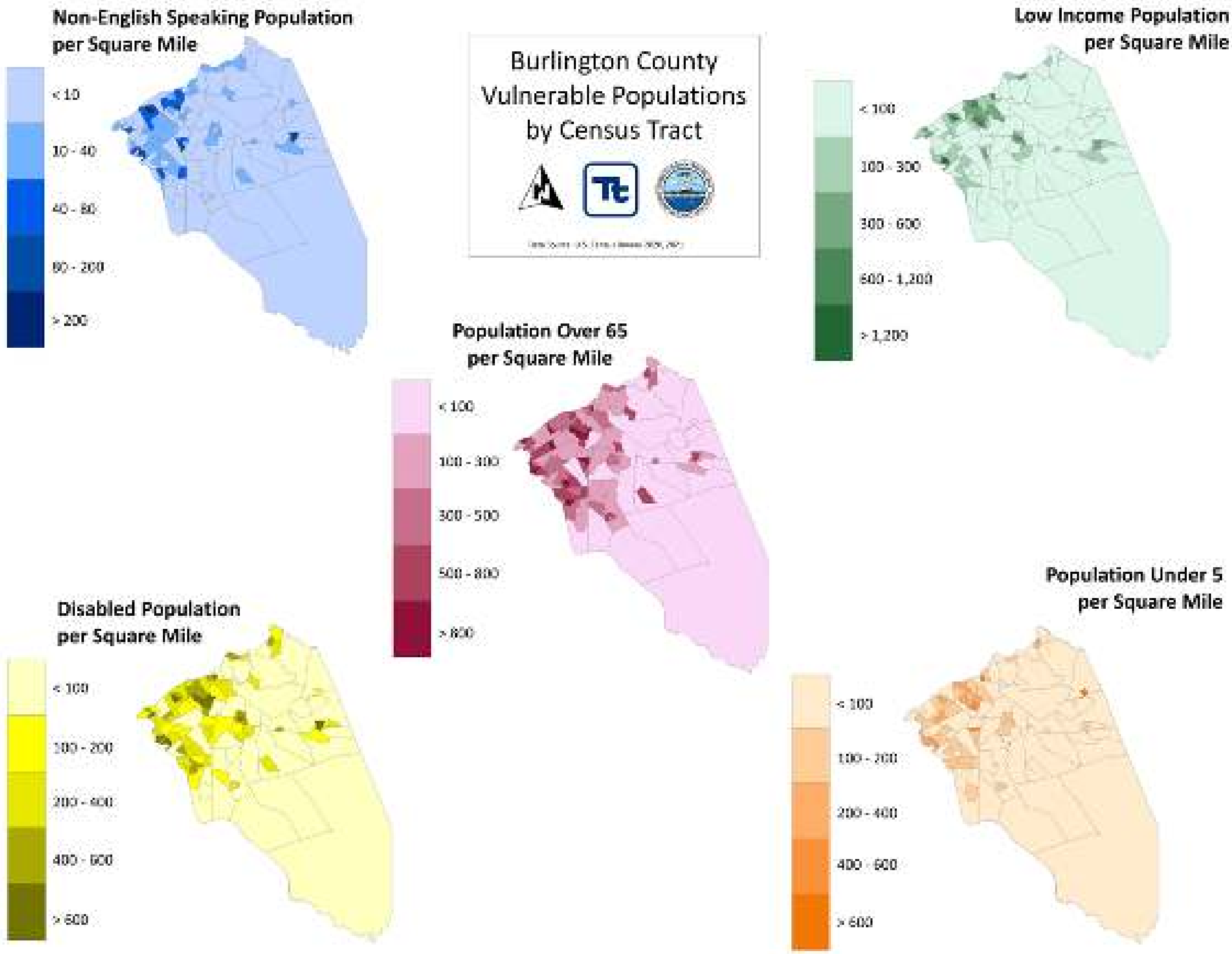
Jurisdiction	Total Population (2020 Decennial Census)	Percent of County Total	American Community Survey 5-Year Population Estimates (2021)									
			Over 65	Percent of Jurisdiction Total	Under 5	Percent of Jurisdiction Total	Non-English Speaking	Percent of Jurisdiction Total	Disability	Percent of Jurisdiction Total	Poverty Level	Percent of Jurisdiction Total
Bass River (T)	1,355	0.3%	248	18.3%	67	4.9%	0	0.0%	175	12.9%	95	7.0%
Beverly (C)	2,499	0.5%	292	11.7%	183	7.3%	0	0.0%	249	10.0%	300	12.0%
Bordentown (C)	3,993	0.9%	772	19.3%	216	5.4%	16	0.4%	422	10.6%	227	5.7%
Bordentown (T)	11,791	2.6%	1,601	13.6%	472	4.0%	289	2.4%	1,092	9.3%	194	1.6%
Burlington (C)	9,743	2.1%	1,301	13.4%	661	6.8%	208	2.1%	1,251	12.8%	1,422	14.6%
Burlington (T)	23,983	5.2%	3,526	14.7%	1,497	6.2%	385	1.6%	2,366	9.9%	2,185	9.1%
Chesterfield (T)	9,422	2.0%	760	8.1%	578	6.1%	153	1.6%	423	4.5%	165	1.8%
Cinnaminson (T)	17,064	3.7%	3,103	18.2%	929	5.4%	208	1.2%	1,661	9.7%	584	3.4%
Delanco (T)	4,824	1.0%	1,297	26.9%	191	4.0%	42	0.9%	676	14.0%	322	6.7%
Delran (T)	17,882	3.9%	2,570	14.4%	1,047	5.9%	723	4.0%	1,548	8.7%	902	5.0%
Eastampton (T)	6,191	1.3%	557	9.0%	264	4.3%	0	0.0%	478	7.7%	488	7.9%
Edgewater Park (T)	8,930	1.9%	1,571	17.6%	700	7.8%	367	4.1%	1,465	16.4%	1,645	18.4%
Evesham (T)	46,826	10.1%	8,574	18.3%	2,237	4.8%	749	1.6%	4,504	9.6%	1,476	3.2%
Fieldsboro (B)	526	0.1%	82	15.6%	64	12.2%	0	0.0%	62	11.8%	36	6.8%
Florence (T)	12,812	2.8%	2,122	16.6%	645	5.0%	260	2.0%	1,460	11.4%	827	6.5%
Hainesport (T)	6,035	1.3%	1,327	22.0%	58	1.0%	0	0.0%	744	12.3%	250	4.1%
Lumberton (T)	12,803	2.8%	2,048	16.0%	661	5.2%	107	0.8%	1,490	11.6%	805	6.3%
Mansfield (T)	8,897	1.9%	2,506	28.2%	394	4.4%	330	3.7%	1,465	16.5%	181	2.0%
Maple Shade (T)	19,980	4.3%	2,897	14.5%	1,159	5.8%	694	3.5%	2,433	12.2%	1,971	9.9%
Medford (T)	24,497	5.3%	5,151	21.0%	1,085	4.4%	31	0.1%	2,775	11.3%	724	3.0%
Medford Lakes (B)	4,264	0.9%	879	20.6%	211	4.9%	0	0.0%	407	9.5%	26	0.6%
Moorestown (T)	21,355	4.6%	3,480	16.3%	837	3.9%	603	2.8%	1,654	7.7%	807	3.8%
Mount Holly (T)	9,981	2.2%	1,199	12.0%	454	4.5%	133	1.3%	1,624	16.3%	958	9.6%
Mount Laurel (T)	44,633	9.7%	8,299	18.6%	2,011	4.5%	889	2.0%	4,203	9.4%	1,689	3.8%
New Hanover (T)	6,367	1.4%	311	4.9%	214	3.4%	29	0.4%	192	3.0%	116	1.8%
North Hanover (T)	7,963	1.7%	532	6.7%	975	12.2%	125	1.6%	631	7.9%	481	6.0%
Palmyra (B)	7,438	1.6%	1,077	14.5%	190	2.6%	44	0.6%	961	12.9%	616	8.3%
Pemberton (B)	1,371	0.3%	282	20.6%	56	4.1%	47	3.4%	308	22.5%	140	10.2%
Pemberton (T)	26,903	5.8%	4,306	16.0%	1,429	5.3%	1,092	4.1%	4,006	14.9%	2,518	9.4%
Riverside (T)	8,003	1.7%	1,039	13.0%	354	4.4%	754	9.4%	972	12.1%	1,257	15.7%

Jurisdiction	Total Population (2020 Decennial Census)	Percent of County Total	American Community Survey 5-Year Population Estimates (2021)									
			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
Riverton (B)	2,764	0.6%	554	20.0%	80	2.9%	5	0.2%	187	6.8%	72	2.6%
Shamong (T)	6,460	1.4%	1,313	20.3%	324	5.0%	0	0.0%	671	10.4%	136	2.1%
Southampton (T)	10,317	2.2%	3,153	30.6%	293	2.8%	125	1.2%	1,551	15.0%	589	5.7%
Springfield (T)	3,245	0.7%	479	14.8%	129	4.0%	65	2.0%	311	9.6%	160	4.9%
Tabernacle (T)	6,776	1.5%	1,524	22.5%	380	5.6%	0	0.0%	747	11.0%	233	3.4%
Washington (T)	693	0.2%	138	19.9%	8	1.2%	8	1.1%	87	12.6%	21	3.0%
Westampton (T)	9,121	2.0%	1,139	12.5%	263	2.9%	81	0.9%	802	8.8%	268	2.9%
Willingboro (T)	31,889	6.9%	5,707	17.9%	1,916	6.0%	538	1.7%	5,100	16.0%	2,685	8.4%
Woodland (T)	1,544	0.3%	319	20.7%	49	3.2%	0	0.0%	627	40.6%	363	23.5%
Wrightstown (B)	720	0.2%	58	8.1%	69	9.6%	5	0.7%	119	16.5%	13	1.8%
Burlington County Total	**461,860**	**100.0%**	**78,093**	**16.9%**	**23,350**	**5.1%**	**9,103**	**2.0%**	**51,899**	**11.2%**	**27,947**	**6.1%**

Source: U.S. Census Bureau 2020, 2021

Notes: Persons per household = 2.6; (B) = Borough; (C) = City; (T) = Township

Figure 3-14. Distribution of Socially Vulnerable Populations in Burlington County



TETRA TECH

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. The elderly are more apt to lack the physical and economic resources necessary for response to hazard events and are more likely to suffer health-related consequences. Elderly populations living on their own may have more difficulty evacuating their homes. The elderly 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 2017-2021 American Community Survey 5-Year Estimates, the median age in Burlington County was 41.5 years. The U.S. Census Bureau reports 5.1 percent of the 2020 Burlington County population is under the age 5 and 16.9 percent of the County's population is age 65 and older. Figure 3-14 shows the distribution of persons over age 65 under the age of 5 and in Burlington County.

Income

The 2017-2021 American Community Survey 5-Year Estimates find that the median household income in Burlington County was $100,478, and the per capita income was $47,065. The U.S. Census Bureau identifies households with two adults and two children with an annual household income below $29,678 per year as "low income" (US Census Bureau 2023). The 2017-2021 American Community Survey 5-Year Estimates indicates a total of 6.6 percent of Burlington County is below the poverty level.

The spatial U.S. Census data for household income provided in Hazus includes two ranges (less than $10,000 and $10,000-$20,000/year) that were totaled to provide the "low-income" data used in this study. This does not correspond exactly with the "poverty" thresholds established by the 2023 U.S. Census Bureau data. This difference is not believed to be significant for the purposes of this planning effort; therefore, for the exposure and loss estimations in the risk assessment, the 2020 U.S. Census data in Hazus is reported. Figure 3-14 shows the distribution of the low-income population in Burlington County.

While the poverty threshold is a standard for identifying low-income populations, the Steering Committee noted that households may be above the poverty threshold but still struggle financially, making them socially vulnerable to hazard events. The County also used data available from United for ALICE. ALICE stands for Asset Limited, Income Constrained, Employed. This dataset is meant to identify households with income above the federal poverty threshold but below the basic cost of living. This 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 data from ALICE, 174,454 households in Burlington County are ALICE households. The median household income in Burlington is $100,478, and the County sees a labor force participation rate of 67 percent. Burlington County benefits from a higher-than-average household income compared to the state average of $96,346, and a lower-than-average poverty rate at 7 percent (compared to the state average of 10 percent) (United for ALICE 2022).

Table 3-8. Burlington County ALICE Data

Name	% Below ALICE Threshold	# of Households Below ALICE
Bass River (T)	37%	131
Beverly (C)	46%	383
Bordentown (C)	42%	777
Bordentown (T)	29%	1,295
Burlington (C)	51%	1,921
Burlington (T)	38%	3,318
Chesterfield (T)	18%	421
Cinnaminson (T)	21%	1,284
Delanco (T)	47%	1,000
Delran (T)	32%	2,183
Eastampton (T)	28%	749
Edgewater Park (T)	47%	1,590
Evesham (T)	29%	5,538
Fieldsboro (B)	35%	90
Florence (T)	35%	1,715
Hainesport (T)	23%	566
Lumberton (T)	31%	1,492
Mansfield (T)	28%	1,005
Maple Shade (T)	50%	4,340
Medford Lakes (B)	21%	308
Medford (T)	19%	1,723
Moorestown (T)	21%	1,612
Mount Holly (T)	43%	1,546
Mount Laurel (T)	31%	5,860
New Hanover (T)	29%	167
North Hanover (T)	44%	1,223
Palmyra (B)	35%	1,120
Pemberton (B)	37%	199
Pemberton (T)	47%	4,698
Riverside (T)	53%	1,578
Riverton (B)	23%	236
Shamong (T)	18%	402
Southampton (T)	37%	1,640
Springfield (T)	22%	266
Tabernacle (T)	30%	796
Washington (T)	45%	109
Westampton (T)	18%	594
Willingboro (T)	37%	3,956
Woodland (T)	22%	96
Wrightstown (B)	56%	111

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

Physical or Mental Disability

Persons with a disability are those who have long-term physical, mental, intellectual or sensory impairments (such as hearing or vision) that, in interaction with various barriers, may hinder their participation in society on an equal basis with others (CDC 2020). These impairments may increase the level of difficulty that individuals face during an emergency. Cognitive impairments may reduce an individual's capacity to receive, process, and respond to emergency information or warnings. Individuals with a physical or sensory disability may face issues of mobility, sight, hearing, or reliance on specialized medical equipment. According to the 2017-2021 American Community Survey, 12.6 percent of residents in Burlington County are living with a disability.

Figure 3-14 shows the geographic distribution of disabled individuals throughout Burlington County. This includes individuals with hearing, vision, cognitive, ambulatory, self-care, and independent living difficulties.

Non-English Speakers

Individuals who do not have a working proficiency in English are vulnerable because they may have difficulty with understanding hazard mitigation guidance and emergency information being conveyed to them. Cultural differences can also add complexity to how information is being conveyed to populations with limited proficiency of English. According to the 2017-2021 American Community Survey, 13.9 percent of the County's population over the age of 5 primarily speaks a language other than English at home. This is significantly less than the State average of 31.9 percent. Of the County's population, 4.4 percent speak Spanish and 6.4 percent speak other Indo-European languages. Figure 3-14 shows the geographic distribution of individuals who speaker a language other than English.

3.4.3 Employment

The U.S. Census Bureau's 2021 County Business Patterns data identified 10,438 business establishments employing 180,387 people in Burlington County. The industry with the greatest number of employees (29,150) is the health care and social assistance industry, followed by the retail trade industry (24,171).

3.4.4 Population Trends

This section discusses population trends to use as a basis for estimating future change in population and in 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 where these approaches should be applied. This information can support planning decisions regarding future development in vulnerable areas.

According to the U.S. Census Bureau, Burlington County's 2020 population was 461,860 persons, which is a 2.9 percent increase from the 2010 Census population of 448,734. Table 3-9 displays the population of the County's municipalities from 1970 to 2020. Table 3-10 displays the total County population and population differences from 1900 to 2020. From 1900 to 2020, the County experienced a constant growth in population. The largest increase was between 1950 and 1960, when the County experienced a 65.2 percent population increase (88,589 persons).

Table 3-9. Burlington County Resident Population by Municipality: 1970-2020

Municipality	1970	1980	1990	2000	2010	2020	Percent Change 2010 - 2020
Bass River (T)	815	1,344	1,580	1,510	1,443	1,355	-6.10%
Beverly (C)	3,105	2,919	2,973	2,661	2,577	2,499	-3.03%
Bordentown (C)	4,490	4,441	4,341	3,969	3,924	3,993	+1.76%
Bordentown (T)	7,303	7,170	7,683	8,380	11,367	11,791	+3.73%
Burlington (C)	12,010	10,246	9,835	9,736	9,920	9,743	-1.78%
Burlington (T)	10,621	11,527	12,454	20,294	22,594	23,983	+6.15%
Chesterfield (T)	3,190	3,867	5,152	5,955	7,699	9,422	+22.38%
Cinnaminson (T)	16,962	16,072	14,583	14,595	15,569	17,064	+9.60%
Delanco (T)	4,157	3,730	3,316	3,237	4,283	4,824	+12.63%
Delran (T)	13,178	15,536	13,178	15,536	16,896	17,882	+5.84%
Eastampton (T)	2,284	3,814	4,962	6,202	6,069	6,191	+2.01%
Edgewater Park (T)	7,412	9,273	8,388	7,864	8,881	8,930	+0.55%
Evesham (T)	13,477	21,508	35,309	42,275	45,538	46,826	+2.83%
Fieldsboro (B)	615	597	579	522	540	526	-2.59%
Florence (T)	8,560	9,084	10,266	10,746	12,109	12,812	+5.81%
Hainesport (T)	2,990	3,236	3,249	4,126	6,110	6,035	-1.23%
Lumberton (T)	3,945	5,236	6,705	10,461	12,559	12,803	+1.94%
Mansfield (T)	2,597	2,523	3,874	5,090	8,544	8,897	+4.13%
Maple Shade (T)	16,464	20,525	19,211	19,079	19,131	19,980	+4.44%
Medford (T)	8,292	17,622	20,526	22,253	23,033	24,497	+6.36%
Medford Lakes (B)	4,792	4,958	4,462	4,173	4,146	4,264	+2.85%
Moorestown (T)	15,577	15,596	16,116	19,017	20,726	21,355	+3.03%
Mt. Holly (T)	12,713	10,818	10,639	10,728	9,536	9,981	+6.61%
Mount Laurel (T)	11,221	17,614	30,270	40,221	41,864	44,633	+4.67%
New Hanover (T)	27,410	14,258	9,546	9,744	7,385	6,367	-13.78%
North Hanover (T)	9,858	9,050	9,994	7,347	7,678	7,963	+3.71%
Palmyra (B)	6,969	7,085	7,056	7,091	7,398	7,438	+0.54%
Pemberton (B)	1,344	1,198	1,367	1,210	1,409	1,371	-2.70%
Pemberton (T)	19,754	29,720	31,342	28,691	27,912	26,903	-3.61%
Riverside (T)	8,591	7,941	7,974	7,911	8,079	8,003	-0.94%
Riverton (B)	3,412	3,068	2,775	2,759	2,779	2,764	-0.54%
Shamong (T)	1,318	4,537	5,765	6,462	6,490	6,460	-0.46%
Southampton (T)	4,982	8,808	10,202	10,388	10,464	10,317	-1.40%
Springfield (T)	2,244	2,691	3,028	3,227	3,414	3,245	-4.95%
Tabernacle (T)	2,103	6,236	7,360	7,170	6,949	6,776	-2.49%
Washington (T)	673	808	805	621	687	693	+0.87%
Westampton (T)	2,680	3,383	6,004	7,217	8,813	9,121	+3.49%
Willingboro (T)	43,386	39,912	36,291	33,008	31,629	31,889	+0.82%
Woodland (T)	2,032	2,285	2,063	1,170	1,788	1,544	-13.65%
Wrightstown (B)	2,719	3,031	3,843	746	802	720	-10.22%

Source: U.S. Census of Population and Housing, Date Unknown.
Notes: (B) = Borough; (C) = City; (T) = Township

Table 3-10. Burlington County Population Trends, 1900 to 2020

Year	Population	Change in Population	Percent (%) Population Change
1900	58,241	-	-
1910	66,565	8,324	14.3
1920	81,770	15,205	22.8
1930	93,541	11,771	14.4
1940	97,013	3,472	3.7
1950	135,910	38,897	40.1
1960	224,499	88,589	65.2
1970	323,132	98,633	43.9
1980	362,542	39,410	12.2
1990	395,066	32,524	9.0
2000	423,394	28,328	7.2
2010	448,734	25,340	6.0
2020	461,860	13,126	2.9

Source: Population data from U.S. Census Bureau, 2020, 2021; change and percent change calculated for this plan.

Table 3-11. Ten Largest Municipalities in Burlington County

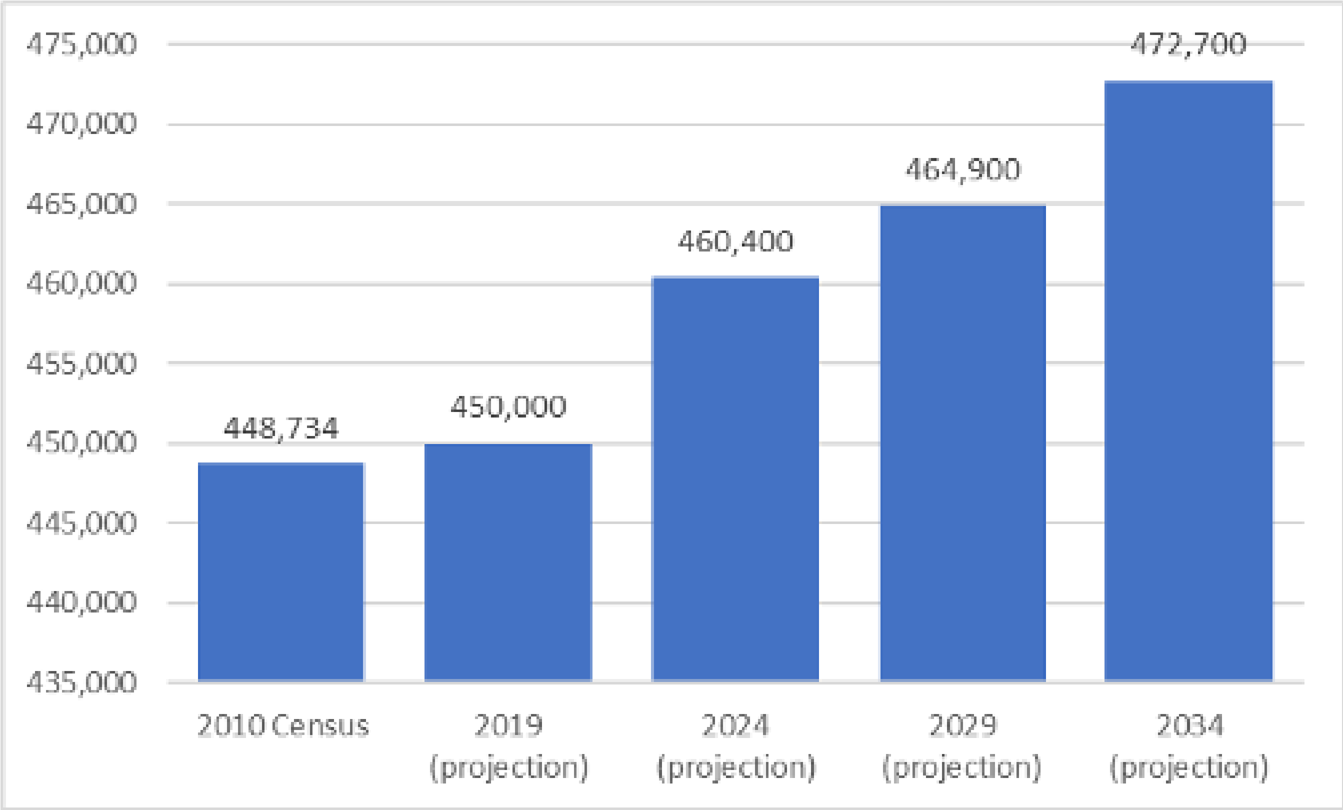
Rank	Municipality	Population
1	Evesham (T)	46,826
2	Mount Laurel (T)	44,633
3	Willingboro (T)	31,889
4	Pemberton (T)	26,903
5	Medford (T)	24,497
6	Burlington (T)	23,983
7	Moorestown (T)	21,355
8	Maple Shade (T)	19,980
9	Delran (T)	17,882
10	Cinnaminson (T)	17,064

Source: U.S. Census Bureau 2020, 2021
Notes: (T) = Township

Between 2010 and 2020, 16 of the 40 municipalities experienced an overall decrease in their population. The Township of New Hanover experienced the greatest loss of population, losing 13.78 percent of its population from 2010. The Township of Chesterfield experienced a population increase of 22.38 percent. Table 3-11 displays the 2020 Census population for the 10 most populous municipalities in the County.

Based on New Jersey Department of Labor 2014 population projections (the most recent projections available for this HMP update), the County population is expected to reach 472,700 by 2034, a 2.3 percent increase over 2020 (Figure 3-15). It should be noted that these projections likely underestimate population growth as the projected population for 2024 (460,400) was already surpassed by the 2020 Census generated population (461,860).

Figure 3-15. Burlington County Population Projections, 2010 to 2034



Source: New Jersey Department of Labor and Workforce Development 2014

3.5 GENERAL BUILDING STOCK

The 2018-2022 American Community Survey 5-year estimates identify 174,454 households and 186,192 housing units in Burlington County (U.S. Census Bureau 2023). U.S. Census defines household as all the persons who occupy a housing unit, and a housing unit as a house, an apartment, a mobile home, a group of rooms, or a single room that is occupied (or if vacant, is intended for occupancy) as separate living quarters. The median price of a single-family home in Burlington County was estimated at $304,600 in 2022 (U.S. Census Bureau 2023).

3.5.1 Existing Inventory

For this update, the default general building stock for Burlington County in Hazus was replaced with a custom building inventory, both at the aggregate and structure level. The updated building inventory was built using detailed building footprints, parcels, and structure-specific building attributes. This inventory shows a countywide total building replacement cost value (structure and contents) of about $168 billion. The value for residential properties makes up 42.12 percent of that total. Table 3-13 presents replacement cost values for the countywide total and for residential, commercial, and industrial properties.

Table 3-12. Replacement Cost Values

Municipality	All Occupancies Replacement Cost Value				Residential		Commercial		All Other	
	Count	Structure	Contents	Total (Structure + Contents)	Count	Total Replacement Cost (Structure + Contents)	Count	Total Replacement Cost (Structure + Contents)	Count	Total Replacement Cost (Structure + Contents)
Bass River (T)	719	$483,881,130	$397,541,907	$881,423,037	579	$259,670,056	96	$543,313,007	44	$78,439,974
Beverly (C)	939	$669,929,481	$548,860,852	$1,218,790,333	863	$432,319,481	40	$616,625,900	36	$169,844,952
Bordentown (C)	1,041	$1,479,824,214	$1,314,249,979	$2,794,074,193	916	$706,670,430	87	$1,635,106,800	38	$452,296,963
Bordentown (T)	3,389	$3,186,141,590	$2,680,343,840	$5,866,485,430	3,086	$1,766,729,960	217	$3,517,905,557	86	$581,849,913
Burlington (C)	3,165	$3,145,969,808	$2,667,342,597	$5,813,312,405	2,765	$1,518,510,304	299	$3,500,557,703	101	$794,244,398
Burlington (T)	6,525	$4,634,035,930	$4,185,447,965	$8,819,483,895	6,048	$2,934,257,367	237	$2,386,745,363	240	$3,498,481,165
Chesterfield (T)	2,673	$1,303,855,975	$939,319,829	$2,243,175,804	2,126	$1,103,061,825	47	$347,053,060	500	$793,060,919
Cinnaminson (T)	5,833	$3,434,863,845	$2,771,169,719	$6,206,033,564	5,429	$2,731,582,306	226	$2,021,885,178	178	$1,452,566,080
Delanco (T)	1,717	$985,026,322	$792,402,612	$1,777,428,934	1,614	$841,361,930	59	$419,325,074	44	$516,741,930
Delran (T)	5,008	$3,051,288,422	$2,291,350,984	$5,342,639,406	4,727	$2,668,403,916	199	$1,600,206,655	82	$1,074,028,835
Eastampton (T)	1,947	$749,463,463	$474,495,345	$1,223,958,808	1,834	$874,691,882	70	$166,158,619	43	$183,108,307
Edgewater Park (T)	2,210	$1,387,987,910	$1,003,689,830	$2,391,677,740	2,081	$1,278,170,463	78	$801,318,205	51	$312,189,072
Evesham (T)	13,368	$6,510,994,305	$4,617,372,226	$11,128,366,531	12,701	$5,930,712,659	435	$3,873,745,449	232	$1,323,908,423
Fieldsboro (B)	224	$135,036,357	$106,487,900	$241,524,257	198	$110,749,114	9	$81,006,201	17	$49,768,942
Florence (T)	4,084	$3,528,711,900	$3,053,611,216	$6,582,323,116	3,701	$2,350,465,686	172	$1,581,677,655	211	$2,650,179,775
Hainesport (T)	2,546	$1,785,836,114	$1,497,815,806	$3,283,651,920	2,287	$1,086,125,466	145	$1,636,784,252	114	$560,742,202
Lumberton (T)	3,724	$2,390,626,131	$1,914,047,617	$4,304,673,748	3,216	$1,812,943,463	188	$1,406,090,443	320	$1,085,639,842
Mansfield (T)	3,805	$2,003,311,609	$1,395,018,415	$3,398,330,024	3,364	$1,858,477,945	117	$947,329,277	324	$592,522,802
Maple Shade (T)	5,120	$3,235,266,889	$2,599,911,292	$5,835,178,181	4,713	$2,068,249,243	341	$3,283,684,244	66	$483,244,694
Medford (T)	8,792	$5,812,040,470	$4,230,185,586	$10,042,226,056	8,027	$4,901,417,210	424	$3,967,624,253	341	$1,173,184,593
Medford Lakes (B)	1,804	$621,483,458	$345,754,770	$967,238,228	1,770	$835,521,941	17	$86,031,441	17	$45,684,846
Moorestown (T)	7,173	$6,671,888,749	$5,560,574,376	$12,232,463,125	6,514	$4,438,790,790	343	$4,816,222,006	316	$2,977,450,329
Mount Holly (T)	2,987	$2,062,906,178	$1,700,392,140	$3,763,298,318	2,676	$1,178,094,611	209	$2,105,277,964	102	$479,925,743
Mount Laurel (T)	13,150	$8,580,722,190	$6,837,746,789	$15,418,468,979	12,354	$5,967,010,088	545	$7,446,607,450	251	$2,004,851,441
New Hanover (T)	1,068	$1,454,681,464	$1,414,258,123	$2,868,939,587	295	$121,270,024	41	$366,498,051	732	$2,381,171,512
North Hanover (T)	2,176	$1,320,455,662	$1,084,214,685	$2,404,670,347	1,486	$717,750,341	73	$635,193,370	617	$1,051,726,636
Palmyra (B)	2,482	$1,222,466,403	$910,640,737	$2,133,107,140	2,340	$1,069,114,169	95	$772,733,661	47	$291,259,310
Pemberton (B)	519	$405,485,181	$330,656,310	$736,141,491	460	$249,199,271	42	$397,861,568	17	$89,080,652
Pemberton (T)	9,729	$4,061,985,822	$2,911,257,017	$6,973,242,839	8,863	$3,653,826,405	230	$1,769,740,069	636	$1,549,676,365
Riverside (T)	2,532	$1,350,008,041	$1,109,946,125	$2,459,954,166	2,331	$773,639,516	134	$1,461,350,211	67	$224,964,439
Riverton (B)	989	$644,201,505	$452,528,093	$1,096,729,598	938	$588,701,595	35	$355,954,948	16	$152,073,055

Municipality	All Occupancies Replacement Cost Value Count	Structure	Contents	Total (Structure + Contents)	Residential Count	Total Replacement Cost (Structure + Contents)	Commercial Count	Total Replacement Cost (Structure + Contents)	All Other Count	Total Replacement Cost (Structure + Contents)
Shamong (T)	2,494	$1,491,241,787	$1,013,684,949	$2,504,926,736	2,144	$1,462,605,155	69	$446,950,399	281	$595,371,182
Southampton (T)	5,368	$2,659,445,297	$1,933,572,958	$4,593,018,255	4,687	$2,260,892,149	231	$1,462,121,392	450	$870,004,714
Springfield (T)	1,826	$1,185,123,238	$955,394,082	$2,140,517,320	1,199	$689,187,469	128	$670,084,855	499	$781,244,996
Tabernacle (T)	2,938	$1,305,660,575	$894,779,662	$2,200,440,237	2,620	$1,246,359,444	103	$526,604,504	215	$427,476,289
Washington (T)	538	$323,371,754	$280,713,195	$604,084,949	390	$163,324,082	18	$215,449,707	130	$225,311,160
Westampton (T)	2,795	$2,386,264,842	$2,234,027,803	$4,620,292,645	2,458	$1,265,684,407	202	$1,506,024,338	135	$1,848,583,900
Willingboro (T)	10,830	$5,456,305,158	$3,333,129,001	$8,789,434,159	10,529	$6,486,858,226	152	$1,325,032,834	149	$977,543,099
Woodland (T)	782	$661,123,288	$672,372,543	$1,333,495,831	602	$269,628,815	89	$751,176,335	91	$312,690,681
Wrightstown (B)	296	$388,229,854	$360,642,569	$748,872,423	185	$94,109,208	55	$475,166,687	56	$179,596,528
Burlington County	**149,305**	**$94,167,142,311**	**$73,816,951,444**	**$167,984,093,755**	**135,116**	**$70,766,138,412**	**6,297**	**$61,926,224,685**	**7,892**	**$35,291,730,658**

Source: Burlington County, 2023; NJOGIS 2023; Microsoft BING 2022; RS Means 2022

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

TETRA TECH

Figure 3-16 through Figure 3-18 show the distribution of residential, commercial, and industrial buildings in Burlington County by total value (structure and contents) per square mile. Content value various widely depending on the usage of the structure. Generally, contents for residential structures are valued at about 50 percent of the building's structural value. For commercial facilities, the value of the content is generally about equal to the building's structural value. These maps can assist communities in visualizing areas of high exposure and in evaluating aspects of the study area in relation to specific hazard risks.

Figure 3-16. Distribution of Residential Building Stock Replacement Cost Value in Burlington County

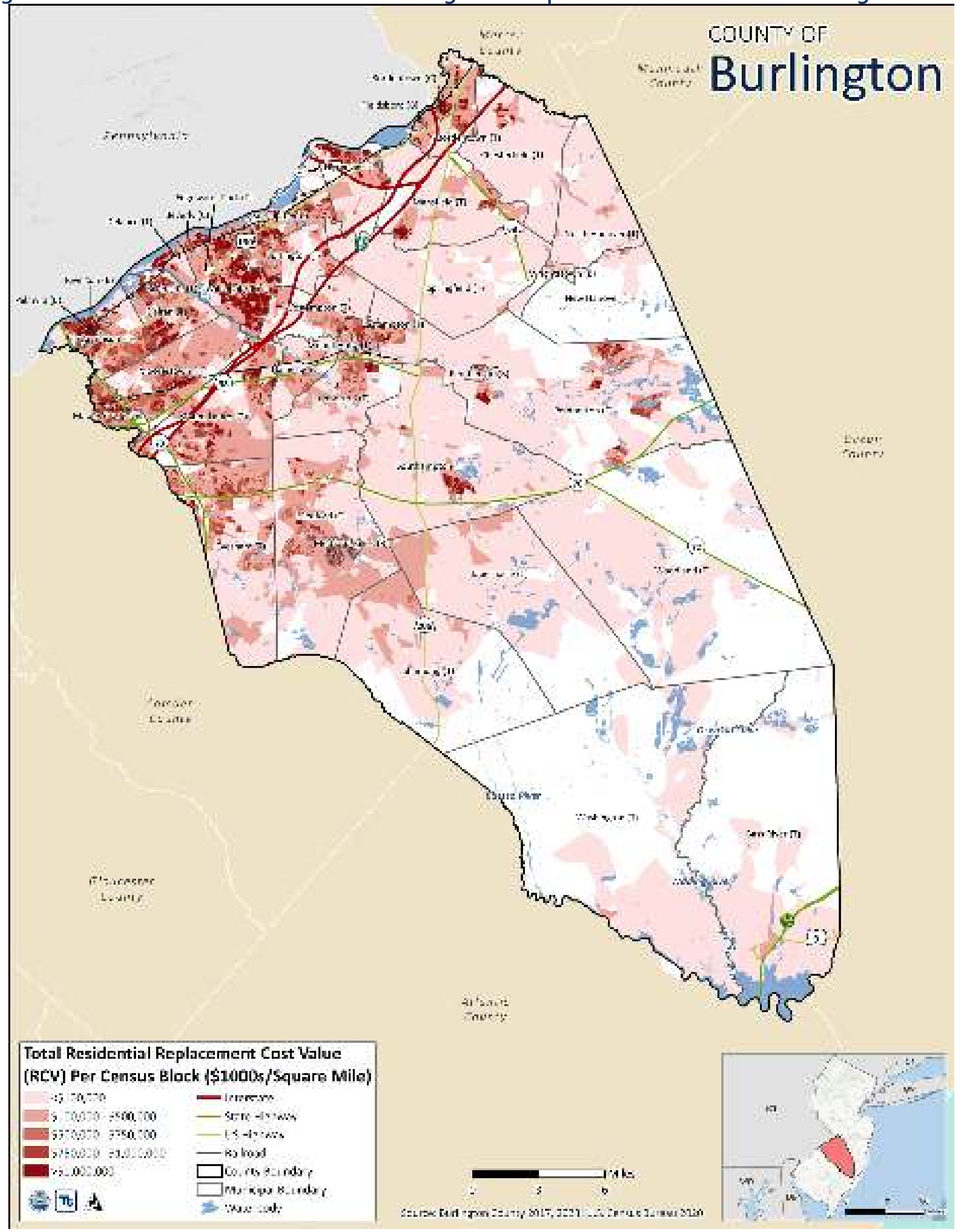


Figure 3-17. Distribution of Commercial Building Stock Replacement Cost Value in Burlington County

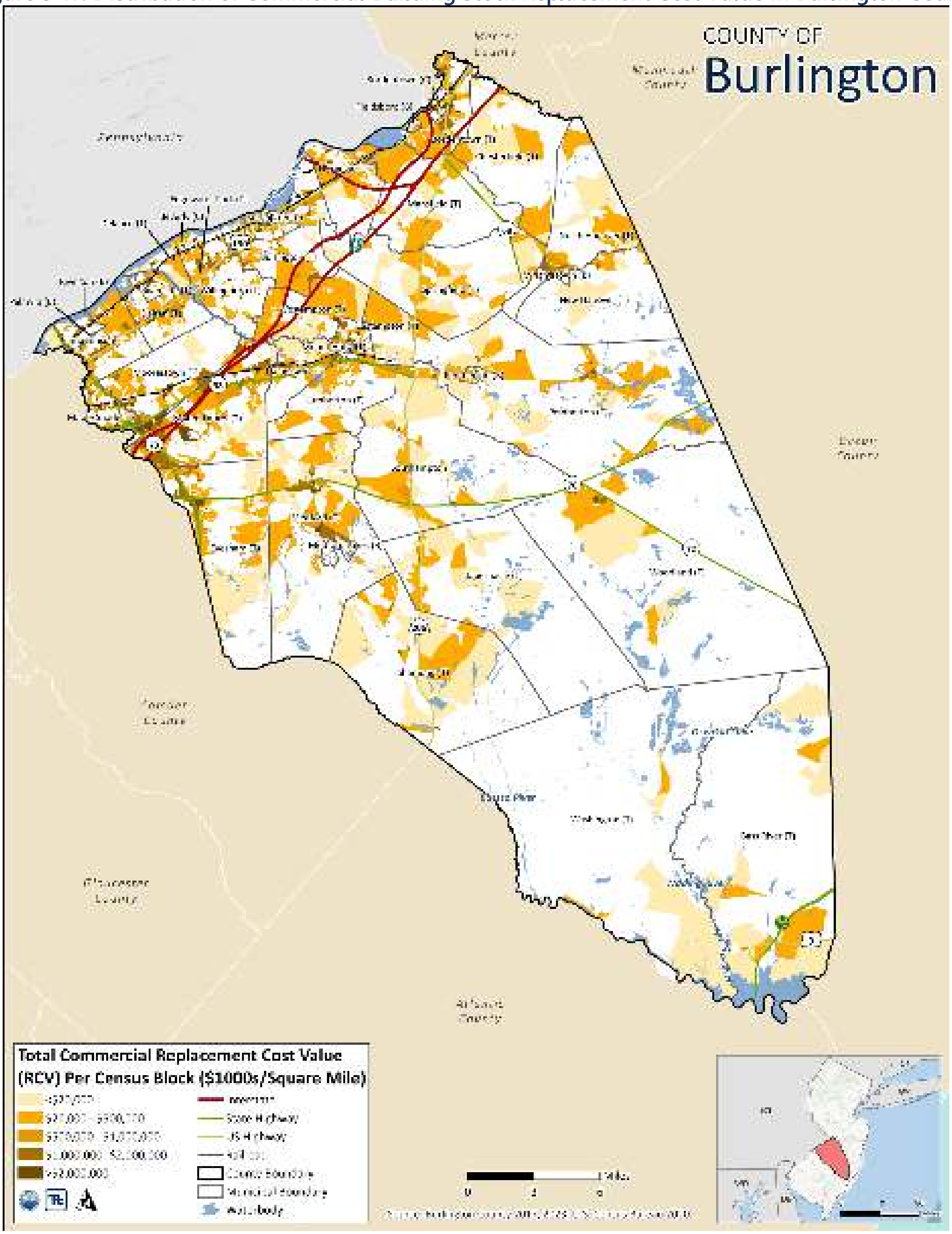
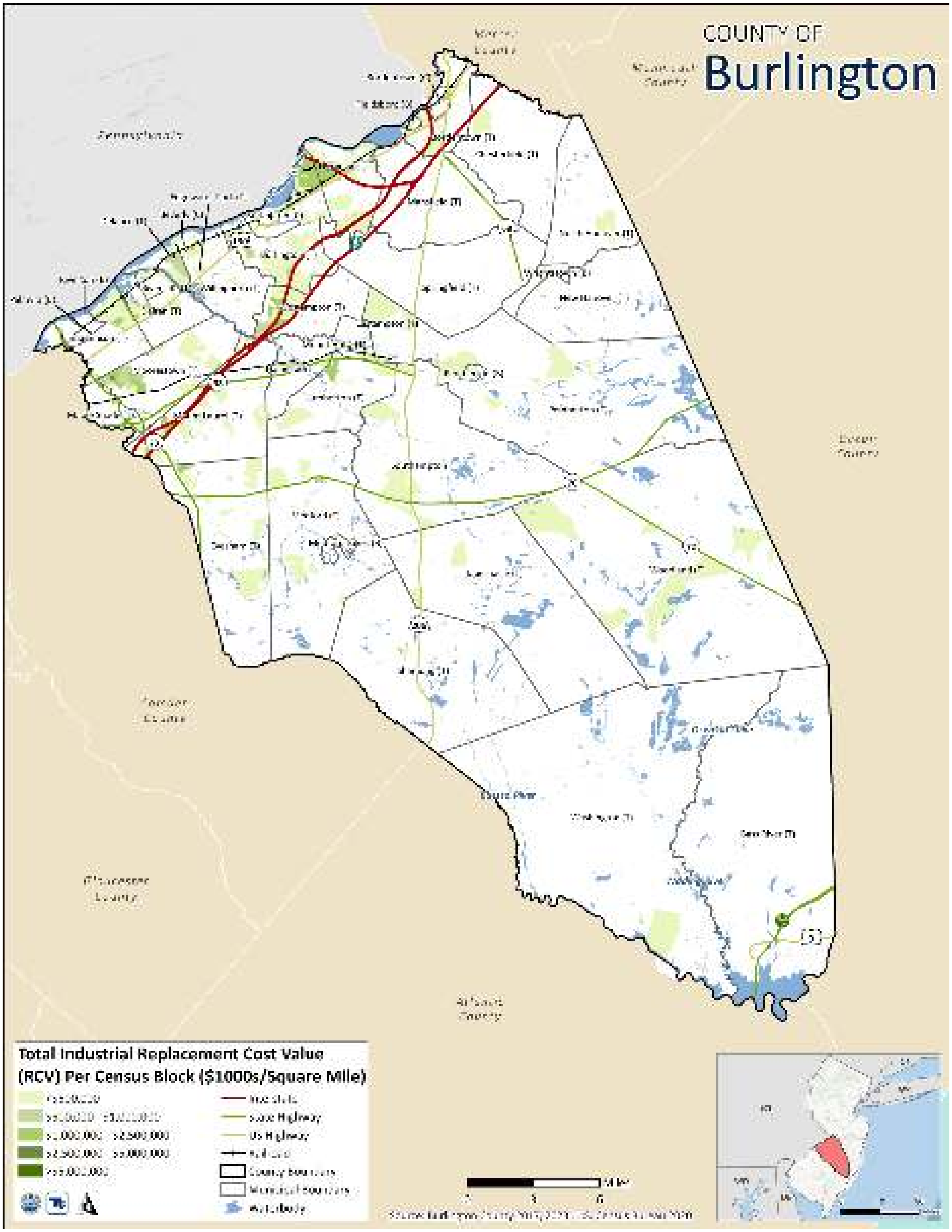


Figure 3-18. Distribution of Industrial Building Stock Replacement Cost Value in Burlington County



3.5.2 Development Trends and New Development

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

This plan provides a general overview of population and land use, and types of development occurring within the study area. An understanding of these development trends can assist in planning for future development and ensuring that appropriate mitigation, planning, and preparedness measures are in place to protect human health and community infrastructure. For municipal identified new development, refer to the municipal annexes in Section 9.

3.6 LIFELINES FACILITIES

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

To facilitate consistency with the National Response Framework, FEMA Strategic Plan, and guidance for the Building Resilient Infrastructure and Communities grant program, critical facilities in Burlington County are discussed in terms of “community lifelines.” FEMA defines these as the most fundamental services in the community that, when stabilized, enable all other aspects of society. Following a disaster event, intervention is required to stabilize community lifelines. Lifelines are divided into the following categories (FEMA 2023):

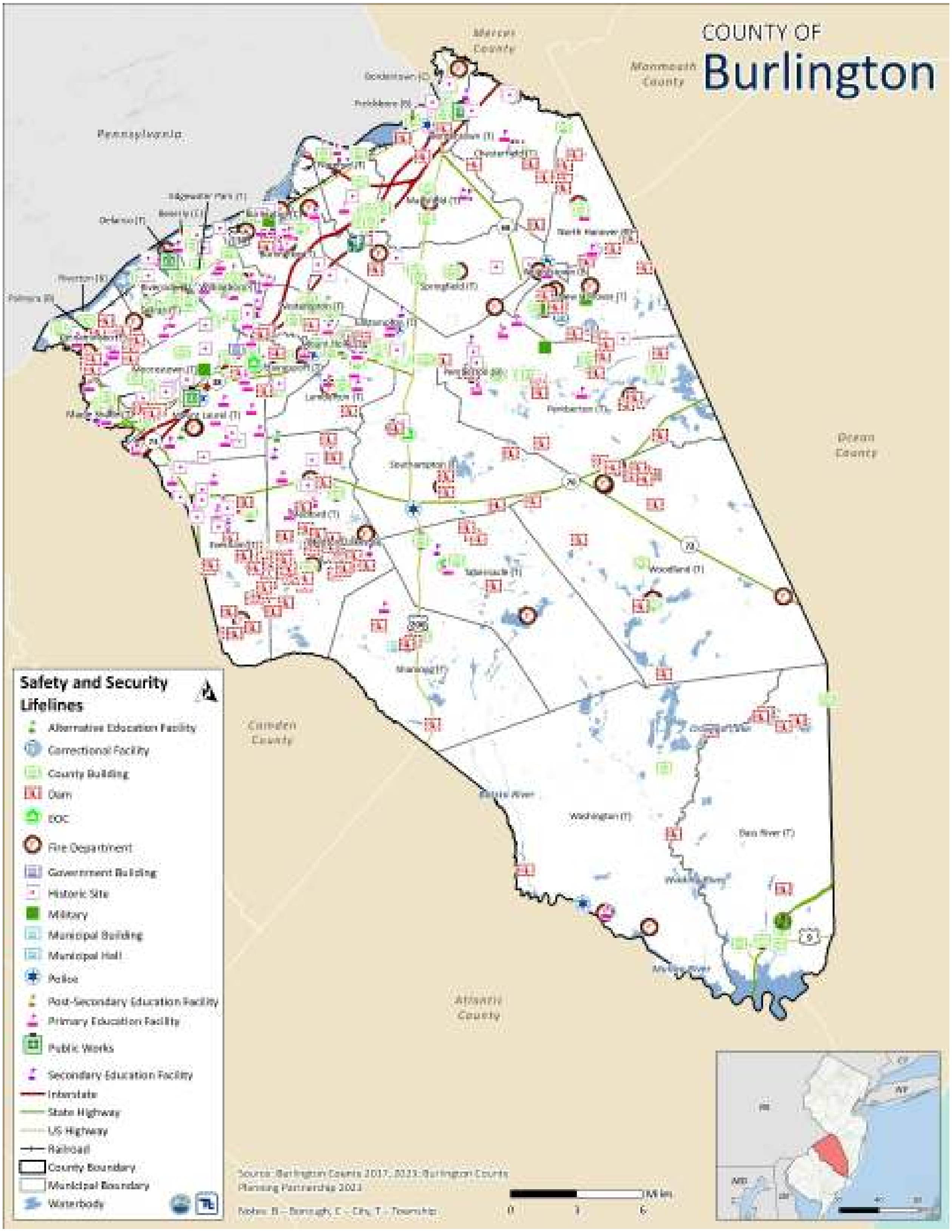
- Safety and Security
- Food, Hydration, Shelter
- Health and Medical
- Energy
- Communications
- Transportation
- Hazardous Materials
- Water Systems

A comprehensive inventory of lifelines in Burlington County was developed from the Burlington County Department of Information Technology, GIS Division. The inventory of lifelines presented in this section represents the current state of this effort at the time of publication of the HMP and was used for the risk assessment. The inventory of lifelines identified for the HMP is considered sensitive information. It is protected by the Protected Critical Infrastructure Information (PCII) program and under New Jersey Executive Order 21. Therefore, individual facility names and addresses are not provided in this HMP. A summary of the facility types used for the risk assessment are presented further in this section.

3.6.1 Safety and Security

Figure 3-19 shows the general location of safety and security lifeline facilities in Burlington County. General descriptions of the types of facilities included are presented in the sections below.

Figure 3-19. Safety and Security Lifelines in Burlington County



Emergency Facilities

The County has a highly coordinated and interconnected network of emergency facilities and services at the County and municipal level. The Burlington County Office of Emergency Management (OEM) serves as the primary coordinating agency between local, state, and federal emergency agencies. In response to an emergency event, the Burlington County OEM works with County and municipal health agencies and healthcare providers, emergency facilities, and the County Sheriff's Office to provide aid to residents of the County.

Each municipality is responsible for maintaining its own fire department; however, not every municipality maintains its own police department or emergency medical services facility. All municipalities included in this HMP maintain their own police department except Bass River Township, Hainesport Township, Shamong Township, Southampton Township, Tabernacle Township, Woodland Township, and Wrightstown Borough, all of which are covered by the State Police. The Burlington County Sheriff's Office and NJ State Police also provide emergency support to the municipalities.

Municipalities that maintain their own EMS facilities and provide support to surrounding municipalities are the City of Beverly, Bordentown City, Burlington City, Chesterfield Township, Cinnaminson Township, Delanco Township, Delran Township, Eastampton Township, Evesham Township, Florence Township, Hainesport Township, Lumberton Township, Mansfield Township, Maple Shade Township, Medford Township, Moorestown Township, Mount Holly Township, Mount Laurel Township, New Hanover Township, North Hanover Township, Palmyra Borough, Pemberton Township, Shamong Township, Southampton Township, Springfield Township, Tabernacle Township, Washington Township, Westampton Township, Willingboro Township, and Woodland Township.

Overall, there are 412 local, County, and state law enforcement facilities, 122 fire and EMS facilities, 41 police facilities, and 75 emergency operation centers (EOCs) in Burlington County. The EOC total includes municipal halls, fire departments, public work buildings, and others that were identified as EOCs by the municipalities.

Military Installations

There are five military installations in Burlington County. The County is home to the U.S. Defense Department's only tri-service installation—Joint Base McGuire-Dix-Lakehurst (JB MDL), which is home to five wings and covers 42,000 acres. JB MDL's host wing, the 87th Air Base Wing, supports 88 mission partners by providing installation support to all mission commanders and sustaining mission-ready expeditionary service members (Joint Base MDL n.d.).

Dams and Levees

The New Jersey Department of Environmental Protection (NJDEP) defines four hazard classifications for dams in New Jersey, based on the potential for property damage and/or loss of life should the dam fail:

- 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 and/or significant property damage.
- Class IV (Small-Dam Low-Hazard Potential)—Failure of the dam is not expected to result in loss of life or significant property damage. Dam must also meet the requirements of a Class IV dam above.

Table 3-14 summarizes dams present in Burlington County according to the U.S. Army Corps of Engineers (USACE) National Inventory of Dams; 10 of these have a high hazard classification. Figure 3-19 illustrates the locations of these dams.

Table 3-13. Dams in Burlington County

County	Total Count	Class I	Class II	Class III	Class IV
Burlington	74	10	40	24	0

Source: USACE 2023

The USACE National Levee Database lists no levees in Burlington County (USACE 2024).

3.6.2 Food, Hydration, Shelter

Figure 3-20 shows the general location of food, hydration, and shelter lifeline facilities in Burlington County. General descriptions of the types of facilities included are presented in the sections below.

Shelters

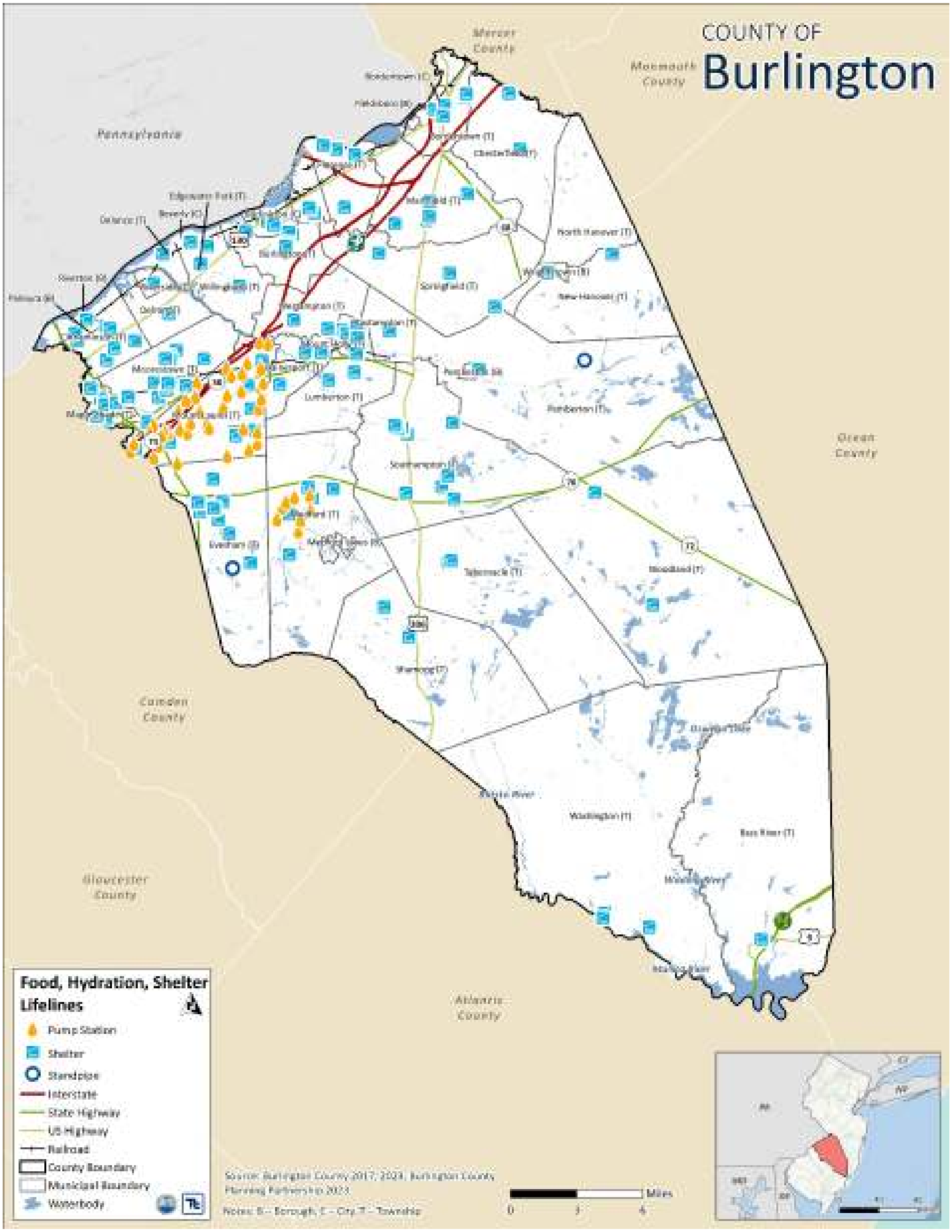
With support and cooperation of the American Red Cross and local jurisdictions, the County references an inventory of suitable shelter locations and can assist with the coordination and communication of shelter availability as necessitated by the execution of local municipal emergency operation plans.

There are 139 shelters identified within Burlington County. Many schools, community centers, and municipal buildings could serve as a shelter during an emergency.

Schools

In times of need, schools can function as shelters and are an important resource to the community. There are 85 schools, ranging from elementary to post-secondary education, that service the County. Several municipalities in the County have their own school systems, while other municipalities are served by regional school districts. In addition to the public schools throughout the County, there are several private education facilities.

Figure 3-20. Food, Hydration, Shelter Lifelines in Burlington County



TETRA TECH

3.6.3 Health and Medical

Figure 3-21 shows the general location of health and medical lifeline facilities in Burlington County. General descriptions of the types of facilities included are presented in the sections below.

Hospitals and Medical Facilities

Burlington County has a dynamic health care industry that includes hospitals, rehabilitation centers, and behavioral health facilities. There are 15 hospital and medical facilities located in Burlington County.

Senior Care and Living Facilities

The County has an extensive system of programs and services for the senior population, including 65 senior care facilities. These facilities are highly vulnerable to potential impacts from disasters. Knowing the location and numbers of these types of facilities will be effective in managing a response plan pre- and post-disaster.

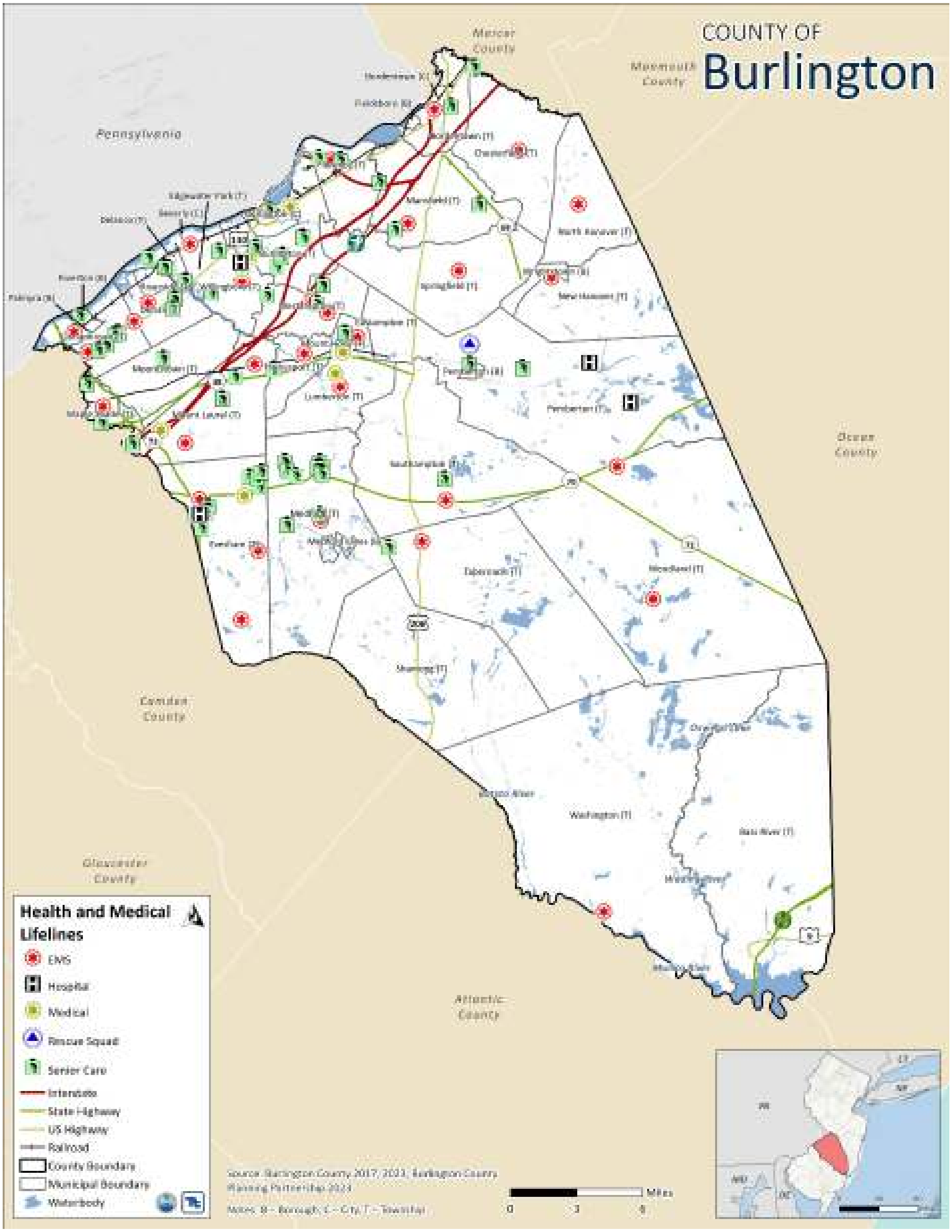
3.6.4 Energy

Figure 3-22 shows the general location of energy lifeline facilities in Burlington County. General descriptions of the types of facilities included are presented in the section below.

Energy Resources

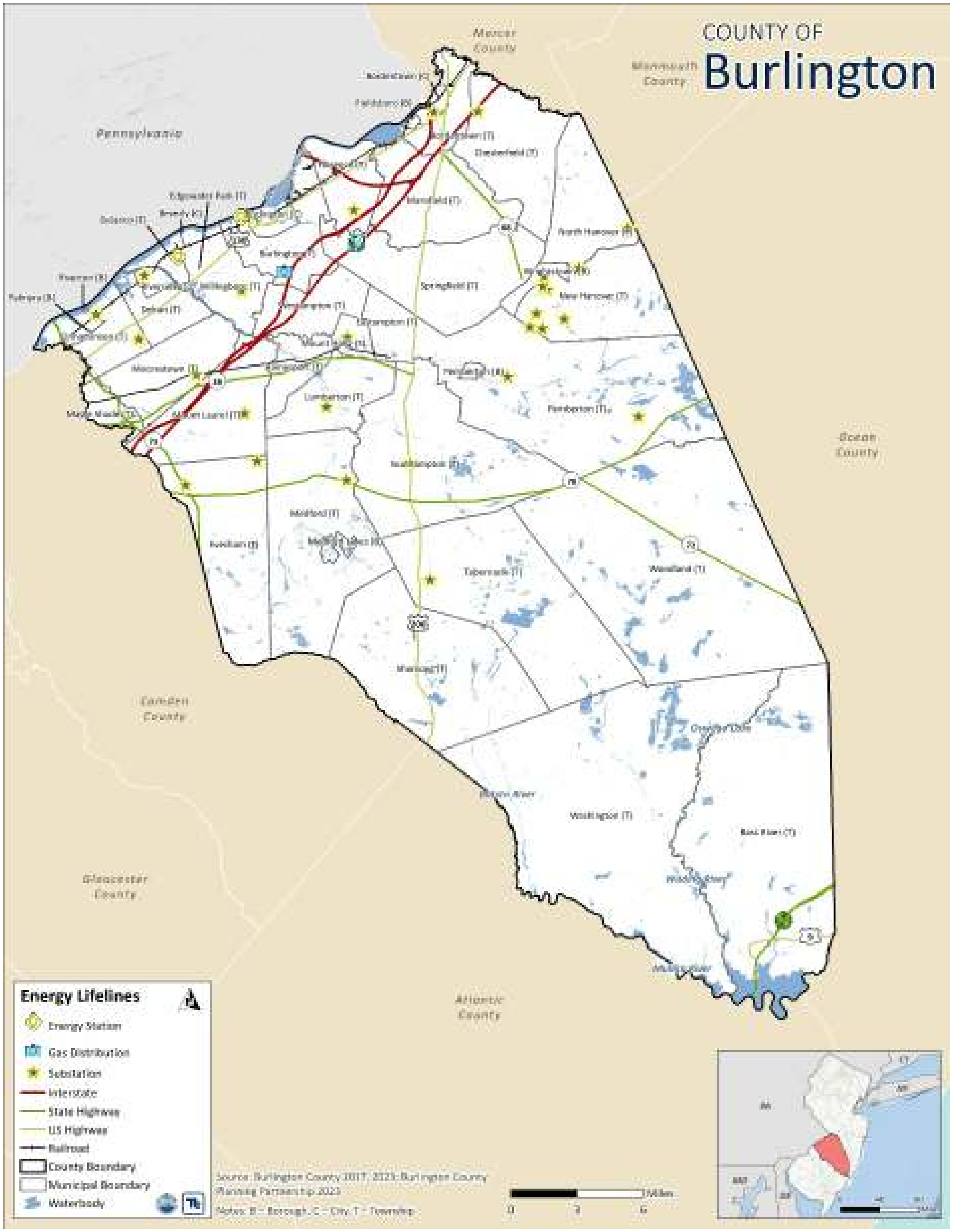
JCP&L and PSE&G are the primary electric and gas utility companies in Burlington County. In addition, South Jersey Gas provides natural gas service to Burlington County. Verizon is the primary provider of landline service in Burlington County. Homes in the County are heated by many different sources, with a majority using natural gas or fuel oil.

Figure 3-21. Health and Medical Lifelines in Burlington County



TETRA TECH

Figure 3-22. Energy Lifelines in Burlington County



TETRA TECH

3.6.5 Communications

Figure 3-23 shows the general location of communications lifeline facilities in Burlington County. General descriptions of the types of facilities included are presented in the sections below.

Emergency Warnings and Responder Communications

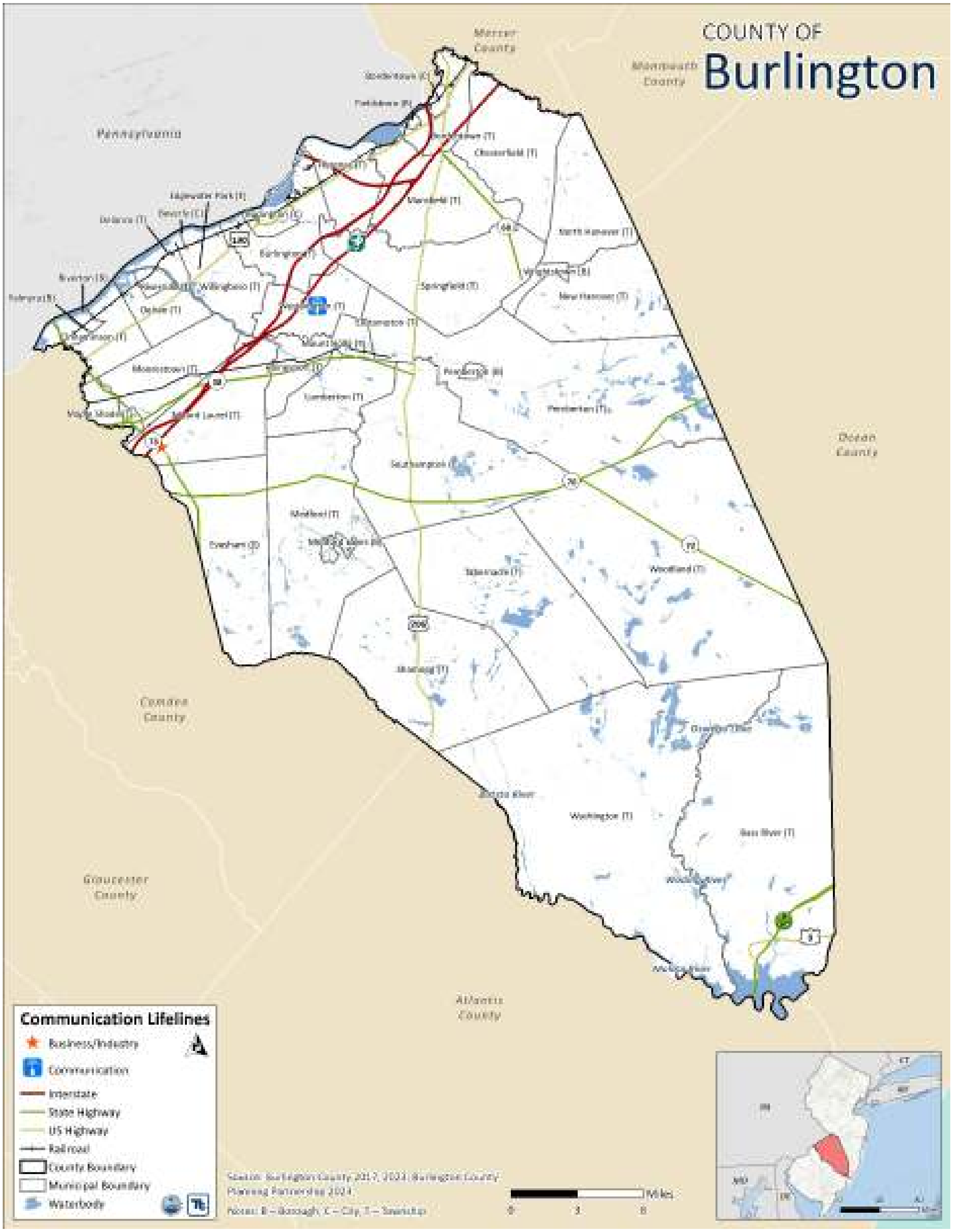
Burlington County OEM operates an emergency operations center in the Township of Westampton. This is a specially designed facility where public organizations and private-sector agencies meet to decide and coordinate emergency response to community-wide disasters.

Additionally, Burlington County has a central communications facility, which serves as the public safety answering point to dispatch all public safety services throughout the County.

Communications

Burlington County is served by a variety of communications systems, including traditional land line, fiber optic, and cellular service provided by multiple companies, such as Verizon, Direct TV, Comcast, and AT&T. 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, Burlington 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 two communication facilities in Burlington County identified as critical facilities.

Figure 3-23. Communication Lifelines in Burlington County



TETRA TECH

3.6.6 Transportation

Figure 3-24 shows the general location of transportation lifeline facilities in Burlington County. General descriptions of the types of facilities included are presented in the sections below.

Highway, Roadways, and Associated Systems

Interstates 295 and 95 are the major north-south routes that pass through the County. These routes are vital corridors connecting major cities of the east coast. Additionally, a small portion of Interstate 276 connects Interstates 95 and 295 to northern Philadelphia and the Pennsylvania Turnpike's Northeast Extension. The Garden State Parkway (US Route 9), another north-south route, passes through the eastern edge of the County. The Garden State Parkway extends from New York to the tip of Cape May County. Other important routes in Burlington County are U.S. Route 206 (north-south), U.S. Route 130 (north-south), NJ Route 70 (east-west), and NJ Route 72 (east-west).

Evacuation Routes

The County has identified evacuation zones for severe weather and can assist with the coordination and communication of evacuation routing as necessitated by the execution of local municipal emergency operation plans. Evacuation routes utilized are determined based on the specific hazard events.

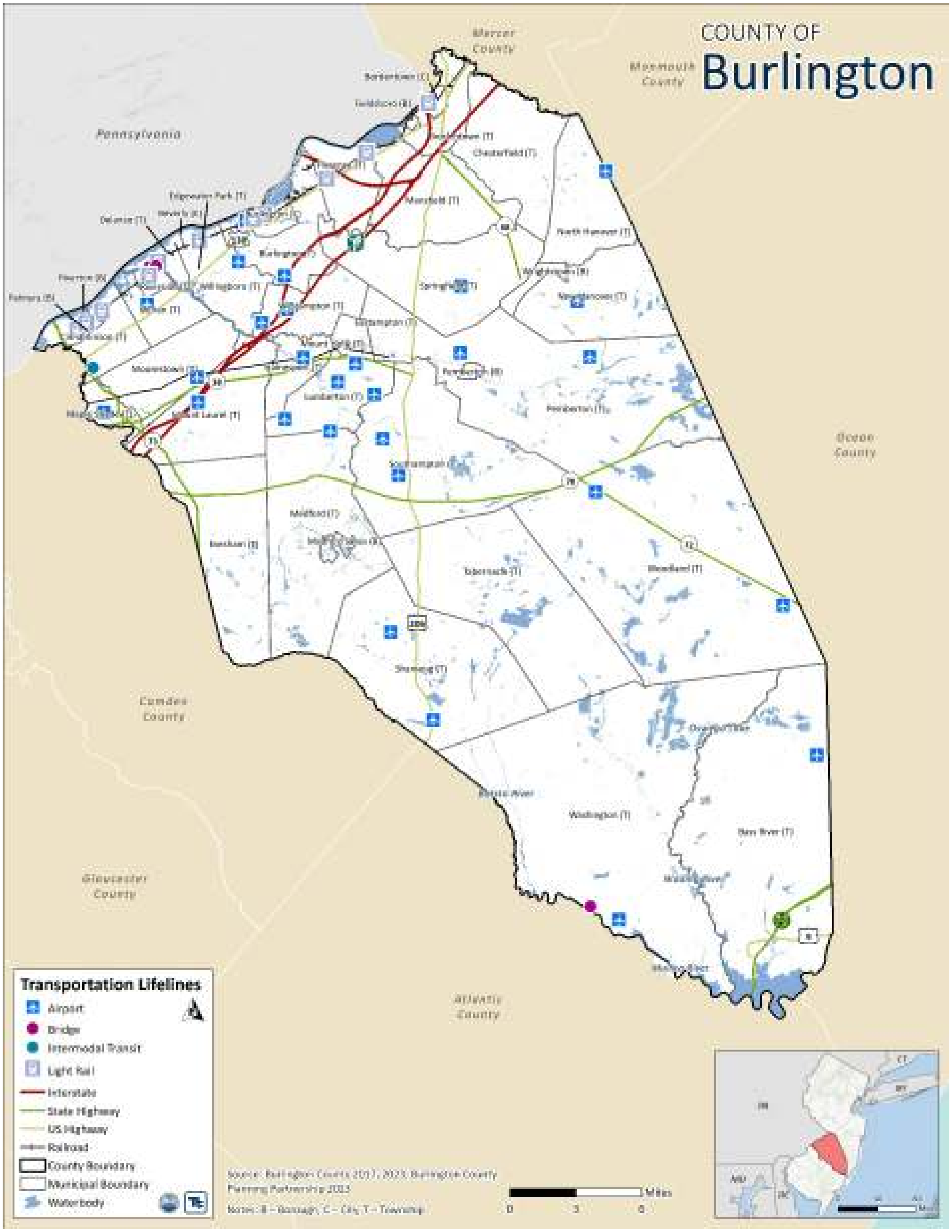
Bus and Other Transit Facilities

Burlington County is served primarily by New Jersey Transit bus and rail lines. The NJ Transit River Line connects to Amtrak's Northeast Corridor at Trenton and to PATCO which connects Philadelphia to Camden. These lines provide the connection between Burlington County and other major cities such as Washington D.C., Baltimore, MD, Wilmington, DE, Philadelphia, PA, and New York, NY. Rail service extends to points north and south.

Air

There are 28 air facilities in the County. These facilities include both airports and heliports that are utilized for public, private, medical, and military purposes.

Figure 3-24. Transportation Lifelines in Burlington County



3.6.7 Hazardous Materials

Figure 3-25 shows the general location of hazardous materials lifeline facilities in Burlington County. General descriptions of the types of facilities included are presented in the sections below. Due to heightened security concerns, local hazardous materials lifeline data sufficient to complete the analysis have only partially been obtained.

Hazardous Material Facilities

The U.S. Environmental Protection Agency's (EPA) 2023 Toxics Release Inventory (TRI) database indicates that there are 20 TRI facilities in Burlington County. TRI facilities are those required to report on chemical storage and use, based on particular volumes of specified chemicals stored and used (US EPA 2023). NJDEP Bureau of Release Prevention identifies facilities in the County where an extraordinarily hazardous substance may be present or generated above regulatory levels that are subject to the Toxic Catastrophe Prevention Act, (N.J.S.A. 13:1K-19 et seq.) and the regulations arising from the Act as codified in N.J.A.C. 7:31 (NJDEP Compliance and Enforcement 2018).

After a series of hazardous waste releases that caused human and environmental harm, there was a great need for reporting on hazardous materials that are housed within industrial facilities. This led to Emergency Planning and Community Right-to-Know Act (EPCRA) being passed in 1986. The EPCRA group of regulations includes (US EPA 2024):

- Emergency planning (Sections 301-303).
- Emergency release notification (Section 304).
- Hazardous Chemical Storage Reporting Requirements (Sections 311-312).
- Toxic Chemical Release Inventory (Section 313).
- Tier II (SARA 312).

Tier II (SARA 312) is under section 312 of EPCRA, and it is a mandatory report of hazardous and toxic substances that are housed at your facility at any given point during the reporting year. Facilities are required to report Tier II substances and Extremely Hazardous Substances (EHS) that are equal to or greater than the defined Tier II reporting thresholds. These substances must maintain an SDS under OSHA's hazard communication standard (US EPA 2024).

3.6.8 Water Systems

Figure 3-26 shows the general location of water system lifeline facilities in Burlington County. General descriptions of the types of facilities included are presented in the sections below.

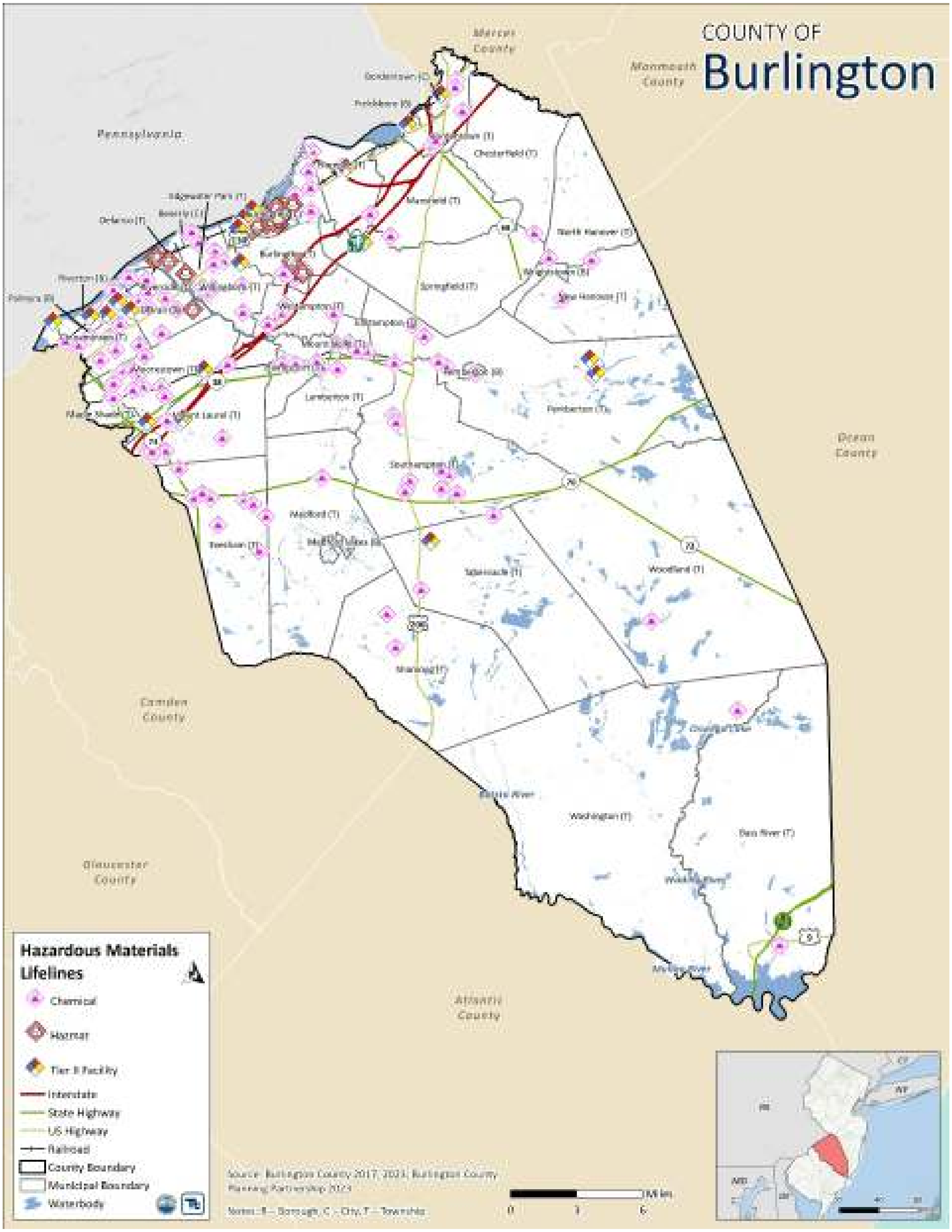
Potable Water

New Jersey American Water (NJAW) serves more than 80,000 people in 20 communities in Burlington County and more than 2 million people statewide. NJAW's main production facility in the region is the Delaware River Water Treatment Plant (DRWTP), located in Delran. The DRWTP produces an average of 22 million gallons of water per day and serves customers in Burlington, Camden, and Gloucester counties. The largest water purveyor in the state, NJAW is a wholly owned subsidiary of American Water, which serves more than 14 million people in 24 states (American Water 2023).

Aqua America New Jersey provides drinking water and wastewater services to 150,000 residents in 18 municipalities in nine New Jersey counties (State of New Jersey 2012).

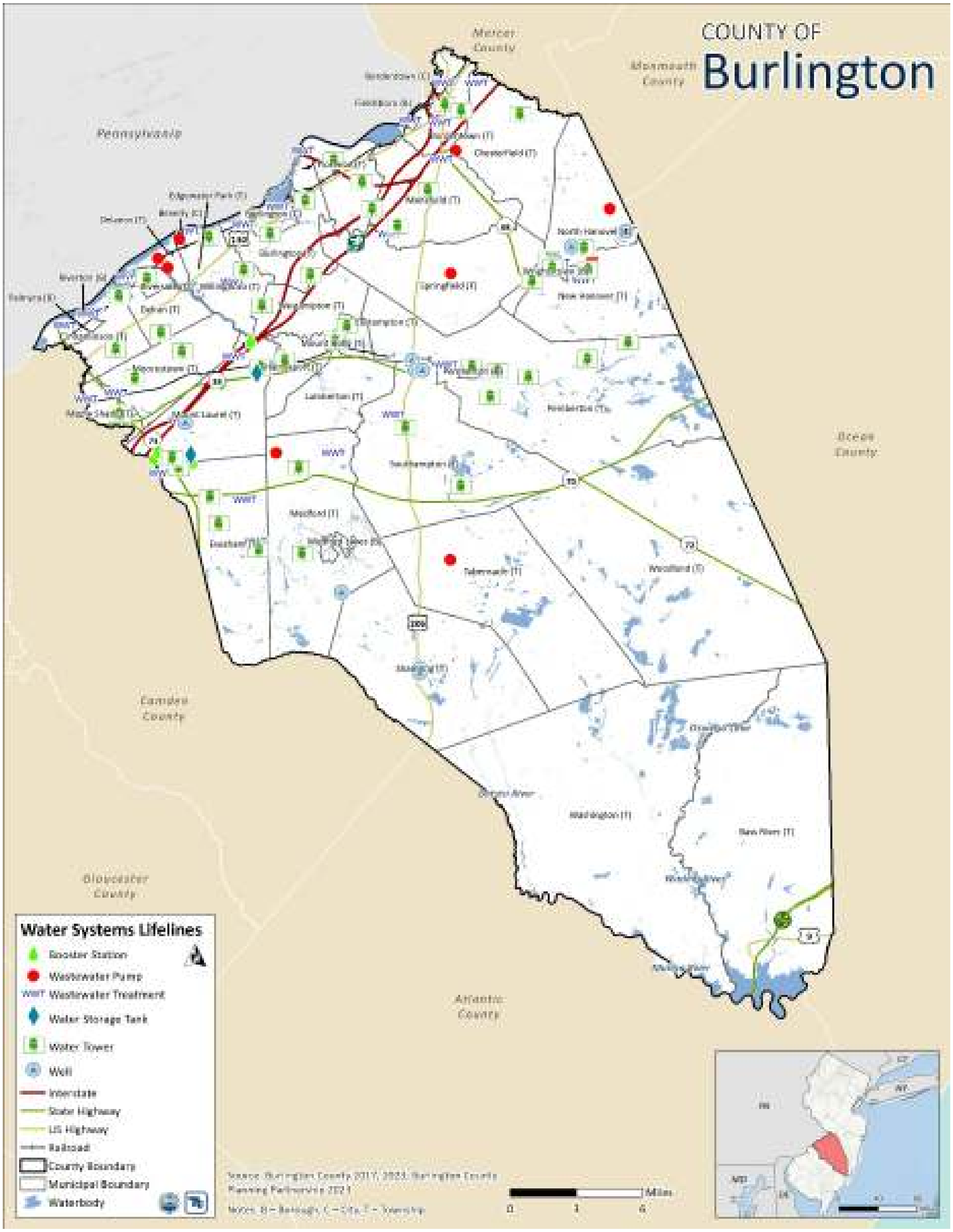
Burlington County's water is predominantly from surface water sources. A small portion of the water supply is well water from well fields distributed throughout the system.

Figure 3-25. Hazardous Material Lifelines in Burlington County



TETRA TECH

Figure 3-26. Water System Lifelines in Burlington County



TETRA TECH

Wastewater Facilities

Table 3-15 lists the wastewater treatment facilities in Burlington County.

Table 3-14. Burlington County Wastewater Treatment Facilities

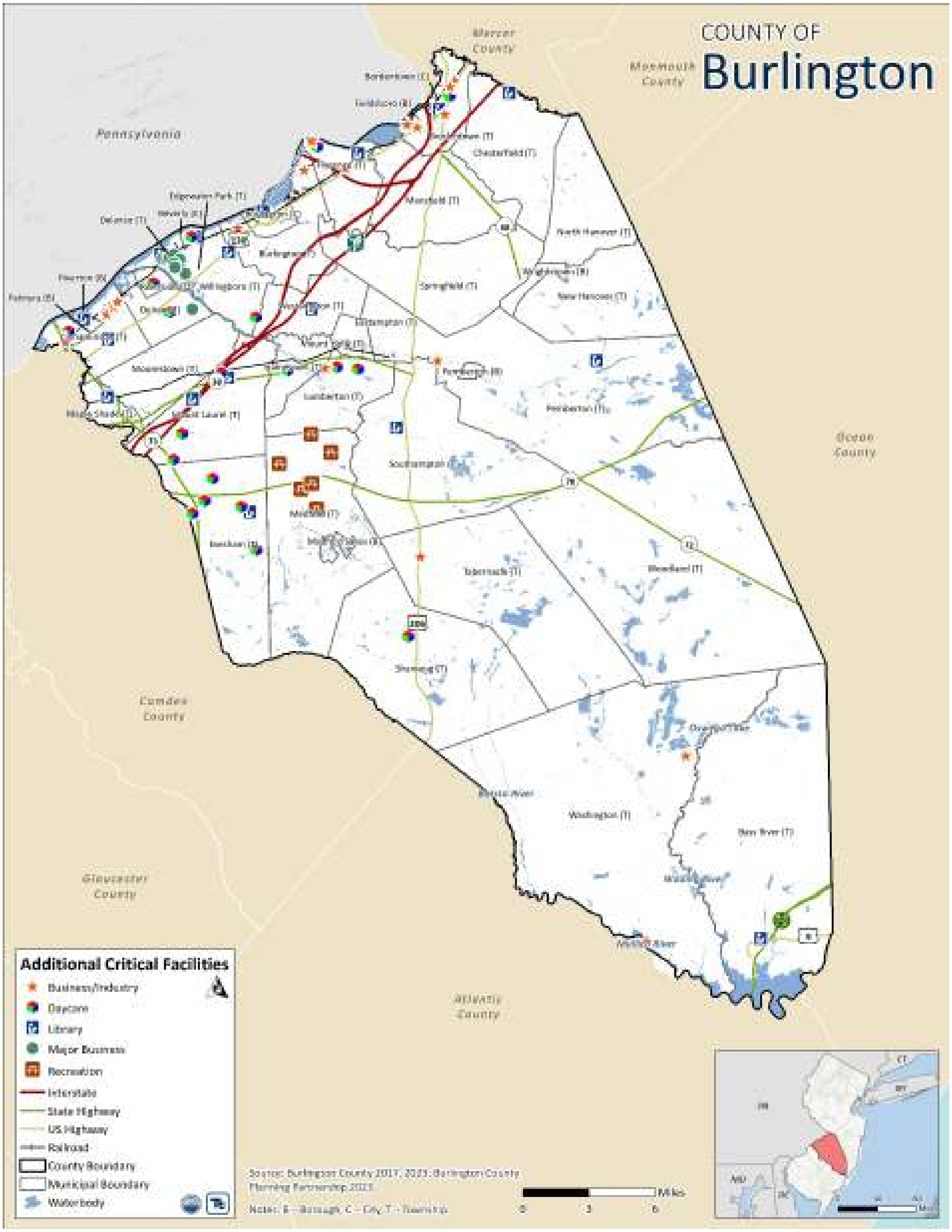
Name	Municipalities Served
A.C. Wagner Youth Correctional Institution	Chesterfield Township
Beverly Sewerage Authority	Beverly City and Delanco Township
Bordentown Sewerage Authority	Bordentown City, Bordentown Township
Burlington City Sewerage Authority	Burlington City, Burlington Township
Central Avenue Sewerage Treatment Plant	Burlington Township, Springfield Township
Camden County Municipal Utilities Authority	Portions of Mount Laurel Township and Evesham Township
Cinnaminson Township Sewerage Authority	Cinnaminson Township
Delran Sewerage Authority	Delran Township, Moorestown Township
Edgewater Park Sewerage Authority	Edgewater Park Township, portion of Delanco Township
Evesham Township MUA	Evesham Township, portions of Mount Laurel Township, portions of Medford Township
Florence Sewerage Treatment Plant	Florence Township, portion of Burlington Township
Maple Shade Township	Maple Shade Township and a portion of Cinnaminson Township
Medford Lakes Sewerage Authority	Medford Lakes Borough and a portion of Medford Township
Medford Township MUA	Medford Township
Moorestown Township Sewerage Treatment Plant	Moorestown Township
Mount Holly Municipal Utility Authority	Mount Holly, Eastampton, a portion of Westampton, Hainesport, Lumberton, a portion of Moorestown
Mount Laurel Municipal Utilities Authority	Mount Laurel, Evesham
Palmyra Sewerage Treatment Plant	Palmyra Township and a portion of Riverton Borough
Pemberton Township Municipal Utilities Authority	Pemberton Township and Pemberton Borough
Pinelands Wastewater Company	Southampton Township
Riverside Township Sewerage Treatment Plant	Riverside Township and a portion of Delran Township
US Army Fort Dix/McGuire Air Force Base	Military installation in each of the following: New Hanover, Pemberton, North Hanover Townships
Willingboro Municipal Sewerage Treatment Plant	Willingboro Township, Edgewater Park Township, a portion of Delanco Township and a portion of Westampton Township
Wrightstown Municipal Utilities Authority	Wrightstown and a portion of Springfield Township

Source: (Burlington County Department of Resource Conservation 2017)

3.6.9 Other Lifeline Facilities

The Planning Partnership identified additional lifeline facilities (user-defined facilities) as critical, including libraries, daycares, businesses, and recreation. Figure 3-27 illustrates the locations of these facilities. These facilities have been incorporated into the Burlington County inventory and the hazard analyses performed for this plan.

Figure 3-27. Additional Lifeline Facilities in Burlington County



TETRA TECH

SECTION 4. RISK ASSESSMENT

4.1 IDENTIFICATION OF HAZARDS OF CONCERN

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

To provide a strong foundation for mitigation strategies, Burlington County considered a full range of natural hazards that could impact the area, and then identified and ranked the hazards that present the greatest concern. The hazard identification process included the following:

- Input from the County and participating jurisdictions
- Review of the 2019 State of New Jersey Hazard Mitigation Plan and previous hazard identification efforts
- Research and local, state, and federal information on the frequency, magnitude, and costs associated with hazards that have impacted or could impact the region
- Qualitative or anecdotal information regarding natural hazards and the perceived vulnerability of the study area's assets to them.

4.1.1 Changes from the 2019 Hazard Mitigation Plan

Many of the hazards of concern for the Burlington County 2024 HMP update are the same as Burlington County's 2019 plan. A few hazards were renamed to be more encompassing, and a few hazards were removed. Since the development of the last plan, hazards and disasters not assessed in the prior plan have occurred in the Planning Area. These hazards were identified by stakeholders as areas to address in the plan. Key changes from 2019 are as follows:

- The prior plan did not address disease outbreak. Beginning in March 2020, the Planning Area was hit with the COVID-19 pandemic along with the rest of the world. The new disease outbreak hazard profile includes influenza, West Nile Virus, Lyme disease, and the coronavirus that causes COVID-19.
- The prior plan addressed extreme temperature in the severe weather hazard profile. The update addresses extreme temperatures as its own section.
- The prior plan addressed dam failure in the flood hazard profile. The update addresses dam failure as its own section.
- The plan update removed the coastal erosion hazard profile and incorporated it into the flood hazard profile. After reviewing the 2019 HMP and current conditions, the Steering Committee noted that coastal erosion in the County is primarily associated with flooding events. The updates flood hazard profile also includes riverine flooding, coastal flooding, flash flooding, stormwater flooding, ice jams, and sea level rise.
- The landslide hazard profile was removed from this 2024 update in recognition of the infrequency and low risk of the hazard in Burlington County.

- The 2024 Burlington County Hazard Mitigation Plan Update includes best available data throughout the plan to present an updated understanding the Planning Area's risk.

4.1.2 Hazard Groupings

Like the 2019 Burlington County HMP, updated HMP groups hazards based on the similarity of hazard events, typical concurrence or impacts, consideration of how hazards have been grouped in FEMA guidance documents (*FEMA 386-2 Understanding Your Risks, Identifying Hazards and Estimating Losses*; *Multi-Hazard Identification and Risk Assessment – The Cornerstone of the National Mitigation Strategy*; *Local Mitigation Planning Handbook*), and consideration of hazard grouping in the State of New Jersey HMP. The final identification and grouping of hazards of concern for the Planning Area is as follows:

The *dam failure* hazard profile addresses dam failures.

The *disease outbreak* hazard profile addresses diseases, including influenza, West Nile Virus, Lyme disease, and COVID-19.

The *drought* hazard profile addresses drought events.

The *earthquake* hazard profile addresses earthquake events.

The *extreme temperature* hazard profile addresses periods of extreme heat and cold.

The *flood* hazard addressed riverine flooding, coastal flooding, flash flooding, stormwater flooding, ice jams, erosion, and sea level rise. This grouping is consistent with FEMA's *Multi-Hazard Identification and Risk Assessment* guidance.

The *severe weather* hazard profile addresses high wind events, tornadoes, thunderstorms and lightning, hailstorms, and hurricanes and other tropical storms. This grouping is consistent with the State of New Jersey HMP.

The *severe winter weather* profile includes blizzards, heavy snow, ice storms, nor'easters, and sleet. This grouping is consistent with the State of New Jersey HMP.

The *wildfire* profile addresses wildfires.

4.1.3 Hazards of Concern for the 2024 Hazard Mitigation Plan

According to input from the County, and review of all available resources, nine hazards concern were identified as significant hazards affecting the entire planning area, to be addressed at the county level in this plan:

- Dam failure
- Disease outbreak
- Drought
- Earthquake
- Extreme temperature
- Flood
- Severe weather
- Severe winter weather
- Wildfire

Other natural and human-caused hazards of concern have not occurred within Burlington County, have a low potential to occur or to result in significant impacts within the County, or are covered in other plans. Therefore, these hazards will not be further addressed within this version of the plan. However, if deemed necessary by the County, these hazards may be considered in future versions of the HMP.

These hazards of concern were identified based on the following:

- Input from all Planning Partners
- Review of the New Jersey State Hazard Mitigation Plan
- Review of the 2019 Burlington 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.

Table 4.1-1 documents the process of identifying the natural hazards of concern for further profiling and evaluation.

Table 4.1-1. Identification of Hazards of Concern for Burlington County

Hazard	Is this a hazard that may occur in Burlington County?	Why was this determination made?	Sources
Coastal Erosion	Yes – this is profiled with flooding	• The 2019 New Jersey State HMP identifies coastal erosion as a hazard of concern for New Jersey in the coastal erosion and sea level rise hazard profile. • Burlington County stretches from the Delaware River to the Mullica River, in which coastal erosion has the potential to occur along tidal waterways. Fluvial erosion can occur along rivers, streams, and creeks in the County. • The Planning Partnership identified erosion as a hazard that may impact the County. However, the coastal erosion hazard was identified as a condition associated with flooding, so it is included in the flood hazard profile.	• New Jersey State HMP • FEMA • NOAA NCEI • USACE • Stockton Coastal Research Center • Planning Partnership Input
Dam Failure	Yes	• The 2019 New Jersey State HMP identifies dam failure as a hazard of concern for New Jersey. • Burlington County has 10 high hazard classified dams and 40 dams with a significant hazard potential classification. • The Planning Partnership identified dam failure as a hazard of concern for Burlington County.	• New Jersey State HMP • Planning Partnership Input • USACE National Inventory of Dams
Disease Outbreak	Yes – influenza, West Nile Virus, Lyme disease, and COVID-19	• The 2019 New Jersey State HMP identifies pandemic as a hazard of concern for New Jersey. • Burlington County has been identified in two FEMA declarations for COVID-19. • Burlington County has been impacted by mosquito and tick-borne diseases. • The Planning Partnership identified disease outbreak as a hazard of concern for Burlington County.	• New Jersey State HMP • FEMA • Burlington County Department of Health • Planning Partnership Input
Drought	Yes	• The 2019 New Jersey State HMP identifies drought as a hazard of concern for New Jersey. • New Jersey has entered periods of drought and Burlington County has experienced droughts classified in the abnormally dry and moderate categories. • The Planning Partnership identified drought as a hazard of concern for Burlington County.	• New Jersey State HMP • FEMA • NOAA NCEI • USDA • U.S. Drought Monitor • NDMC • Planning Partnership Input

Hazard	Is this a hazard that may occur in Burlington County?	Why was this determination made?	Sources
Earthquake	Yes	• The 2019 New Jersey State HMP identifies earthquake as a hazard of concern for New Jersey. • Although the County has not experienced a major earthquake, there have been 10 instances where the epicenter of an earthquake was located in Burlington County, the most recent occurring in 2018. • The Planning Partnership identified earthquake as a hazard of concern for Burlington County.	• New Jersey State HMP • FEMA • NJGWS • USGS • Planning Partnership Input
Extreme Temperature	Yes – heat and cold	• The 2019 New Jersey State HMP discusses extreme temperatures in its hazard profile for severe weather. • Burlington County has been included in four documented NOAA events related to extreme temperature since 2021. One was cold/wind chill, and the remaining three were extreme heat. • The Planning Partnership identified extreme temperature as a hazard of concern for Burlington County.	• FEMA • NOAA NCEI • Planning Partnership Input
Flood	Yes – riverine, coastal, flash flooding, stormwater flooding, ice jams, erosion, and sea level rise	• The 2019 New Jersey State HMP identifies flood as a hazard of concern for New Jersey. • Burlington County was included in 32 emergency declarations where flooding may have occurred. • Burlington County has been included in numerous flood and flash flood events from the NOAA database since 2018. • Burlington County stretches from the stretches from the Delaware River to the Mullica River. These rivers and their tributaries are tidally influenced and are impacted by coastal flooding. • The Planning Partnership identified Flood as a hazard of concern for Burlington County.	• New Jersey State HMP • FEMA • NOAA NCEI • Planning Partnership Input
Geological Hazards	No	• The 2019 New Jersey State HMP discusses landslides and land subsidence within the geological hazard profile. • Previous analysis of Burlington County has shown that the risks associated with geologic hazards are extremely minimal. • The Planning Partnership elected to not include this hazard.	• New Jersey State HMP • FEMA • 2019 Burlington County HMP • USGS • NJGWS • Planning Partnership Input

Hazard	Is this a hazard that may occur in Burlington County?	Why was this determination made?	Sources
Land Subsidence (includes abandoned mines)	No	Please see Geological Hazards	
Landslide (includes mudslides)	No	Please see Geological Hazards	
Sea Level Rise	Yes – this is profiled with flooding	• The 2019 New Jersey State HMP identifies sea level rise as a hazard of concern for New Jersey in the coastal erosion and sea level rise hazard profile. • Burlington County stretches from the Delaware River to the Mullica River. These rivers and their tributaries are tidally influenced and are likely to be impacted by sea level rise. • The Planning Partnership identified sea level rise as a hazard that may impact the County and has included sea level rise in the flood hazard profile.	• New Jersey State HMP • NOAA • Rutgers University • Planning Partnership Input
Severe Weather	Yes – high wind events, tornadoes, thunderstorms and lightning, hailstorms, and hurricanes and other tropical storms	• The 2019 New Jersey State HMP identifies severe weather as a hazard of concern for New Jersey. • Burlington County was included in 28 FEMA declarations between 1985-2022 in relation to severe storms. • The Planning Partnership identified severe weather as a hazard of concern for Burlington County.	• New Jersey State HMP • FEMA • NOAA NCEI • Planning Partnership Input
Severe Winter Weather	Yes – blizzards, heavy snow, ice storms, nor'easters, and sleet	• The 2019 New Jersey State HMP identifies severe winter weather as a hazard of concern for New Jersey. • Burlington County was included in 4 FEMA disaster declarations for winter weather between 2000-2022. • The Planning Partnership identified severe winter weather as a hazard of concern for Burlington County.	• New Jersey State HMP • FEMA • NOAA NCEI • Planning Partnership Input
Storm Surge	Yes – this is profiled with flooding	• The 2019 New Jersey State HMP discusses storm surge within the hurricane and tropical storm hazard profile. • Burlington County stretches from the Delaware River to the Mullica River. These rivers and their tributaries are tidally influenced and are impacted by storm surges. • The Planning Partnership identified storm surge as a hazard that may impact the County and has included storm surge/ coastal flooding in the flood hazard profile.	• New Jersey State HMP • FEMA • NOAA NCEI • Planning Partnership Input

Hazard	Is this a hazard that may occur in Burlington County?	Why was this determination made?	Sources
Tornado	Yes – this is profiled with severe weather	• The 2019 New Jersey State HMP discusses tornadoes within the severe weather hazard profile. • Burlington County has had five tornadoes since 2018, according to NOAA NCEI. • The Planning Partnership identified tornado as a hazard that may impact the County and has included tornado in the severe weather hazard profile	• New Jersey State HMP • FEMA • NOAA NCEI • Planning Partnership Input
Wildfire	Yes	• The 2019 New Jersey State HMP identifies wildfire as a hazard of concern for New Jersey. • There have been many occurrences of wildfires of varying severity in Burlington County. • The Planning Partnership identified wildfire as a hazard of concern for Burlington County.	• New Jersey State HMP • FEMA • New Jersey Forest Fire Service • Planning Partnership Input

Notes: FEMA = Federal Emergency Management Agency; NDMC = National Drought Mitigation Center; NJGWS = New Jersey Geological and Water Survey; NOAA = National Oceanic and Atmospheric Administration; NCEI = National Centers for Environmental Information; USACE = U.S. Army Corps of Engineers; USDA = U.S. Department of Agriculture; USGS = U.S. Geological Survey

4.2 METHODOLOGY AND TOOLS

Risk assessment is the process of measuring the potential loss of life, personal injury, economic injury, and property damage resulting from identified hazards. It allows emergency management personnel to establish early response priorities by identifying potential hazards and vulnerable assets. The process focuses on the following elements:

- **Hazard identification**—Use all available information to determine what types of hazards may affect a jurisdiction, how often they can occur, and their potential severity.
- **Exposure identification**—Estimate the total number of people and properties in the jurisdiction that are likely to experience a hazard event if it occurs.
- **Vulnerability identification and loss estimation**—Assess the impact of hazard events on the people, property, environment, economy, and lands of the region, including estimates of the cost of potential damage or cost that can be avoided by mitigation.

The risk assessment for this hazard mitigation plan update evaluates the risk of natural hazards prevalent in the planning area and meets federal requirements for hazard mitigation planning (44 CFR, Section 201.6(c)(2)). The following describes the methodology and tools used to conduct the risk assessment for the Burlington County Hazard Mitigation Plan 2024 update.

4.2.1 Risk Assessment Tools

Mapping

National, state, and county databases were reviewed to locate available spatially based data relevant to this planning effort. Maps were produced using geographic information system (GIS) software to show the spatial extent and location of hazards when such datasets were available. These maps are included in the hazard profile chapters of this document.

Hazus

FEMA's Hazus model is a GIS-based software program used to support risk assessments, mitigation planning, and emergency planning and response. It provides a wide range of inventory data, such as demographics, building stock, critical facility, transportation and utility lifeline, and multiple models to estimate potential losses from earthquakes, floods, and hurricanes. The program maps and displays hazard data and the results of damage and economic loss estimates for buildings and infrastructure. Its advantages include the following:

- Provides a consistent methodology for assessing risk across geographic and political entities.
- Provides a way to save data so that it can readily be updated as population, inventory, and other factors change and as mitigation planning efforts evolve.

- Facilitates review of mitigation plans because it helps to ensure that FEMA methodologies are incorporated.
- Supports grant applications by calculating benefits using FEMA definitions and terminology.
- Produces hazard data and loss estimates that can be used in communication with local stakeholders.
- Is administered by the local government and can be used to manage and update a hazard mitigation plan throughout its implementation.

Hazus provides default data for inventory, vulnerability, and hazards; the default data can be supplemented with local data to provide a more refined analysis. The model can carry out three levels of analysis, depending on the format and level of detail of information about the planning area:

- Level 1—All of the information needed to produce an estimate of losses is included in the software's default data. This data is derived from national databases and describes in general terms the characteristic parameters of the planning area.
- Level 2—More accurate estimates of losses require more detailed information about the planning area. To produce Level 2 estimates of losses, detailed information is required about local geology, hydrology, hydraulics, and building inventory, as well as data about utilities and critical facilities. This information is needed in a GIS format.
- Level 3—This level of analysis generates the most accurate estimate of losses. It requires detailed engineering and geotechnical information to customize it for the planning area.

4.2.2 Risk Assessment Approach

The risk assessments in this plan describe the risks associated with each identified hazard of concern. The following steps were used to define the risk of each hazard:

- **Identify and profile each hazard**—The following information is given for each hazard:
  - Geographic areas most affected by the hazard
  - Event frequency estimates
  - Severity estimates
- **Determine exposure to each hazard**—Exposure was assessed by overlaying hazard maps with an inventory of structures, facilities, and systems to decide which of them would be exposed to each hazard.
- **Assess the vulnerability of exposed facilities**—Vulnerability of exposed structures and infrastructure was evaluated by interpreting the probability of occurrence of each event and assessing structures, facilities, and systems that are exposed to each hazard. Tools such as GIS and FEMA's hazard-modeling program Hazus were used for this assessment for the earthquake, flood, and hurricane analyses. Outputs similar to those from Hazus were generated for other hazards, using data generated through GIS.

Dam Failure

Burlington County has 10 high hazard dams. Dam failure inundation maps and downstream hazard areas are considered sensitive information and were not available for review in the Burlington County Hazard Mitigation Plan. To assess the County's risk to dam failure, a qualitative review was implemented.

Disease Outbreak

All of Burlington County is exposed to disease outbreak events. A qualitative assessment was conducted. Research from the Centers for Disease Control and Prevention (CDC), World Health Organization (WHO), and the New Jersey Department of Health (NJDOH) was utilized to qualitatively assess the identified infectious diseases.

Drought

To assess the vulnerability of Burlington County to drought and its associated impacts, a qualitative assessment was conducted. The U.S. Department of Agriculture (USDA) Census of Agriculture 2017 was used to estimate economic impacts. Information regarding the number of farms and farmland area was extracted from the report and summarized in the vulnerability assessment. Additional resources from New Jersey's 2019 State Hazard Mitigation Plan and FEMA's National Risk Index were used to assess the potential impacts on the population from a drought event.

Earthquake

Probabilistic assessment was conducted for Burlington County for the 500-year and 2,500-year mean return periods (MRPs) through a Level 2 analysis in Hazus (v6.0) to analyze the earthquake hazard and provide a range of loss estimates. The probabilistic method uses information from historical earthquakes and inferred faults, locations, and magnitudes, and computes the ground shaking levels that may be experienced during an event of a given recurrence period by census tract.

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

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

The default assumption is a magnitude 7.0 earthquake for all return periods. Although damage is estimated at the census tract level, results are 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.

Extreme Temperature

All of Burlington County is exposed to extreme temperature events. A qualitative assessment was conducted for the extreme temperature hazard. Information from the National Weather Service (NWS), the CDC, stakeholder plans/reports, the 2019 New Jersey Hazard Mitigation Plan, USDA, the FEMA National Risk Index, and the Planning Partnership were used to assess potential impacts on the County's assets.

Flood

The 1-percent and 0.2-percent annual chance flood events were examined to evaluate the County's risk from the flood hazard. These flood events are generally those considered by planners and evaluated under federal programs such as NFIP. The following data was used to evaluate exposure and determine potential future losses for this plan update:

- Burlington County effective FEMA Digital Flood Insurance Rate Map (DFIRM) dated August 28, 2019
- A depth grid developed using data from USGS's 1-meter-resolution Digital Elevation Model from 2021.

To estimate exposure to the 1-percent and 0.2-percent annual chance flood events, the effective DFIRM flood boundaries were overlaid on the centroids of updated assets (population, building stock, and critical facilities) Centroids that intersected the flood boundaries were totaled to estimate the building replacement cost value and population vulnerable to the flood inundation areas. A Level 2 Hazus riverine flood analysis was performed in Hazus (v6.0). The critical facility and building inventories were formatted to be compatible with Hazus and its Comprehensive Data Management System. Once updated with the inventories, the Hazus riverine and coastal flood models were run to estimate potential losses in Burlington County for the 1-percent annual chance flood event. A user-defined analysis was also performed for the building stock. Buildings located within the floodplain were imported as user-defined facilities to estimate potential losses to the building stock at the structural level. Hazus calculated the estimated potential losses to the population (default 2020 U.S. Census data across dasymetric blocks), potential damage to the general building stock, and potential damage to critical facility inventories based on the depth grid generated and the default Hazus damage functions in the flood model.

Sea-level rise 1-foot and 3-foot hazard data was sourced from NOAA. For this risk assessment, the sea level rise hazard area data was utilized to determine what assets are exposed. Population, general building stock, critical facility, and anticipated new development datasets were overlaid with the hazard area. Assets with their centroid in the hazard area were totaled to estimate the risk associated with impacts from a sea level rise hazard event, in regard to building replacement cost value (RCV) and vulnerable populations.

Severe Weather

All of Burlington County is exposed to severe weather. A qualitative analysis was conducted for this hazard and information from the New Jersey 2019 Hazard Mitigation Plan, NWS, NOAA, the FEMA National Risk Index, and the Planning Partnership were used to develop the hazard profile and to determine risk and exposure.

Hurricane Winds

A Hazus probabilistic analysis was performed to analyze the wind hazard losses for Burlington County for the 100- and 500-year MRP events. The probabilistic Hazus hurricane model activates a database of thousands of potential storms that have tracks and intensities reflecting the full spectrum of Atlantic hurricanes observed since 1886 and identifies those with tracks associated with Burlington County. Hazus contains data on historical hurricane events and wind speeds. It also includes surface roughness and vegetation (tree coverage) maps for the area. Surface roughness and vegetation data support the modeling of wind force across various types of land surfaces.

Default demographic and updated building and critical facility inventories in Hazus were used for the analysis. Although damage is estimated at the census tract level, results were presented at the municipal level. Because there are multiple census tracts that contain more than one jurisdiction, a density analysis was used to extract the percentage of building structures that fall within each tract and jurisdiction. The percentage was multiplied against the results calculated for each tract and summed for each jurisdiction.

Storm Surge

Category 1, 2, and 3 hazard areas were assessed using the National Hurricane Center's SLOSH (Sea, Lake, and Overland Surges from Hurricanes) model to estimate exposure to storm surge. The SLOSH boundaries (sourced from NOAA) were overlaid on the centroids of updated assets (population, building stock, and critical facilities), as well as on the centroids of anticipated new development. Centroids that intersect the SLOSH boundaries were totaled to estimate the building RCV and populations vulnerable to the SLOSH Category 1, 2 and 3 hazard areas.

Severe Winter Weather

All of Burlington 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 contents. Current modeling tools are not available to estimate specific losses for this hazard. Information and data from the New Jersey 2019 Hazard Mitigation Plan, NWS, NOAA, the FEMA National Risk Index, and the Planning Partnership were used to develop the hazard profile and to determine risk and exposure.

Wildfire

Wildfire hazard data was obtained through the New Jersey Forest Fire Service (NJFFS 2012). For this risk assessment, Extreme, Very High, and High Fuel Risk hazard areas were combined and used as the "Wildfire Fuel Risk" hazard area. To determine what assets are exposed to wildfire, the inventory datasets (critical facilities, general building stock, population, and new development) were overlaid with the hazard area. Assets with their centroid located in the hazard area were totaled to estimate the totals and values at risk from a wildfire event.

4.2.3 Sources of Data Used in Hazus Modeling and Exposure Analysis

Burlington County assets were identified to assess potential exposure and loss associated with the hazards of concern. For the HMP update, Burlington County assessed exposure and vulnerability of the following types of assets: population, buildings, and critical facilities/infrastructure. Some assets may be more vulnerable because of their physical characteristics or socioeconomic uses. To protect individual privacy and the security of critical facilities, information on properties assessed is presented in aggregate, without details about specific individual private or public properties.

Building and Cost Data

A custom general building stock inventory was created for Burlington County. The general building stock development was created utilizing MOD4 Assessor and Parcel data provided by Burlington County (2023), in addition to MOD4 Assessor data sourced from NJOGIS (2023) and Microsoft Bing Maps footprints (2022). The building inventory attributes were updated using the MOD4 datasets from Burlington County and NJOGIS, and the parcel data from Burlington County. Attributes provided in the associated files were used to further define each structure, such as year built, number of stories, basement type, occupancy class, and square footage. The centroids of each building footprint were used to estimate a building location. Where there was no existent building footprint data, but there was evidence of a structure, which displayed an improvement value, parcel centroids were preserved to fill in the structure inventory gap and to estimate the building location.

Structural and content RCV was calculated for each building using the available assessor data, the building footprint, and RSMeans 2022 values. A regional location factor for Burlington County was applied based on the individual building stock's zip code location, as shown in Table 4.2-1.

Table 4.2-1. Zip-Code-Based RCV Regional Location Factors for Burlington County

Zip Code	RCV Regional Location Factor	
	Residential	Non-Residential
080xx	1.10	1.06
081xx	1.17	1.12
082xx	1.21	1.09
085xx	1.17	1.13
086xx	1.17	1.17

RCV is the current cost of returning a destroyed asset to its pre-damaged condition using present-day cost of labor and materials. Total RCV consists of both the structural cost to replace a building and the estimated value of building contents. The occupancy classes available in Hazus were condensed into the categories of residential, commercial, "all other" to facilitate analysis and presentation of results. Residential loss estimates cover both multi-family and single-family dwellings.

Critical Facilities and Lifelines

The 2024 HMP critical facility inventory, which includes essential facilities, utilities, government offices, transportation features and user-defined facilities, was updated by Burlington County. The update involved a review for accuracy, additions, or deletions of new/moved critical assets. It identified backup power for each asset (if known) and whether the critical facility is considered a lifeline in accordance with FEMA's definition. To protect individual privacy and the security of assets, information is presented in aggregate, without details about specific individual properties or facilities.

Population

Burlington County used the total population statistics from the 2020 Decennial Census and the 2017-2021 American Community Survey (ACS) 5-year estimates for vulnerable populations. Population data was used to estimate the exposure and potential impacts on the county's population in place of the 2020 U.S. Census block estimates. Statistics were extracted directly from the Census Bureau. Limitations of these analyses are recognized, and thus the results are used only to provide a general estimate for planning purposes.

Vulnerable populations in Burlington County included in the risk assessment are children, elderly, non-English speaking, disabled, and people living in low-income households.

FEMA's Hazus program was used to model estimated potential losses due to earthquake, flood, and wind hazards. Hazus contains 2020 U.S. Census data and was used to estimate sheltering and injuries as part of the hazard analysis.

Hazus Data Inputs

The following hazard datasets were used for the Hazus Level 2 analysis conducted for the risk assessment:

- **Earthquake**—A Hazus earthquake probabilistic analysis was performed to analyze the earthquake hazard losses for the 500- and 2500-year MRP events.
- **Flood**—The 2019 effective DFIRM for the County was used to delineate flood hazard areas and estimate potential losses from the FEMA 1-percent-annual chance flood event. Using the DFIRM floodplain boundaries and base flood (1-percent-annual chance flood) elevation information, and the USGS 1-meter digital elevation model data, flood depth grids were generated and integrated into the Hazus model.
- **Hurricane**—A Hazus probabilistic analysis was performed to analyze the wind hazard losses for the 100- and 500-year MRP events.

Other Local Hazard Data

Locally relevant information on hazards was gathered from a variety of sources. Frequency and severity indicators include past events and the expert opinions of geologists, emergency management specialists, and others.

No GIS format datasets appropriate for an exposure analysis were identified for the following hazards: dam failure, disease outbreak, drought, extreme temperatures, and severe winter weather.

Data Source Summary

Table 4.2-2 summarizes the data sources used for the risk assessment for this plan.

Table 4.2-2. Risk Assessment Data Source Summary

Data	Source	Date	Format
Population Data	U.S. Census Bureau; American Community Survey 5-Year Estimates; Stats America	2020; 2017-2021	Digital (.csv) Format
New Development	Burlington County Planning Partnership	2023	Digital (GIS) Format
Building Inventory	Burlington County; NJOGIS; Microsoft Bing	2023; 2023; 2022	Digital (GIS) Format
Critical Facilities and Lifelines	Burlington County; Burlington County Planning Partnership	2023	Digital (GIS) Format; Excel
Digitized Effective FIRM Data	FEMA	2019	Digital (GIS) Format
1-meter Digital Elevation Model	USGS	2021	Digital (GIS) Format
Sea Level Rise	NOAA	2022	Digital (GIS) Format
SLOSH	NOAA	2022	Digital (GIS) Format
Wildfire	NJFFS	2012	Digital (GIS) Format

Notes: NJOGIS = New Jersey Office of GIS; FEMA = Federal Emergency Management Agency; USGS = United States Geological Survey; NOAA = National Oceanic and Atmospheric Association; NJFFS = New Jersey Forestry Fire Service

4.2.4 Limitations

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

- Approximations and simplifications necessary to conduct a study
- Incomplete or outdated inventory, demographic, or economic parameter data
- The unique nature, geographic extent, and severity of each hazard
- Mitigation measures already employed
- The amount of advance notice residents have to prepare for a specific hazard event

These factors can affect loss estimates by a factor of two or more. Therefore, potential exposure and loss estimates are approximate and should be used only to understand relative risk. Over the long term, Burlington County will collect additional data to assist in estimating potential losses associated with other hazards.

4.3 HAZARD PROFILES

4.3.1 Dam Failure

2024 HMP Changes

- Dam failure has been removed from the flood hazard profile and is now a stand-alone hazard of concern.
- New and updated figures from federal and state agencies are incorporated.
- Previous occurrences were updated with events that occurred between 2018 and 2023.

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

Hazard Description

A dam is a structure built across a river or stream to hold back water. The materials used for construction of dams include earth, rock, tailings from mining or milling, concrete, masonry, steel, timber, miscellaneous materials (such as plastic or rubber) and any combination of these materials. 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. Many dams fulfill a combination of the above functions. Dams require regular maintenance to retain their level of protection. When dams fail or overtop, they can cause catastrophic impacts and lead to major flooding and impacts (Association of State Dam Safety Officials 2023).

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. According to the Association of State Dam Safety Officials, dam failures are most likely to occur as a result of the following:

- 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 through a dam that is not properly filtered so that soil particles form sinkholes in the dam (Association of State Dam Safety Officials 2021).

Despite efforts to provide sufficient structural integrity and to perform inspection and maintenance, problems can develop that lead to failure. While most dams have storage volumes small enough that failures would have little or no consequences, dams with large storage amounts could cause significant flooding downstream (FEMA 2013).

Location

According to NJDEP, Burlington County has 74 dams. Of these dams, 10 are considered high hazard, 40 are considered significant hazard, and 24 are considered low hazard (USACE 2023).

In addition to dams located within the County, there are multiple dams that are located in neighboring counties that could impact Burlington County if failure occurs. The County might require emergency action plans for these respective dams for the various communities that might be affected. Table 4.3.1-1 lists these dams.

Table 4.3.1-1. Dams in Neighboring Counties

Dam Name	Dam Location	Classification
Pleasant Milles Dam	Mullica, Atlantic County	Significant
Cedar Lake Dam	Voorhees, Camden County	Significant
Sunshine Lake Dam	Voorhees, Camden County	Significant
Gropps Lake Dam	Hamilton, Mercer County	Low
Oakford Lake Dam	New Egypt, Ocean County	Low
Brindle Lake Dam	Plumsted, Ocean County	Low
New Jersey No Name #101 Dam	Manchester, Ocean County	Low
Gaunts Reservoir Dam	Manchester, Ocean County	Low
Prospertown Dam	Jackson, Ocean County	High
Lahaway Plantation Dam	Jackson, Ocean County	Low

Source: USACE 2023

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; (1) the amount of water impounded; and (2) the density, type, and value of development and infrastructure located downstream (FEMA 2018).

FEMA, USACE, and NJDEP all have classification systems for dams. Please refer to *Federal Guidelines for Dam Safety: Hazard Potential Classification System for Dams* (2004) and *Safety of Dams – Police and Procedures* (2014) for an explanation of the FEMA and USACE classifications.

The New Jersey Department of Environmental Protection (NJDEP) assigns one of four hazard classifications to state-regulated dams in New Jersey. The classifications relate to the potential property damage and/or loss of life in the event of a dam failure, as follows (NJDEP 2008):

- 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 and/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. Dam must also meet the requirements of a Class IV dam above.

It is required by the State of New Jersey that all High Hazard and Significant Hazard dams must have NJDEP-approved Emergency Action Plans (EAP) in place. It is the responsibility of the dam owner to review and update the EAP on an annual basis. The State also requires regular dam inspections. Dam Safety Inspections are intended to identify conditions that may adversely affect the safety and functionality of a dam and its appurtenant structures; 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. Inspection guidelines are summarized in Table 4.3.1-2. Complete inspection and operating requirements for dams can be found in the New Jersey Dam Safety Standards (N.J.A.C. 7:20-1.11) (NJDEP 2008).

Table 4.3.1-2. New Jersey 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: NJDEP 2008

NJDEP has set guidelines to meet the requirements of the National Inventory of Dams condition assessment of existing dams. Table 4.3.1-3 lists definitions for each potential deficiency rating.

In New Jersey, every dam in the State as defined in the Safe Dam Act, NJSA 58:4 is required to meet State dam safety standards. Dam Safety Laws provide the NJDEP with enforcement capabilities to achieve statewide compliance with dam safety standards. This includes issuing orders for compliance to dam owners, and pursuing legal action if the owner does not comply (with the goal of compliance and possible fines levied on a per-day basis for violations) (NJDEP 2023).

Table 4.3.1-3. New Jersey Dam Inspection 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

Previous Occurrences and Losses

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

FEMA Major Disasters and Emergency Declarations

Between May 1953 and June 2023, FEMA has not included New Jersey, or consequently Burlington County, in any dam failure-specific disasters (DR) or emergencies (EM). However, dam-failures have occurred due to other precursor events, such as hurricanes, tropical storms, and severe storms (FEMA 2023). These events are listed in Table 4.3.1-4. Multiple dam failures occurred in Burlington County associated with DR-1530-NJ, as further described below.

Table 4.3.1-4. FEMA Declarations for Dam Failure Events in Burlington County

FEMA Declaration Number	Date of Declaration	Date of Event	Event Type	Event Title
EM-3148-NJ	September 17, 1999	September 16 – 18, 1999	Hurricane	New Jersey Hurricane Floyd
DR-1530-NJ	July 16, 2004	July 12 – 23, 2004	Severe Storm	New Jersey Severe Storms and Flooding
EM-3332-NJ	August 27, 2011	August 26 – September 5, 2011	Hurricane	Hurricane Irene in New Jersey
DR-4021-NJ	August 31, 2011	August 27 – September 5, 2011	Hurricane	Hurricane Irene in New Jersey

Source: FEMA 2023

U.S. Department of Agriculture Disaster Declarations

The Secretary of Agriculture from the U.S. Department of Agriculture (USDA) is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in counties that are contiguous to a designated county. Between August 2018 and June 2023, Burlington County was not included in any dam failure-related agricultural disaster declarations (USDA 2023).

Previous Events

As stated in the 2019 New Jersey State HMP Update, dam failures can occur suddenly, without warning, and may occur during normal operating conditions. This is referred to as a "sunny day" failure. Dam failures may also occur during a large storm event. Significant rainfall can quickly inundate an area and cause floodwaters to overwhelm a reservoir. If the spillway of the dam cannot safely pass the resulting flows, water will begin flowing in areas not designed for such flows, and a failure may occur. New Jersey has seen significant property damage including damage or loss of dams, bridges, roads, and buildings as a result of storm events and dam failures (NJOEM 2019).

In September 1940, torrential rains caused flooding, leading to dam failures at Taunton and Medford Lakes in Lumberton Township (FEMA 2019).

On September 16, 1999, Hurricane Floyd, a tropical storm by the time it hit New Jersey, combined with a weather system from the west to drop significant rainfall in portions of the State. Although the State's dams were spared the worst and no loss of life or significant property damage was attributed to the failure of a dam, the storm left behind a trail of damage to the State's dams. The Kirby's Mill Dam in Medford Township, Burlington County experienced a complete failure as a result of the storm (NJOEM 2019).

On July 12-13, 2004, the Townships of Lumberton and Medford experienced major flooding due to heavy rainfall. 17 dams failed and 28 more dams were damaged along various streams (FEMA 2019). Doppler radar estimates of total rainfall for the 24-hour period ending at 5:00PM on July 13, 2004, were between 8-12 inches. Property damage from the flood was estimated at $50 million. The flooding led to the evacuation of about 760 residents, the complete destruction of seven homes, major flood damage to approximately 200 homes, flood damage to approximately

1,000 homes, the closing of 25 major roads, (including the New Jersey Turnpike and New Jersey State Routes 70 and 73), and serious damage or destruction to 14 bridges (NJDEP 2020).

Rainfall totaling as much as 10 inches fell during August 27–28, 2011 and, combined with wet conditions caused by 8 to 16 inches of rain statewide during the 3 weeks preceding Hurricane Irene, set the stage for record-breaking floods on many streams in New Jersey. NJDEP reported the failure of six dams as a result of Hurricane Irene, including the New Jersey No Name # 89 Dam. This dam, which had failed completely, is located on a tributary to Crosswicks Creek in North Hanover Township in Burlington County upstream from the gage on Crosswicks Creek at Extonville (USGS 2011).

There have been no recorded dam failures in, or which have impacted, the County since the last HMP update in 2019. (Association of State Dam Safety Officials 2021); (Stanford University 2018)

Probability of Future Occurrence

Dam failure events are infrequent and usually coincide with events that cause them, such as earthquakes, landslides, and excessive rainfall or snowmelt. As noted in the *Previous Occurrences and Losses* section, dam failures typically occur in New Jersey as a result of heavy rains or other precipitation. There is a "residual risk" associated with dams. Residual risk is the risk that remains after safeguards have been implemented. For dams, the residual risk is associated with events beyond those that the facility was designed to withstand. However, the probability of any type of dam failure is low in today's dam safety regulatory and oversight environment (NJOEM 2019).

For the 2024 HMP update, the most up-to-date data was collected to calculate the probability of future occurrence of dam failure events for the County. Information from Stanford University's National Performance of Dams Program database, Association of State Dam Safety Official's Dam Incident Database, NOAA-NCEI storm events database, the County FIS Report, the 2019 State of New Jersey HMP, and the 2019 Burlington County HMP were used to identify the number of flood events that occurred between January 1950 and May 2023. Table 4.3.1-5 presents the probability of future events for dam failure in Burlington County.

Table 4.3.1-5. Probability of Future Occurrences of Dam Failure Events

Hazard Type	Occurrences Between 1940 and 2023	% Chance of Occurring in Any Given Year	Recurrence Interval (in years) (# Years/Number of Events)
Dam Failure	21	25.3%	3.95
Total	**21**	**25.3%**	**3.95**

Source: NOAA 2023; FEMA 2019; Association of State Dam Safety Officials 2021; Burlington County 2019; Stanford University 2018; NJOEM 2019
Note: Disaster occurrences include federally declared disasters since the 1950 Federal Disaster Relief Act, and selected events since 1968. Due to limitations in data, not all dam failure events occurring between 1954 and 1996 are accounted for in the tally of occurrences. As a result, the number of hazard occurrences is underestimated.

In Section 4.4, the identified hazards of concern for the County were ranked (Table 4.4-2). The probability of occurrence, or likelihood of the event, is one parameter used for hazard rankings. Based on historical records and input from the Planning Team, the probability of occurrence rating for dam failure in the County is "rare."

Climate Change Impacts

Providing projections of future climate change for a specific region is challenging. Shorter term projections are more closely tied to existing trends making longer term projections even more challenging. The further out a prediction reaches the more subject to changing dynamics it becomes.

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 (1.9 °C) increase in the State's average temperature, which is faster than the rest of the Northeast region (2 °F [1.1 °C]) and the world (1.5 °F [0.8 °C]). This warming trend is expected to continue. By 2050, temperatures in New Jersey are expected to increase by 4.1 to 5.7 °F (2.3 °C to 3.2 °C). 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 (5.6 °C) 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. Changes in winter temperatures could result in a change in the frequency of ice jam events (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, New Jersey 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. New Jersey will experience more intense rain events, less snow, and more rainfalls. 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).

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. Over the last 50 years, in 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).

Climate change can impact stored water systems as increased rainfall accumulations can cause reservoirs to overtop. 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 may result in overtopping, as the hydrographs are based off historical events (USBR 2003). The overtopping of a dam can lead to areas downstream to become inundated with flood waters that would otherwise be safely stored.

Vulnerability Assessment

The dam failure hazard is of significance to Burlington County because 74 dams are present across the County, 10 of which are identified as high hazard (Table 4.3.1-1) (USACE 2023). Dam failure events are frequently associated with other natural hazard events such as earthquakes, landslides, or severe weather, which limits their predictability and compounds the hazard.

Dam failure inundation maps and downstream hazard areas are considered sensitive information and are not made available in the Burlington County Hazard Mitigation Plan. To assess the County's risk from dam failure, a qualitative review was implemented.

Impact on Life, Health, and Safety

The impact of dam failure on life, health, and safety is dependent on several factors such as the class of dam, the area that the dam is protecting, the location of the dam, and the proximity of structures, infrastructure, and critical facilities to the dam structure. According to the State HMP, the level of impact that a failure would have can be predicted based upon the hazard potential classification as rated by the United States Army Corps of Engineers (USACE 2014). Table 4.3.1-6 outlines the recommended hazard classifications.

Table 4.3.1-6. U.S. Army Corps of Engineers Hazard Potential Classification

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

Source: USACE 2014

a. Categories are assigned to overall projects, not individual structures at a project.
b. Loss-of-life potential is based on inundation mapping of area downstream of the project. Analyses of loss-of-life potential should consider the population at risk, time of flood wave travel, and warning time.
c. 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.
d. 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.
e. 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.

Socially Vulnerable Populations

The entire population residing within a dam failure inundation zone is considered exposed and vulnerable to an event. The potential for loss of life is affected by the 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.

According to the 2021 5-year ACS estimates, there are 27,947 total persons living below the poverty level, 78,093 persons over the age of 65 years, 23,350 persons under the age of 5 years, 9,103 non-English speakers, and 51,899 persons with a disability in Burlington County. These populations are more at risk during a dam failure event because economically disadvantaged populations are likely to evaluate their risk and make the decision to evacuate based upon the net economic impact to their family, while elderly populations are likely to seek or need medical attention. The availability of medical attention may be limited due to isolation during a flood event and other difficulties in evacuating. There is often limited warning time for a dam failure event. Populations without adequate warning of the event are highly vulnerable.

As shown in Table 4.3.1-7, Evesham Township has the highest population over 65 (8,574) and highest population under the age of 5 (2,237). Pemberton Township has the largest population of non-English speaking persons (1,092). Willingboro Township has the greatest population of individuals living in poverty (2,685) and the largest disabled population (5,100). Wrightstown Township has the lowest population over 65 (58). Washington Township has the lowest population of individuals under the age of 5 (8). Bass River Township, Beverly City, Eastampton Township, Fieldsboro Borough, Medford Lakes Borough, Shamong Township, and Woodland Township all have no (0) non-English speaking persons living within the jurisdiction. Fieldsboro Borough has fewest number of disabled persons in their jurisdiction (62). Wrightstown Borough has the lowest population living in poverty (21).

Dam failure can cause persons to become displaced if flooding of structures occurs. Dam failure may mimic flood events, depending on the size of the dam reservoir and breach. Understanding potential outcomes of flooding for each dam in Burlington County would require intensive hydraulic modeling.

Table 4.3.1-7. Burlington County Socially Vulnerable Populations by Municipality

Jurisdiction[a]	Decennial Population 2020		American Community Survey 5-Year Population Estimates (2021)									
			Population Over 65		Population Under 5		Non-English Speaking Population		Population with Disability		Population Below Poverty Level	
	Jurisdiction Total	% of County Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total
Bass River (T)	1,355	0.3%	248	18.3%	67	4.9%	0	0.0%	175	12.9%	95	7.0%
Beverly (C)	2,499	0.5%	292	11.7%	183	7.3%	0	0.0%	249	10.0%	300	12.0%
Bordentown (C)	3,993	0.9%	772	19.3%	216	5.4%	16	0.4%	422	10.6%	227	5.7%
Bordentown (T)	11,791	2.6%	1,601	13.6%	472	4.0%	289	2.4%	1,092	9.3%	194	1.6%
Burlington (C)	9,743	2.1%	1,301	13.4%	661	6.8%	208	2.1%	1,251	12.8%	1,422	14.6%
Burlington (T)	23,983	5.2%	3,526	14.7%	1,497	6.2%	385	1.6%	2,366	9.9%	2,185	9.1%
Chesterfield (T)	9,422	2.0%	760	8.1%	578	6.1%	153	1.6%	423	4.5%	165	1.8%
Cinnaminson (T)	17,064	3.7%	3,103	18.2%	929	5.4%	208	1.2%	1,661	9.7%	584	3.4%
Delanco (T)	4,824	1.0%	1,297	26.9%	191	4.0%	42	0.9%	676	14.0%	322	6.7%
Delran (T)	17,882	3.9%	2,570	14.4%	1,047	5.9%	723	4.0%	1,548	8.7%	902	5.0%
Eastampton (T)	6,191	1.3%	557	9.0%	264	4.3%	0	0.0%	478	7.7%	488	7.9%
Edgewater Park (T)	8,930	1.9%	1,571	17.6%	700	7.8%	367	4.1%	1,465	16.4%	1,645	18.4%
Evesham (T)	46,826	10.1%	8,574	18.3%	2,237	4.8%	749	1.6%	4,504	9.6%	1,476	3.2%
Fieldsboro (B)	526	0.1%	82	15.6%	64	12.2%	0	0.0%	62	11.8%	36	6.8%
Florence (T)	12,812	2.8%	2,122	16.6%	645	5.0%	260	2.0%	1,460	11.4%	827	6.5%
Hainesport (T)	6,035	1.3%	1,327	22.0%	58	1.0%	0	0.0%	744	12.3%	250	4.1%
Lumberton (T)	12,803	2.8%	2,048	16.0%	661	5.2%	107	0.8%	1,490	11.6%	805	6.3%
Mansfield (T)	8,897	1.9%	2,506	28.2%	394	4.4%	330	3.7%	1,465	16.5%	181	2.0%
Maple Shade (T)	19,980	4.3%	2,897	14.5%	1,159	5.8%	694	3.5%	2,433	12.2%	1,971	9.9%
Medford (T)	24,497	5.3%	5,151	21.0%	1,085	4.4%	31	0.1%	2,775	11.3%	724	3.0%
Medford Lakes (B)	4,264	0.9%	879	20.6%	211	4.9%	0	0.0%	407	9.5%	26	0.6%
Moorestown (T)	21,355	4.6%	3,480	16.3%	837	3.9%	603	2.8%	1,654	7.7%	807	3.8%
Mount Holly (T)	9,981	2.2%	1,199	12.0%	454	4.5%	133	1.3%	1,624	16.3%	958	9.6%
Mount Laurel (T)	44,633	9.7%	8,299	18.6%	2,011	4.5%	889	2.0%	4,203	9.4%	1,689	3.8%
New Hanover (T)	6,367	1.4%	311	4.9%	214	3.4%	29	0.4%	192	3.0%	116	1.8%
North Hanover (T)	7,963	1.7%	532	6.7%	975	12.2%	125	1.6%	631	7.9%	481	6.0%
Palmyra (B)	7,438	1.6%	1,077	14.5%	190	2.6%	44	0.6%	961	12.9%	616	8.3%
Pemberton (B)	1,371	0.3%	282	20.6%	56	4.1%	47	3.4%	308	22.5%	140	10.2%

Jurisdiction[a]	Decennial Population 2020		American Community Survey 5-Year Population Estimates (2021)									
			Population Over 65		Population Under 5		Non-English Speaking Population		Population with Disability		Population Below Poverty Level	
	Jurisdiction Total	% of County Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total
Pemberton (T)	26,903	5.8%	4,306	16.0%	1,429	5.3%	1,092	4.1%	4,006	14.9%	2,518	9.4%
Riverside (T)	8,003	1.7%	1,039	13.0%	354	4.4%	754	9.4%	972	12.1%	1,257	15.7%
Riverton (B)	2,764	0.6%	554	20.0%	80	2.9%	5	0.2%	187	6.8%	72	2.6%
Shamong (T)	6,460	1.4%	1,313	20.3%	324	5.0%	0	0.0%	671	10.4%	136	2.1%
Southampton (T)	10,317	2.2%	3,153	30.6%	293	2.8%	125	1.2%	1,551	15.0%	589	5.7%
Springfield (T)	3,245	0.7%	479	14.8%	129	4.0%	65	2.0%	311	9.6%	160	4.9%
Tabernacle (T)	6,776	1.5%	1,524	22.5%	380	5.6%	0	0.0%	747	11.0%	233	3.4%
Washington (T)	693	0.2%	138	19.9%	8	1.2%	8	1.1%	87	12.6%	21	3.0%
Westampton (T)	9,121	2.0%	1,139	12.5%	263	2.9%	81	0.9%	802	8.8%	268	2.9%
Willingboro (T)	31,889	6.9%	5,707	17.9%	1,916	6.0%	538	1.7%	5,100	16.0%	2,685	8.4%
Woodland (T)	1,544	0.3%	319	20.7%	49	3.2%	0	0.0%	627	40.6%	363	23.5%
Wrightstown (B)	720	0.2%	58	8.1%	69	9.6%	5	0.7%	119	16.5%	13	1.8%
Burlington County Total	**461,860**	**100.0%**	**78,093**	**16.9%**	**23,350**	**5.1%**	**9,103**	**2.0%**	**51,899**	**11.2%**	**27,947**	**6.1%**

Source: U.S. Census Bureau 2020, 2021

Note: Persons per household = 2.6

a. (B) = borough; (C) = city; (T) = township

Impact on General Building Stock

Buildings located downstream of a dam are at risk of damage should there be a failure. Downstream inundation areas were not available to quantify any potential losses to structures. Properties located closest to the dam inundation area have the greatest potential to experience the largest, most destructive surge of water. The overall impact of flooding damage caused by dam failure will vary depending on the depth of flooding and velocity of the surge.

Impact on Critical Facilities

Dam failures may also impact critical facilities and lifelines located in the downstream inundation zone. Consequentially, dam failure can cut evacuation routes, limit emergency access, and/or create isolation issues. Dam 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. Further, utilities such as overhead power lines, cable and phone lines could also be vulnerable. Loss of these utilities could create additional isolation issues for the inundation areas.

Impact on Economy

Severe flooding that follows an event like a dam failure can cause extensive structural damage and withhold essential services. The cost to recover from flood damage after a surge will vary depending on the hazard risk of each dam. The 2019 State HMP discusses damage from dam failures ranging from $7 million to $25 million as a result of previous events in the State. This cost likely varies because of the density of structures and businesses that surround the protected area (NJOEM 2019).

Severe flooding that follows an event like a dam failure can cause extensive damage to public utilities and disruptions to delivery of services. Loss of power and communications may occur and drinking water and wastewater treatment facilities can become temporarily out of operation. Debris from surrounding buildings can accumulate should the dam mimic major flood events, such as the 1-percent annual chance flood event that is discussed in Section 4.3.6 (Flood).

Based on existing data, given the County's higher density along the Delaware River, potential damage might cascade from upstream of hazardous dams, namely the Atsion Lake, Timber Lake, Sylvan Lake, Centennial Lake, Mirror Lake, Mishe-Mokwa, Vincentown Mill, Ballinger Lake, Smithville, and Wagush Dams which are all ranked as high hazard dams (USACE 2023).

Impact on Environment

The environmental impacts of a dam failure can include significant water-quality and debris-disposal issues or severe erosion that can impact local ecosystems. Flood waters can back up sanitary sewer systems and inundate wastewater treatment plants, causing raw sewage to contaminate residential and commercial buildings and the flooded waterway. The contents of unsecured containers of oil, fertilizers, pesticides, and other chemicals may be added to flood waters. Hazardous materials may be released and distributed widely across the floodplain. Water supply and wastewater treatment facilities could be offline for weeks. After the flood waters subside, contaminated and flood-damaged building materials and contents must be properly disposed of. Contaminated sediment must be removed from buildings, yards, and properties.

Cascading Impacts on Other Hazards

Dam failure can cause severe downstream flooding, depending on the magnitude of the failure. Other potential secondary hazards of dam failure are landslides around the reservoir perimeter, bank erosion on the rivers, and destruction of downstream habitat. Dam failures can occur as a result of structural failures, such as progressive erosion of an embankment or overtopping and breaching by a severe flood. Earthquakes may weaken dams. Floods caused by dam failures have caused loss of life and property damage (FEMA 2013).

Further Changes that May Impact Vulnerability

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

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

Projected Development

As discussed, and illustrated 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 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.

Projected Changes in Population

Burlington County has experienced an increase in its population since 2010. According to the U.S. Census Bureau, the County's population increased by approximately 3 percent between 2010 and 2020 (U.S. Census Bureau 2020). 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, Burlington County is projected to have a population of 460,400 by 2024, 464,900 by 2029, and 472,700 by 2034 (State of New Jersey 2017). As the population increases any changes in the density of population 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 failure event but can also have an effect on commuters that travel into and out of the County for work, particularly during a flood event that may impact transportation corridors, which are also major commuter roads. Refer to Section 3 (County Profile) for more information about population trends in the County.

Climate Change

As discussed above, most studies project that the State of New Jersey will see an increase in average annual precipitation. Annual precipitation amounts in the region are projected to increase, primarily in the form of heavy rainfalls, which have the potential to increase the risk of dam failures. Increases in precipitation may stress the structures. Further, existing flood control structures may not be able to retain and manage increases in water flow from more frequent, heavy rainfall events. Heavy rainfalls may result in more frequent overtopping of these dams and flooding of the County's assets in adjacent inundation areas. However, the probable maximum flood used to design each dam may be able to accommodate changes in climate.

Change of Vulnerability Since 2019 HMP

Overall, the County's vulnerability has not changed, and the County will continue to be exposed and vulnerable to dam failure events, especially those located within or near downstream inundation zones. Because of the sensitive nature of the dam failure inundation zones, potential losses have not been quantified and presented in this plan. To estimate potential losses to population, buildings, critical facilities and infrastructure, dam inundation areas and depths of flooding may be used to generate depth grids. Hazus may be used to estimate potential losses for the County and participating municipalities.

4.3.2 Disease Outbreak

2024 HMP Changes

- Disease outbreak is a new hazard of concern for this 2024 HMP update.

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

Hazard Description

An outbreak or an epidemic occurs when new cases of a certain disease, in a given population, substantially exceed what is expected. An epidemic may be restricted to one locale, or it may be global, at which point it is called a pandemic. A pandemic is defined as a disease occurring over a wide geographic area and affecting a high proportion of the population. A pandemic can cause sudden, pervasive illness in all age groups on a local or global scale. A pandemic is a novel virus to which humans have no natural immunity that spreads from person to person. A pandemic will cause both widespread and sustained effects and is likely to stress the resources of both the State and Federal government (Columbia University 2021).

Most disease outbreaks occur due to respiratory viruses. A respiratory virus with pandemic potential is a highly contagious respiratory virus that spreads easily from person to person and for which there is little human immunity. This hazard includes pandemic influenza. This hazard strains the healthcare system, requires school closures, causes high rates of illness and absenteeism that undermine critical infrastructure across the city, and decreases community trust due to social distancing measures interfering with personal movement and being perceived as being ineffectual. Previous events that exemplify this hazard include the 1918 ("Spanish flu") and 2009 ("Swine flu") influenza pandemics, the 2003 SARS outbreak, which had pandemic potential, and the 2019 COVID-19 pandemic (CDC 2018).

In addition to respiratory viruses, diseases with new or emerging features can challenge control, including those spread from insects. Emerging diseases are difficult to contain or treat and present significant challenges to risk communication since the mechanics of transmission, laboratory identification, and effective treatment protocols may be unknown (Behler McArthur 2019).

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

Influenza

Influenza (the flu) is a contagious virus that affects the nose, throat, lungs, and other parts of the body. It can quickly spread from one person to another, causing mild to severe illness and can lead to death. Symptoms include fever, cough, sore throat, runny or stuffy nose, muscle or body aches, headache, and tiredness (NJDOH 2023).

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

TETRA TECH

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

West Nile Virus

West Nile Virus (WNV) is the leading cause of mosquito-borne disease in the United States. WNV is most commonly spread to people who are bitten by an infected mosquito. WNV is usually diagnosed during mosquito season, starting in the summer months, and continuing through the fall (NJDOH 2023). WNV was first identified in the United States in 1999. Since 1999, 380 human cases of WNV have been reported statewide (CDC 2023). The symptoms of severe infection (West Nile encephalitis or meningitis) can include headache, high fever, neck stiffness, muscle weakness, stupor, disorientation, tremors, seizures, paralysis, and coma. WNV can cause serious illness, and in some cases, death. Usually, symptoms occur from 3 to 14 days after being bitten by an infected mosquito (NJDOH 2023).

Lyme Disease

Lyme disease is the most common vector-borne disease in the United States. It is an illness caused by infection with the bacterium *Borrelia burgdorferi* and rarely, *Borrelia mayoni*, which are carried by ticks and transmitted through its bite. Typical symptoms include fever, headache, fatigue, and skin rash. If left untreated, symptoms can be severe. Most cases of Lyme disease can be treated successfully with a few weeks of antibiotics. Steps to prevent Lyme disease include using insect repellent, removing ticks promptly, applying pesticides, and reducing tick habitat (CDC 2022). In New Jersey, the commonly infected tick is the deer tick. Immature ticks become infected by feeding on infected white-footed mice and other small mammals. Deer ticks can also spread other tick-borne diseases. Anyone who is bitten by a tick carrying the bacteria can become infected (NJDOH 2012).

Coronavirus

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

Reported illnesses have ranged from mild symptoms to severe illness and death. Reported symptoms include difficulty breathing and shortness of breath, fever or chills, cough, fatigue, muscle or body aches, loss of smell or taste, sore throat, congestion, and nausea or vomiting. Emergency symptoms that require immediate medical attention include trouble breathing, persistent pain or pressure in the chest, confusion, or inability to wake or stay awake, and bluish lips or face. Symptoms may appear 2 to 14 days after exposure to the virus (based on the incubation period of MERS-CoV viruses) (CDC 2021).

Location

Burlington County, as the largest county in New Jersey, has large areas that have potential to breed mosquitoes. These areas include farm land, wetlands (fresh and salt water), home yards, stormwater facilities, and sewer plants. These areas need to be addressed as best as possible to control mosquitoes and the viruses they can spread (Burlington County n.d.).

Disease outbreaks can occur without regard for location. However, factors such as density, visitation, and the length of time in which the public spends in a location all contribute to the spread of infectious diseases. For example, COVID-19 and influenza are more likely spread by persons in close contact. Indoor areas in which people are in close contact with each other appear to be significant vectors for the disease, which is spread through respiratory droplets. Infectious diseases spread by insects may be subject to other types of location hazards. For example, the prevalence of standing water can provide breeding grounds for diseases such as West Nile Virus, and wooded areas are favored by the ticks which spread Lyme Disease. Diseases that can infect humans are variable in nature and methods of transmission. Ultimately, residents need to be vigilant about diseases altogether in order to better understand and respond to disease outbreaks.

Extent

The exact size and extent of a disease outbreak event depends on how easily the illness is spread, the mode of transmission, and the amount of contact between infected and uninfected individuals. The transmission rate of infectious diseases will depend on the mode of transmission of a given illness. The transmission rates of respiratory disease are often higher in more densely populated areas while the transmission rates of insect borne disease are often higher in less densely populated areas that provide more habitat for insects The severity and length of the next disease outbreak cannot be predicted; however, experts anticipate that its effect on the United States could be severe as demonstrated by the COVID-19 pandemic.

The CDC and public health officials use the Pandemic Severity Assessment Framework to determine the impact of the pandemic, or how “bad” the pandemic will be. This framework replaced the Pandemic Severity Index (PSI) in 2014. There are two main factors that can be used to determine the impact of a pandemic. The first is clinical severity, or how serious is the illness associated with infection. The second factor is transmissibility, or how easily the pandemic virus spreads from person-to-person. These two factors combined are used to guide decisions about which actions CDC recommends at a given time during the pandemic. The results help public health officials and health care professionals make timely and informed decisions, and to take appropriate actions (CDC 2016).

In 1999, The World Health Organization (WHO) published guidance for pandemic influenza and defined the six phases of a pandemic. The updated guidance was published in 2005 to redefine these phases, and in 2009 WHO published the *Pandemic Influenza Preparedness and Response,* this guidance significantly updates and replaces the guidance published in 2005 (World Health Organization 2009). The revised guidance retains the six-phase approach to facilitate the incorporation of new recommendations. Phases 1-3 and 5-6 have been grouped to include common action points. The WHO pandemic phases are outlined in Table 4.3.2-1.

Table 4.3.2-1. WHO Global Pandemic Phases

Phase	Description
Preparedness and Response– Global, Regional, National, Sub-National Level	
Phase 1	No animal influenza virus circulating among animals has been reported to cause infection in humans.
Phase 2	An animal influenza virus circulating in domesticated or wild animals is known to have caused infection in humans and is therefore considered a potential pandemic threat.
Phase 3	An animal or human-animal influenza reassortant virus has caused sporadic cases or small clusters of disease in people but has not resulted in human-to-human transmission sufficient to sustain community-level outbreaks.
Containment	

Phase	Description
Phase 4	Human-to-human transmission (H2H) of an animal or human-animal influenza reassortant virus able to sustain community-level outbreaks has been verified.
Response – Global Level	
Phase 5	The same identified virus has caused sustained community-level outbreaks in two or more countries in one WHO region.
Phase 6	In addition to the criteria defined in Phase 5, the same virus has caused sustained community-level outbreaks in at least one other country in another WHO region.
Post-Pandemic	
Post-Peak Period	Levels of pandemic influenza in most countries with adequate surveillance have dropped below peak levels.
Possible New Wave	Level of pandemic influenza activity in most countries with adequate surveillance rising again.
Post-Pandemic Period	Levels of influenza activity have returned to the levels seen for seasonal influenza in most countries with adequate surveillance

Source: WHO 2009

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

Influenza and Coronavirus

The US EPA has noted fine droplets and particles spread and accumulate more rapidly in an indoor setting. Therefore, the transmission of respiratory illness from contact with infected individuals is more likely to occur in indoor spaces.

Between January 2019 and December 2022, there were 1,831 confirmed cases of influenza in Burlington County (NJDOH 2022). Those most vulnerable to influenza include young children and the elderly, although anyone can become infected. Table 4.3.2-2 displays the current flu seasons and compares it to previous seasons.

Table 4.3.2-2. Influenza Cases Comparison by Season for Burlington County

Flu Type	Season		
	2019-2020	2020-2021	2021-2022
Influenza Type A	552	534	331
Influenza Type B	82	313	19
Total	**634**	**847**	**350**

Source: NJDOH 2022

According to the State of New Jersey Department of Health, Burlington County totaled 116,563 positive tests of COVID-19 between January 2020 and August 2023; 1,268 residents of Burlington County lost their lives due to COVID-19 during the same time period (NJDOH 2023). Figure 4.3.2-1 visualizes the annual average number of positive cases per 100,000 by county in New Jersey.

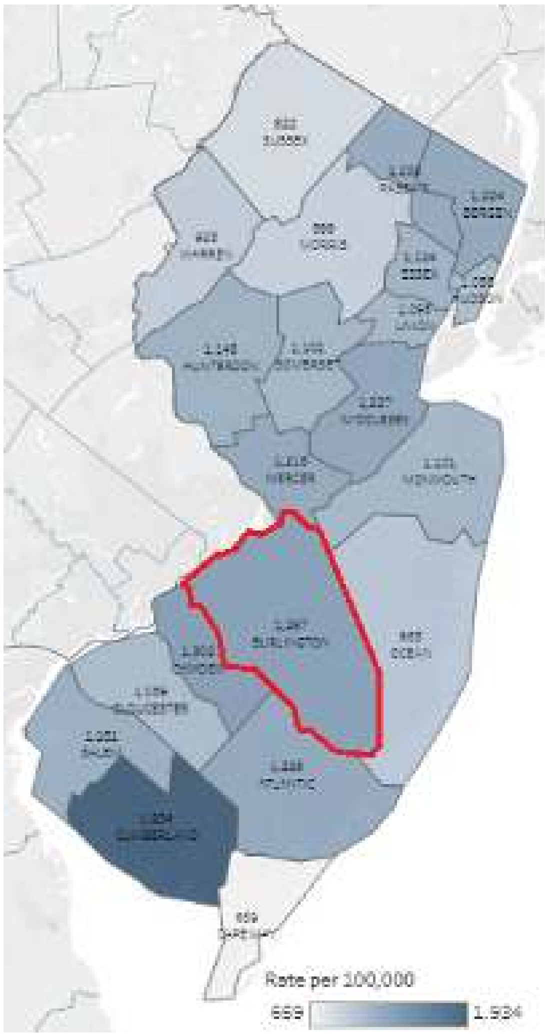
West Nile Virus

WNV is the leading cause of mosquito-borne diseases in the continental United States. There are no vaccines to prevent or medications to treat WNV in people, and those infected rarely experience sickness or symptoms. About 1 in 5 infected people will develop a fever and other symptoms, and 1 in 150 infected people will develop a serious,

TETRA TECH

sometimes fatal, illness (CDC 2023). Figure 4.3.2-2 below shows the West Nile Virus Incidence Rate (per 100,000) by County between year 2010 and 2022. Burlington County has a 5.8 incidence rate of WNV.

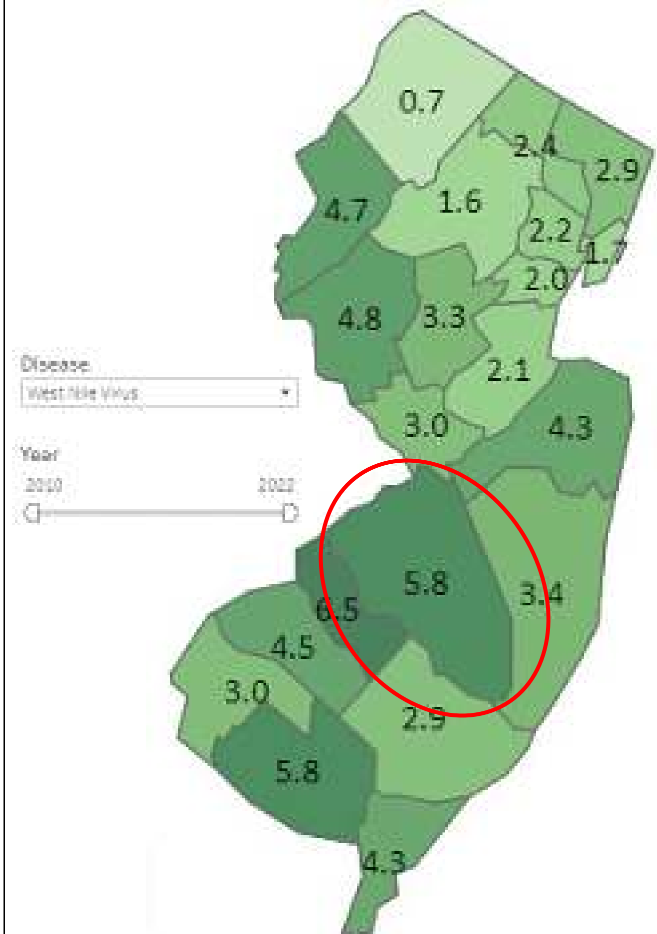
Figure 4.3.2-1. Annual Average COVID-19 Positive Case Rate per 100,000 residents, by County



Notes: Burlington County is outlined in red

Source: NJDOH 2023

Figure 4.3.2-2. West Nile Virus Incidence Rate (per 100,000) by County



Note: Burlington County is circled in red

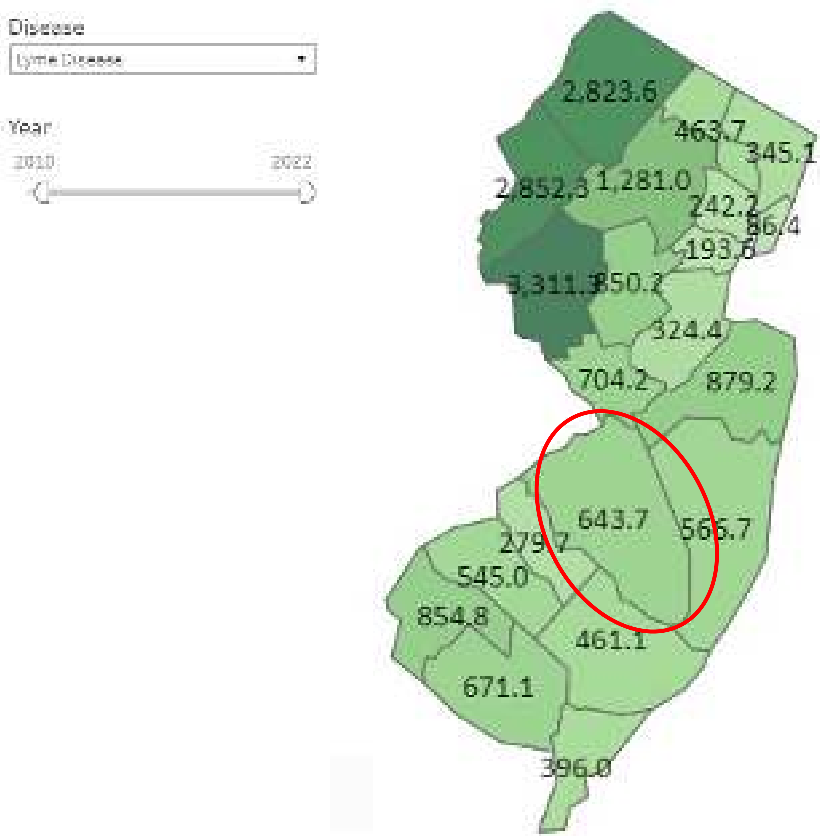
Source: NJDOH 2023

Burlington County, as the largest county in New Jersey, has large areas that have potential to breed mosquitoes which can transmit WNV. These areas include, farmland, wetlands (fresh and salt water), home yards, stormwater facilities, and sewer plants (Burlington County n.d.). New Jersey Title 7 Administrative Code requires that county governments in New Jersey maintain a division of mosquito control. Burlington County Mosquito Control is required to set traps and provide specimens for testing to New Jersey Department of Health to check for certain communicable diseases. The goal is to reduce the mosquito population, which are a primary vector for diseases. The New Jersey Department of Health tests for the following diseases: West Nile Virus, Eastern Equine Encephalitis, Jamestown Canyon Virus, St. Louis Encephalitis, La Crosse Encephalitis, Dengue and Zika (Burlington County 2019).

Lyme Disease

Lyme disease, most commonly found in wooded areas, is the most reported vector borne illness in the U.S. Between 2000 and 2020, there was a total of 3,884 confirmed cases in Lyme disease in Burlington County, including 406 cases in 2009, the highest number of reported cases of a given year (TickCheck 2023). The CDC only reports confirmed cases, due to this the true number of cases is estimated at 38,840. Figure 4.3.2-3 shows the Lyme Disease Incidence Rate (per 100,000) by County between year 2010 and 2022. Burlington County has a 643.7 incidence rate of Lyme Disease.

Figure 4.3.2-3. Lyme Disease Incidence Rate (per 100,000) by County



Note: Burlington County is circled in red

Source: NJDOH 2023

Previous Occurrences and Losses

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

FEMA Major Disaster and Emergency Declarations

Between 1954 and 2022, New Jersey was included in three FEMA declared disease outbreak-related disasters (DR) or emergency declarations (EM); Burlington County was included in all three of these declared disasters, as shown in Table 4.3.2-3.

Table 4.3.2-3. FEMA Declarations for Disease Outbreak Events in Burlington County

FEMA Declaration Number	Date of Declaration	Date of Event	Event Type	Event Title
EM-3156-NJ	November 1, 2000	May 22, 2000 - November 1, 2000	Pandemic: West Nile Virus	New Jersey Virus Threat
DR-4488-NJ	March 25, 2020	January 20, 2020 - May 11, 2023	Pandemic: Coronavirus	New Jersey COVID-19 Pandemic
EM-3451-NJ	March 13, 2020	January 20, 2020 - May 11, 2023	Pandemic: Coronavirus	New Jersey COVID-19

Source: FEMA 2022

USDA Declarations

The Secretary of Agriculture from the U.S. Department of Agriculture (USDA) is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in counties that are contiguous to a designated county. Between 2018 and 2022, Burlington County was not included in any USDA-designated agricultural disasters that included disease outbreak events.

Previous Events

Table 4.3.2-4 identifies the known disease outbreak events that impacted Burlington County between 2018 and 2023. For detailed information on damages and impacts to each municipality, refer to Section 9 (Jurisdictional Annexes).

Table 4.3.2-4. Disease Outbreak Events in Burlington County, 2018 to 2023

Date of Event	Event Type	Declaration Number	Burlington County Designated?	Description
2018	Influenza	N/A	N/A	663 confirmed cases of Influenza in Burlington County
2018	Lyme Disease	N/A	N/A	190 confirmed cases of Lyme Disease in Burlington County
2018	West Nile Virus	N/A	N/A	3 confirmed cases of human-infected West Nile Virus in Burlington County
2019	Influenza	N/A	N/A	634 confirmed cases of Influenza in Burlington County
2019	Lyme Disease	N/A	N/A	236 confirmed cases of Lyme Disease in Burlington County
2019	West Nile Virus	N/A	N/A	2 confirmed cases of human-infected West Nile Virus in Burlington County
2020	Influenza	N/A	N/A	847 confirmed cases of Influenza in Burlington County
2020	Lyme Disease	N/A	N/A	158 confirmed cases of Lyme Disease in Burlington County
2020	Coronavirus	DR-4488-NJ, EM-3451-NJ	Yes	In 2020, Burlington County reported 23,463 positive cases of COVID-19 and 643 deaths.
2021	Influenza	N/A	N/A	350 confirmed cases of Influenza in Burlington County
2021	Lyme Disease	N/A	N/A	201 confirmed cases of Lyme Disease in Burlington County

Date of Event	Event Type	Declaration Number	Burlington County Designated?	Description
2021	West Nile Virus	N/A	N/A	8 confirmed cases of human-infected West Nile Virus in Burlington County
2021	Coronavirus	DR-4488-NJ, EM-3451-NJ	Yes	In 2021, Burlington County reported 40,429 positive cases of COVID-19 and 327 deaths.
2022	Influenza	N/A	N/A	176 confirmed cases of Influenza in Burlington County
2022	Lyme Disease	N/A	N/A	187 confirmed cases of Lyme Disease in Burlington County
2022	West Nile Virus	N/A	N/A	2 confirmed cases of human-infected West Nile Virus in Burlington County
2022	Coronavirus	DR-4488-NJ, EM-3451-NJ	Yes	In 2022, Burlington County reported 46,728 positive cases of COVID-19 and 309 deaths.
2023 [a]	Influenza	N/A	N/A	74 confirmed cases of Influenza in Burlington County
2023 [b]	Lyme Disease	N/A	N/A	168 confirmed cases of Lyme Disease in Burlington County
2023 [c]	West Nile Virus	N/A	N/A	0 confirmed cases of human-infected West Nile Virus in Burlington County
2023 [d]	Coronavirus	DR-4488-NJ, EM-3451-NJ	Yes [e]	In 2023, Burlington County reported 6,127 positive cases of COVID-19 and 32 deaths.

Source: NJDOH 2022; CDC 2023; NJDOH 2023; NJDOH 2023; FEMA 2023

a totals last updated May 20, 2023

b totals last updated August 30, 2023

c totals last update September 5, 2023

d totals last update September 5, 2023

e the declarations for the COVID-19 Pandemic expired on May 11, 2023

Probability of Future Occurrences

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

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

As for mosquito-borne and tick-borne diseases, as long as mosquitoes and ticks are found in Burlington County, the risk of contracting WNV, Lyme disease, or other diseases carried by these insects exists. Instances of WNV have been generally decreasing throughout the northeast United States due to planning and eradication efforts. However, some scientists anticipate an increase in WNV and other mosquito-borne diseases due to changing climate conditions creating suitable habitats for mosquitoes (CDC 2013). Disease-carrying ticks will continue to inhabit Burlington County and the threat of Lyme disease and other tick-borne diseases will continue. Similar to mosquitoes, there are eradication efforts in place to control the tick population and new methods of control are being developed (Steere, Coburn and Glickstein 2004). Therefore, based on all available information and available data regarding mosquito and tick populations, it is anticipated that mosquito- and tick-borne diseases will continue to be a threat to Burlington County. However, vaccines are currently being developed for Lyme Disease, which may assist in slowing the contraction rates (CDC 2022).

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

Climate Change Impacts

Providing projections of future climate change for a specific region is challenging. Shorter term projections are more closely tied to existing trends making longer term projections even more challenging. The further out a prediction reaches the more subject to changing dynamics it becomes.

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 (1.9 °C) increase in the State’s average temperature, which is faster than the rest of the Northeast region (2 °F [1.1 °C]) and the world (1.5 °F [0.8 °C]). This warming trend is expected to continue. By 2050, temperatures in New Jersey are expected to increase by 4.1 to 5.7 °F (2.3 °C to 3.2 °C). 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 (5.6 °C) 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).

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, New Jersey 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. New Jersey will experience more intense rain events, less snow, and more rainfalls. 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).

The relationship between climate change and increase in infectious diseases is difficult to predict with certainty, but there are scientific linkages between the two. Increased rainfall and heavy rainfalls increase the chances of standing water where mosquitos breed. As flooding events increase in the County owing to climate change, water-borne and vector-borne diseases (particularly those associated with mosquitos) may similarly increase owing to the prevalence of standing water over long periods (National Geographic 2022).

The notion that rising temperatures will increase the number of ticks and mosquitoes that can transmit diseases such as Lyme disease and WNV among humans (rather than just shift their range) has been the subject of debate over the past decade. Some believe that climate change may affect the spread of disease, while others are not convinced. However, many researchers point out that climate is not the only force at work in increasing the spread of infectious diseases into the future (Jordan 2019). However, a warming climate is likely to increase the length of the insect season, increasing the potential rates of transmission of insect borne disease.

Vulnerability Assessment

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

Impact on Life, Health, and Safety

The entire population of Burlington County (461,860) is vulnerable to the disease outbreak hazard. Due to a lack of quantifiable loss information, a qualitative assessment was conducted to evaluate the assets exposed to this hazard and the potential impacts associated with this hazard.

Maintaining certain key functions is important to preserve life and decrease societal disruption during disease outbreaks. Heat, clean water, waste disposal, and corpse management all contribute to public health. Ensuring functional transportation systems also protects health by making it possible for people to access medical care and by transporting food and other essential goods. Critical infrastructure groups have a responsibility to maintain public health, provide public safety, transport medical supplies and food, implement a disease outbreak response, and maintaining societal functions. If these workers were absent due to disease outbreak, these systems will fail (CISA n.d.).

Socially Vulnerable Populations

Healthcare providers and first responders have an increased risk of exposure due to their frequent contact with infected populations. Areas with a higher population density also have an increased risk of exposure or transmission of disease due to their proximity to potentially infected people. Further, the elderly and immunocompromised individuals may have increased vulnerability to becoming infected or experience exacerbated impacts depending upon the disease.

As shown in Table 4.3.2-5, Evesham Township has the highest population over 65 (8,574) and highest population under the age of 5 (2,237). Pemberton Township has the largest population of non-English speaking persons (1,092). Willingboro Township has the greatest population of individuals living in poverty (2,685) and the largest disabled population (5,100). Wrightstown Township has the lowest population over 65 (58). Washington Township has the lowest population of individuals under the age of 5 (8). Bass River Township, Beverly City, Eastampton Township, Fieldsboro Borough, Medford Lakes Borough, Shamong Township, and Woodland Township all have no (0) non-English speaking persons living within the jurisdiction. Fieldsboro Borough has fewest number of disabled persons in their jurisdiction (62). Wrightstown Borough has the lowest population living in poverty (21).

Table 4.3.2-5. Burlington County Socially Vulnerable Populations by Municipality

Jurisdiction[a]	Decennial Population 2020		American Community Survey 5-Year Population Estimates (2021)									
			Population Over 65		Population Under 5		Non-English Speaking Population		Population with Disability		Population Below Poverty Level	
	Jurisdiction Total	% of County Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total
Bass River (T)	1,355	0.3%	248	18.3%	67	4.9%	0	0.0%	175	12.9%	95	7.0%
Beverly (C)	2,499	0.5%	292	11.7%	183	7.3%	0	0.0%	249	10.0%	300	12.0%
Bordentown (C)	3,993	0.9%	772	19.3%	216	5.4%	16	0.4%	422	10.6%	227	5.7%
Bordentown (T)	11,791	2.6%	1,601	13.6%	472	4.0%	289	2.4%	1,092	9.3%	194	1.6%
Burlington (C)	9,743	2.1%	1,301	13.4%	661	6.8%	208	2.1%	1,251	12.8%	1,422	14.6%
Burlington (T)	23,983	5.2%	3,526	14.7%	1,497	6.2%	385	1.6%	2,366	9.9%	2,185	9.1%
Chesterfield (T)	9,422	2.0%	760	8.1%	578	6.1%	153	1.6%	423	4.5%	165	1.8%
Cinnaminson (T)	17,064	3.7%	3,103	18.2%	929	5.4%	208	1.2%	1,661	9.7%	584	3.4%
Delanco (T)	4,824	1.0%	1,297	26.9%	191	4.0%	42	0.9%	676	14.0%	322	6.7%
Delran (T)	17,882	3.9%	2,570	14.4%	1,047	5.9%	723	4.0%	1,548	8.7%	902	5.0%
Eastampton (T)	6,191	1.3%	557	9.0%	264	4.3%	0	0.0%	478	7.7%	488	7.9%
Edgewater Park (T)	8,930	1.9%	1,571	17.6%	700	7.8%	367	4.1%	1,465	16.4%	1,645	18.4%
Evesham (T)	46,826	10.1%	8,574	18.3%	2,237	4.8%	749	1.6%	4,504	9.6%	1,476	3.2%
Fieldsboro (B)	526	0.1%	82	15.6%	64	12.2%	0	0.0%	62	11.8%	36	6.8%
Florence (T)	12,812	2.8%	2,122	16.6%	645	5.0%	260	2.0%	1,460	11.4%	827	6.5%
Hainesport (T)	6,035	1.3%	1,327	22.0%	58	1.0%	0	0.0%	744	12.3%	250	4.1%
Lumberton (T)	12,803	2.8%	2,048	16.0%	661	5.2%	107	0.8%	1,490	11.6%	805	6.3%
Mansfield (T)	8,897	1.9%	2,506	28.2%	394	4.4%	330	3.7%	1,465	16.5%	181	2.0%
Maple Shade (T)	19,980	4.3%	2,897	14.5%	1,159	5.8%	694	3.5%	2,433	12.2%	1,971	9.9%
Medford (T)	24,497	5.3%	5,151	21.0%	1,085	4.4%	31	0.1%	2,775	11.3%	724	3.0%
Medford Lakes (B)	4,264	0.9%	879	20.6%	211	4.9%	0	0.0%	407	9.5%	26	0.6%
Moorestown (T)	21,355	4.6%	3,480	16.3%	837	3.9%	603	2.8%	1,654	7.7%	807	3.8%
Mount Holly (T)	9,981	2.2%	1,199	12.0%	454	4.5%	133	1.3%	1,624	16.3%	958	9.6%
Mount Laurel (T)	44,633	9.7%	8,299	18.6%	2,011	4.5%	889	2.0%	4,203	9.4%	1,689	3.8%
New Hanover (T)	6,367	1.4%	311	4.9%	214	3.4%	29	0.4%	192	3.0%	116	1.8%
North Hanover (T)	7,963	1.7%	532	6.7%	975	12.2%	125	1.6%	631	7.9%	481	6.0%
Palmyra (B)	7,438	1.6%	1,077	14.5%	190	2.6%	44	0.6%	961	12.9%	616	8.3%
Pemberton (B)	1,371	0.3%	282	20.6%	56	4.1%	47	3.4%	308	22.5%	140	10.2%

Jurisdiction[a]	Decennial Population 2020		American Community Survey 5-Year Population Estimates (2021)									
			Population Over 65		Population Under 5		Non-English Speaking Population		Population with Disability		Population Below Poverty Level	
	Jurisdiction Total	% of County Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total
Pemberton (T)	26,903	5.8%	4,306	16.0%	1,429	5.3%	1,092	4.1%	4,006	14.9%	2,518	9.4%
Riverside (T)	8,003	1.7%	1,039	13.0%	354	4.4%	754	9.4%	972	12.1%	1,257	15.7%
Riverton (B)	2,764	0.6%	554	20.0%	80	2.9%	5	0.2%	187	6.8%	72	2.6%
Shamong (T)	6,460	1.4%	1,313	20.3%	324	5.0%	0	0.0%	671	10.4%	136	2.1%
Southampton (T)	10,317	2.2%	3,153	30.6%	293	2.8%	125	1.2%	1,551	15.0%	589	5.7%
Springfield (T)	3,245	0.7%	479	14.8%	129	4.0%	65	2.0%	311	9.6%	160	4.9%
Tabernacle (T)	6,776	1.5%	1,524	22.5%	380	5.6%	0	0.0%	747	11.0%	233	3.4%
Washington (T)	693	0.2%	138	19.9%	8	1.2%	8	1.1%	87	12.6%	21	3.0%
Westampton (T)	9,121	2.0%	1,139	12.5%	263	2.9%	81	0.9%	802	8.8%	268	2.9%
Willingboro (T)	31,889	6.9%	5,707	17.9%	1,916	6.0%	538	1.7%	5,100	16.0%	2,685	8.4%
Woodland (T)	1,544	0.3%	319	20.7%	49	3.2%	0	0.0%	627	40.6%	363	23.5%
Wrightstown (B)	720	0.2%	58	8.1%	69	9.6%	5	0.7%	119	16.5%	13	1.8%
Burlington County Total	**461,860**	**100.0%**	**78,093**	**16.9%**	**23,350**	**5.1%**	**9,103**	**2.0%**	**51,899**	**11.2%**	**27,947**	**6.1%**

Source: U.S. Census Bureau 2020, 2021

Note: Persons per household = 2.6

a. (B) = borough; (C) = city; (T) = township

Most recently with COVID-19, the Centers for Disease Control and Prevention have indicated that persons over 65 years and older, persons living in a nursing home or long-term care facility, and persons with underlying medical conditions such as diabetes, severe obesity, serious heart conditions, etc. are at a higher risk of getting severely ill (CDC 2020). According to the 2021 5-year ACS estimates, there are 27,947 total persons living below the poverty level, 78,093 persons over the age of 65 years, 23,350 persons under the age of 5 years, 9,103 non-English speakers, and 51,899 persons with a disability in Burlington County. While the statistics of this virus are subject to change during the publication of this HMP, the New Jersey COVID-19 dashboard shows that Burlington County is within the second third of the impacted Counties. Overall, persons over 65 make up approximately 14.3-percent of positive COVID-19 cases in the entire State (NJDOH 2023).

Impact on General Building Stock

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

Impact on Critical Facilities

While the actual structures of County and municipal buildings, critical facilities, and infrastructure will not be impacted by a pandemic or disease outbreak, the effect of absenteeism on workers will impact local government services. The most significant impact on critical facilities would be the increase in hospitalization and emergency room visits that would take place as a result of the outbreak. This would create a greater demand on these critical facilities, their staff, and resources.

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

The healthcare system will be severely taxed, if not overwhelmed, from the large number of illnesses and complications from influenza requiring hospitalization and critical care. Ventilators will be the most critical shortage if an outbreak were to occur (Homeland Security Council 2006).

Impact on Economy

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

The COVID-19 pandemic had significant economic impacts across the State of New Jersey. Over the course of two months, New Jersey lost nearly 720,000 jobs as businesses were forced to close their doors and residents entered a period of quarantine. This sudden halt of business activity forced the closure of schools, emptied the state’s typically busy roads, and disrupted a previously healthy economy. Every industry sector in New Jersey declined by at least some margin. The leisure and hospitality sector, which includes restaurants and casinos, lost nearly twice as many as any other sector, and accounted for 28-percent of all jobs lost during that time. Employment levels in the retail trade and health care sectors each declined by more than 100,000 jobs. Most of the decline in health care was due to temporary closures and limited capacity of ambulatory care services such as dentist’s offices and other outpatient care centers. Many small businesses did not make it through the COVID-19 pandemic, and those that did had to significantly reduce payrolls to make ends meet (New Jersey Department of Labor and Workforce Development 2021).

Impact on Environment

Disease outbreaks may have an impact on the environment if the outbreaks are caused by invasive species. Invasive species tend to be competitive with native species and their habitat. One study has shown that invasive mosquitos such as the Asian tiger mosquito, a common invasive mosquito found in New Jersey, have "desiccation-resistant eggs," which means that they have enhanced survival in inhospitable environments (Juliano and Lounibos 2005). This species is considered a competitive predator and will prey on other species of mosquitos and a range of insects disrupting the natural food chain. Invasive species of mosquitos can be the major transmitters of disease like Zika, dengue, and yellow fever (CDC 2020).

Secondary impacts from mitigating disease outbreaks could also have an impact on the environment. Pesticides used to control disease carrying insects like mosquitos have been reviewed by the EPA and United States Department of Health. If these sprays are applied in large concentrations, they could potentially leach into waterways and harm nearby terrestrial species. However, there is a law in New Jersey's Pesticide Regulations that states, "no person shall distribute, sell, offer for sale, purchase, or use any pesticide which has been suspended or canceled by the EPA, except as provided for in the suspension of cancellation order" (NJDEP 2020).

Further Changes that May Impact Vulnerability

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

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

Projected Development

Any areas of growth could be potentially impacted by the disease outbreak hazard because the entire planning area is exposed. As population counts change in the County, there may be at increased risk of certain diseases. Higher concentrations of persons traveling via public transportation may become more vulnerable to the exchange of disease through airborne transmission. Increase development in rural areas may expose a higher percentage of the population to insect borne diseases.

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, Burlington County is projected to have a population of 460,400 by 2024, 464,900 by 2029, and 472,700 by 2034 (State of New Jersey 2017). Changes in population density may influence the number of persons exposed to disease outbreaks. Higher density jurisdictions are not only at risk of greater exposure to disease outbreak, but density may also reduce available basic services provided by critical facilities such as hospitals and emergency facilities for persons that are not affected by a disease. Further, as the population ages there may be increased risk to this demographic. Older adults and people who have severe underlying medical conditions like heart or lung disease or diabetes seem to be at higher risk for developing more serious complications from certain diseases, such as COVID-19.

Climate Change

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

The relationship between climate change and infectious diseases is somewhat controversial. The notion that rising temperatures will increase the number of mosquitoes that can transmit malaria among humans (rather than just shift their range) has been the subject of debate over the past decade. Some believe that climate change may affect the spread of disease, while others are not convinced. However, many researchers point out that climate is not the only force at work in increasing the spread of infectious diseases into the future. Other factors, such as expanded rapid travel and evolution of resistance to medical treatments, are already changing the ways pathogens infect people, plants, and animals. As climate change accelerates it is likely to work synergistically with many of these factors, especially in populations increasingly subject to massive migration and malnutrition (Baker, et al. 2021).

Change of Vulnerability Since 2019 HMP

Disease outbreak was not identified as a hazard of concern in the 2019 HMP. Tick-borne diseases including Lyme and West Nile Virus and respiratory illnesses including coronavirus and influenza are included in this section.

4.3.3 Drought

2024 HMP Changes

- New and updated figures from federal and state agencies are incorporated.
- U.S. 2020 Census data was incorporated, where appropriate.
- Previous occurrences were updated with events that occurred between 2018 and 2023.

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

Hazard Description

As defined by the National Weather Service (NWS), drought is a deficiency in precipitation over an extended period, usually a season or more, resulting in a water shortage causing adverse impacts on vegetation, animals, and/or people. 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:

- *Meteorological drought* is a measure of departure of precipitation from normal. It is defined solely by the relative degree of dryness. Due to climatic differences, what might be considered a drought in one location of the country may not be a drought in another location.
- *Agricultural drought* links various characteristics of meteorological (or hydrological) drought to agricultural impacts, focusing on precipitation shortages, differences between actual and potential evapotranspiration, soil water deficits, reduced 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 aforementioned types of drought because its occurrence depends on the time and space processes of supply and demand to identify or classify droughts. The supply of many economic goods depends on the weather (for example water, forage, food grains, fish, and hydroelectric power). Socioeconomic drought occurs when the demand for an economic good exceeds 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 (NDMC n.d.).

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.).

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 (U.S. Energy Information Administration, Date Unknown). According to NOAA, New Jersey is made up of three climate divisions: Northern, Southern, and Coastal (NOAA 2012). Burlington County is located in the Southern Climate Division.

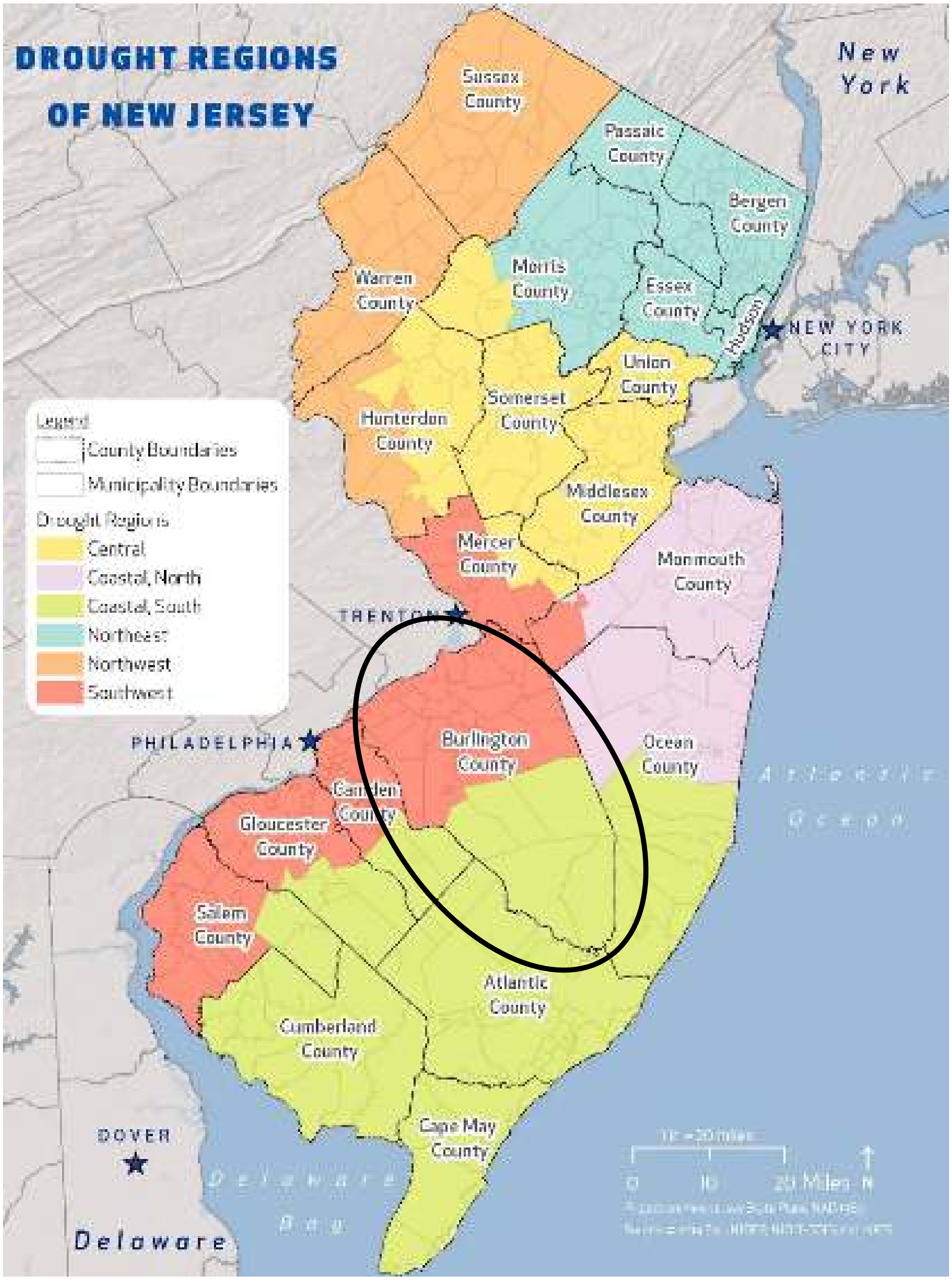
Drought regions allow New Jersey to respond to changing conditions without imposing restrictions on areas not experiencing water supply shortages. New Jersey is divided into six drought regions that are based on regional similarities in water supply sources and rainfall patterns (Hoffman and Domber 2003). These regions were developed based upon hydro-geologic conditions, watershed boundaries, municipal boundaries, and water supply characteristics. Drought region boundaries are contiguous with municipal boundaries because during a water emergency, the primary enforcement mechanism for restrictions is municipal police forces. Figure 4.3.3-1 shows the drought regions of New Jersey. Burlington County is located in both the Southwest, and the Coastal, South Drought Regions. According to the NJDEP, major water supply sources available to the Southwest Drought Region and northern portion of Burlington County include the Delaware River Basin and unconfined ground water, and rivers as a minor source. For the Coastal South Drought Region and southern portion of Burlington County, major water sources include unconfined ground water, and minor sources include rivers and the New Jersey Reservoir.

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 HUC11 (Hydrologic Unit Code). Burlington County is located within both the Lower Delaware and Atlantic Coast water regions; refer to Figure 4.3.3-2 (NJDEP 2022). In terms of annual water withdrawal by sector in the Lower Delaware Region, the majority is for power generation, with a small percent of surface water used for potable water supply. By comparison, in the Atlantic Coast region, the majority of water withdrawals is for potable water supply, followed by agricultural and commercial uses. 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 2017).

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 2017).

Burlington County is also home to a large agricultural industry which is heavily reliant on existing water resources. According to the USDA Agricultural Census, as of 2017 the County has 915 farms which total 96,256 acres of land within Burlington County. The average size of each farm is approximately 105 acres which is an 8 percent decrease since the 2012 Agricultural Census. The total market value of products sold by farms located in Burlington County is roughly 98.6 million dollars while the average market value of products sold by each farm is 107,738 dollars on an annual basis.

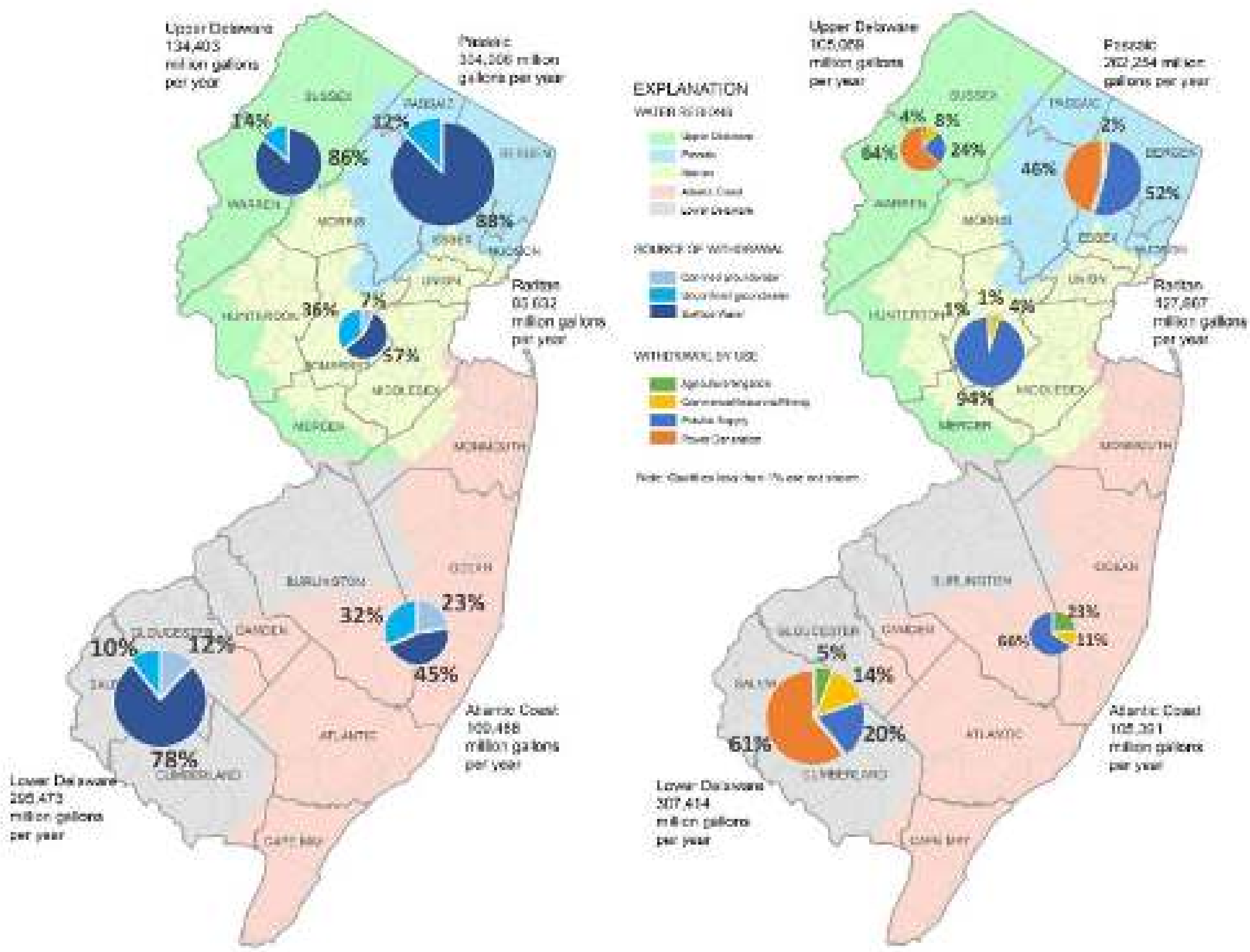
Figure 4.3.3-1. Drought Regions of New Jersey



Note: The black circle indicates the location of Burlington County

Source: NJOEM 2019

Figure 4.3.3-2. Water Regions, Sources and Withdrawal by Sector in New Jersey



Source: NJDEP 2017

40 percent of all farms have a sales value of less than $2,500 while 129 have an annual value of $100,000 or more. Most sales of farms located in the County are from crop production while a small fraction of sales stem from livestock and poultry products (USDA 2019). Because this industry is heavily reliant on water, it is critical to examine the County vulnerability to drought to reduce any loss of income from farming.

Extent

The severity of a drought depends on the degree of moisture deficiency, the duration, and the size and location of the affected area. The longer the duration of the drought and the larger the area impacted, the more severe the potential impacts (NOAA 2021). The State of New Jersey uses a multi-index system that takes advantage of some of these indices to determine the severity of a drought or extended period of dry conditions (NJDEP 2021).

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 4.3.3-1 lists the PDSI classifications. At the one end of the spectrum, 0 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 is not shown in Table 4.3.3-1 (NCAR 2023).

Table 4.3.3-1. 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 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:

- *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 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 (NJDEP 2021).

The National Weather Service Climate Prediction Center can provide seasonal outlooks for droughts that last for three month increments. To view the current seasonal outlook visit, http://www.cpc.ncep.noaa.gov/products/expert_assessment/sdo_summary.php. Predicting 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 depends 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.).

Previous Occurrences and Losses

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

FEMA Major Disasters and Emergency Declarations

Between May 1953 and June 2023, FEMA declared that the State of New Jersey experienced two drought-related disasters (DR) or emergencies (EM). Burlington County was included in both of these drought-related declarations. Table 4.3.3-2 lists declarations from May 1953 and June 2023 for this HMP update. Detailed information about all declared disasters since 1953 is provided in Section 3 (County Profile).

Table 4.3.3-2. FEMA Declarations for Drought Events in Burlington County

FEMA Declaration Number	Date of Declaration	Date of Event	Event Type	Event Title
DR-205-NJ	August 18, 1965	August 18, 1965	Drought	New Jersey Water Shortage
EM-3083-NJ	October 19, 1980	October 19, 1980	Drought	New Jersey Water Shortage

Source: FEMA 2023

U.S. Department of Agriculture Disaster Declarations

The Secretary of Agriculture from the U.S. Department of Agriculture (USDA) is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in counties that are contiguous to a designated county. As shown in Table 4.3.3-3, between January 2015 and June 2023, Burlington County was included in 7 drought-related agricultural disaster declarations.

Table 4.3.3-3. USDA Declarations for Drought Events in Burlington County, August 2018 – June 2023

Date of Event	Event Type	Declaration Number	Description
April 1 – September 29, 2015	Drought	S3930	Excessive Heat and Drought
July 16 – September 29, 2015	Drought	S3932	Excessive Heat and Drought

Date of Event	Event Type	Declaration Number	Description
April 1 – September 10, 2016	Drought	S4071	Combined effects of Freeze, Excessive Heat, and Drought
May 1 – December 10, 2016	Drought	S4165	Drought
April 7 – October 3, 2022	Drought	S5338	Drought
June 18 – September 5, 2022	Drought	S5347	Excessive Heat and Drought
July 1, 2022 - continuing	Drought	S5348	Excessive Heat and Drought

Source: USDA 2023

Previous Events

For the 2024 HMP update, known drought events that impacted Burlington County between August 2018 and May 2023 are listed in Table 4.3.3-4. For events prior to August 2018, refer to the 2019 Burlington County HMP.

Table 4.3.3-4. Drought Incidents in Burlington County, 2018 to 2023

Date of Event	Event Type	Declaration Number	Burlington County Designated?	Description
May 2020	Drought	NA	NA	According to the U.S. Drought Monitor, conditions held at a D0 or "abnormally dry" status across Burlington County in May 2020.
May 19 – June 18, 2021	Drought	NA	NA	Stage 3 fire restrictions took effect on May 19 in 11 of New Jersey's 21 counties. The 11 counties were Atlantic, Burlington, Cape May, Camden, Cumberland, Gloucester, Mercer, except Hopewell Township, Middlesex, south of the Raritan River, Monmouth, Ocean, and Salem. It was prohibited to light fires "within or adjacent to forested areas" unless they're contained in an elevated stove using only propane, natural gas, gas, or electricity.
April – October 2022	Drought	NA	NA	According to the U.S. Drought Monitor, conditions held at a D0 or "abnormally dry" status across Burlington County from April 2022 – October 2022.
June – September 2022	Drought	NA	NA	According to the U.S. Drought Monitor, conditions held at a D1 or "moderate drought" status across Burlington County from June 2022 – September 2022.
August 9 – November 17, 2022	Drought	NA	NA	New Jersey is under a statewide drought watch as drought and heat strain water supplies. Water conservation is urged. Stream flow and ground water levels were below normal for most of the State, and some reservoirs were dropping quickly.
February – March 2023	Drought	NA	NA	According to the U.S. Drought Monitor, conditions held at a D0 or "abnormally dry" status across Burlington County from February 2023 – March 2023.
June 20 – July 20, 2023	Drought	NA	NA	Governor Phil Murphy's administration urged residents and businesses to use water wisely due to the State's dry conditions and the start of summer. Statewide, rainfall in New Jersey has been less than half of normal over the past 30 days.

Source: NIDIS 2023; *USDA 2023; FEMA 2023; NDMC 2023*

Probability of Future Occurrence

For the 2024 HMP update, the most up-to-date data was collected to calculate the probability of future occurrence of drought events for the County. Information from NOAA-NCEI storm events database, FEMA and USDA disaster declarations, and the U.S. Drought Monitor were used to identify the number of drought events that occurred between January 1950 and May 2023. Table 4.3.3-5 presents the probability of future events for drought in Burlington County.

Table 4.3.3-5. Probability of Future Occurrences of Drought Events

Hazard Type	Occurrences Between 1965 and 2023	% Chance of Occurring in Any Given Year
Drought	53	91.37%

Source: NIDIS 2023; USDA 2023; FEMA 2023; NOAA 2023

Note: Disaster occurrences include federally declared disasters since the 1950 Federal Disaster Relief Act, and selected events since 1965. Due to limitations in data, not all drought events occurring between 1954 and 1996 are accounted for in the tally of occurrences. As a result, the number of hazard occurrences is underestimated.

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

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

According to the US Drought Monitor, the long-term projections show that precipitation will increase in the region, which is contradictory to the statement that drought events will increase. However, it is important to note that while precipitation will increase, that is likely due to extreme preceptory events in shorter periods of time. At the same time, the number of drought events will also increase due to the longer periods of no rain. This gives a better understanding of how precipitation can increase at the same time; frequency of droughts also increases.

In Section 4.4, the identified hazards of concern for the County were ranked (Table 4.4-2). The probability of occurrence, or likelihood of the event, is one parameter used for hazard rankings. Based on historical records and input from the Planning Team, the probability of occurrence rating for drought in the County is "rare."

Climate Change Impacts

Providing projections of future climate change for a specific region is challenging. Shorter term projections are more closely tied to existing trends making longer term projections even more challenging. The further out a prediction reaches the more subject to changing dynamics it becomes.

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 (1.9 °C) increase in the State's average temperature, which is faster than the rest of the Northeast region (2 °F [1.1 °C]) and the world (1.5 °F [0.8 °C]). This warming trend is expected to continue. By 2050, temperatures in New Jersey are expected to increase by 4.1 to 5.7 °F (2.3 °C to 3.2 °C). 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 (5.6 °C) 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).

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, New Jersey 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. New Jersey will experience more intense rain events, less snow, and more rainfalls. 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).

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. New Jersey will experience more intense rain events, less snow, and more rainfalls. Also, small decreases in the amount of precipitation may occur in the summer months, resulting in greater potential for more frequent and prolonged droughts (NJDEP 2020).

Droughts along with extreme precipitation have been an increasingly recurring phenomenon over the past decades. Precipitation has increased over time, which is counterintuitive given drought events are also projected to increase. However, this follows the trend of increased extreme weather. With isolated precipitation, in between long stretches of dry weather, wildfires, riverine flooding, and degraded water supply can all happen at the same time and therefore can put communities, especially those that live along a river, susceptible to structural flood damage along with potential degraded water supply due to the receding water table that cannot get replenished from such extreme precipitation. The County is thus vulnerable to droughts, especially along the Delaware River, where the temperatures increase dramatically and severe runoff from dry soils can cause degraded water supply (Cornell University 2021).

Vulnerability Assessment

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

Impact on Life, Health, and Safety

The entire population of Burlington County (461,860) is exposed to this hazard. 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.

Health implications of drought are numerous. Some drought-related health effects are short-term while others can be long-term. 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 (CDC 2021).

Socially Vulnerable Populations

The Centers for Disease Control and Prevention (CDC) 2020 Social Vulnerability Index (SVI) ranks U.S. Census tracts on socioeconomic status, household composition and disability, minority status and language, and housing and transportation. Burlington County's overall national score is 0.2648 and a state score of 0.3, both indicating that its communities have a low to medium level of social vulnerability (CDC 2018). This score indicates that some County residents may not have enough resources to respond to drought events. According to the 2021 5-year ACS estimates, there are 27,947 total persons living below the poverty level, 78,093 persons over the age of 65 years, 23,350 persons under the age of 5 years, 9,103 non-English speakers, and 51,899 persons with a disability in Burlington County.

As shown in Table 4.3.3-6, Evesham Township has the highest population over 65 (8,574) and highest population under the age of 5 (2,237). Pemberton Township has the largest population of non-English speaking persons (1,092). Willingboro Township has the greatest population of individuals living in poverty (2,685) and the largest disabled population (5,100). Wrightstown Township has the lowest population over 65 (58). Washington Township has the lowest population of individuals under the age of 5 (8). Bass River Township, Beverly City, Eastampton Township, Fieldsboro Borough, Medford Lakes Borough, Shamong Township, and Woodland Township all have no (0) non-English speaking persons living within the jurisdiction. Fieldsboro Borough has fewest number of disabled persons in their jurisdiction (62). Wrightstown Borough has the lowest population living in poverty (21).

Drought, often coupled with extreme heat, can cause health risks to farmers and their workers. According to the 2017 Census of Agriculture, there are over 1,500 workers on farms in Burlington County (USDA 2019). Workers who are exposed to extreme heat or work in hot environments may be at risk of heat stress. Heat stress can result in 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 also occur as a result of accidental contact with hot surfaces or steam. Sunlight exposure is highest during the summer and between 10:00 a.m. and 4:00 p.m. Working outdoors during these times increases the chances of getting sunburned. Workers at greater risk of heat stress include those who are 65 years of age or older, are overweight, have heart disease or high blood pressure, or take medications that may be affected by extreme heat (CDC 2020, CDC 2018).

Table 4.3.3-6. Burlington County Socially Vulnerable Populations by Municipality

Jurisdiction[a]	Decennial Population 2020		American Community Survey 5-Year Population Estimates (2021)									
			Population Over 65		Population Under 5		Non-English Speaking Population		Population with Disability		Population Below Poverty Level	
	Jurisdiction Total	% of County Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total
Bass River (T)	1,355	0.3%	248	18.3%	67	4.9%	0	0.0%	175	12.9%	95	7.0%
Beverly (C)	2,499	0.5%	292	11.7%	183	7.3%	0	0.0%	249	10.0%	300	12.0%
Bordentown (C)	3,993	0.9%	772	19.3%	216	5.4%	16	0.4%	422	10.6%	227	5.7%
Bordentown (T)	11,791	2.6%	1,601	13.6%	472	4.0%	289	2.4%	1,092	9.3%	194	1.6%
Burlington (C)	9,743	2.1%	1,301	13.4%	661	6.8%	208	2.1%	1,251	12.8%	1,422	14.6%
Burlington (T)	23,983	5.2%	3,526	14.7%	1,497	6.2%	385	1.6%	2,366	9.9%	2,185	9.1%
Chesterfield (T)	9,422	2.0%	760	8.1%	578	6.1%	153	1.6%	423	4.5%	165	1.8%
Cinnaminson (T)	17,064	3.7%	3,103	18.2%	929	5.4%	208	1.2%	1,661	9.7%	584	3.4%
Delanco (T)	4,824	1.0%	1,297	26.9%	191	4.0%	42	0.9%	676	14.0%	322	6.7%
Delran (T)	17,882	3.9%	2,570	14.4%	1,047	5.9%	723	4.0%	1,548	8.7%	902	5.0%
Eastampton (T)	6,191	1.3%	557	9.0%	264	4.3%	0	0.0%	478	7.7%	488	7.9%
Edgewater Park (T)	8,930	1.9%	1,571	17.6%	700	7.8%	367	4.1%	1,465	16.4%	1,645	18.4%
Evesham (T)	46,826	10.1%	8,574	18.3%	2,237	4.8%	749	1.6%	4,504	9.6%	1,476	3.2%
Fieldsboro (B)	526	0.1%	82	15.6%	64	12.2%	0	0.0%	62	11.8%	36	6.8%
Florence (T)	12,812	2.8%	2,122	16.6%	645	5.0%	260	2.0%	1,460	11.4%	827	6.5%
Hainesport (T)	6,035	1.3%	1,327	22.0%	58	1.0%	0	0.0%	744	12.3%	250	4.1%
Lumberton (T)	12,803	2.8%	2,048	16.0%	661	5.2%	107	0.8%	1,490	11.6%	805	6.3%
Mansfield (T)	8,897	1.9%	2,506	28.2%	394	4.4%	330	3.7%	1,465	16.5%	181	2.0%
Maple Shade (T)	19,980	4.3%	2,897	14.5%	1,159	5.8%	694	3.5%	2,433	12.2%	1,971	9.9%
Medford (T)	24,497	5.3%	5,151	21.0%	1,085	4.4%	31	0.1%	2,775	11.3%	724	3.0%
Medford Lakes (B)	4,264	0.9%	879	20.6%	211	4.9%	0	0.0%	407	9.5%	26	0.6%
Moorestown (T)	21,355	4.6%	3,480	16.3%	837	3.9%	603	2.8%	1,654	7.7%	807	3.8%
Mount Holly (T)	9,981	2.2%	1,199	12.0%	454	4.5%	133	1.3%	1,624	16.3%	958	9.6%
Mount Laurel (T)	44,633	9.7%	8,299	18.6%	2,011	4.5%	889	2.0%	4,203	9.4%	1,689	3.8%
New Hanover (T)	6,367	1.4%	311	4.9%	214	3.4%	29	0.4%	192	3.0%	116	1.8%
North Hanover (T)	7,963	1.7%	532	6.7%	975	12.2%	125	1.6%	631	7.9%	481	6.0%
Palmyra (B)	7,438	1.6%	1,077	14.5%	190	2.6%	44	0.6%	961	12.9%	616	8.3%
Pemberton (B)	1,371	0.3%	282	20.6%	56	4.1%	47	3.4%	308	22.5%	140	10.2%

Jurisdiction[a]	Decennial Population 2020		American Community Survey 5-Year Population Estimates (2021)									
			Population Over 65		Population Under 5		Non-English Speaking Population		Population with Disability		Population Below Poverty Level	
	Jurisdiction Total	% of County Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total
Pemberton (T)	26,903	5.8%	4,306	16.0%	1,429	5.3%	1,092	4.1%	4,006	14.9%	2,518	9.4%
Riverside (T)	8,003	1.7%	1,039	13.0%	354	4.4%	754	9.4%	972	12.1%	1,257	15.7%
Riverton (B)	2,764	0.6%	554	20.0%	80	2.9%	5	0.2%	187	6.8%	72	2.6%
Shamong (T)	6,460	1.4%	1,313	20.3%	324	5.0%	0	0.0%	671	10.4%	136	2.1%
Southampton (T)	10,317	2.2%	3,153	30.6%	293	2.8%	125	1.2%	1,551	15.0%	589	5.7%
Springfield (T)	3,245	0.7%	479	14.8%	129	4.0%	65	2.0%	311	9.6%	160	4.9%
Tabernacle (T)	6,776	1.5%	1,524	22.5%	380	5.6%	0	0.0%	747	11.0%	233	3.4%
Washington (T)	693	0.2%	138	19.9%	8	1.2%	8	1.1%	87	12.6%	21	3.0%
Westampton (T)	9,121	2.0%	1,139	12.5%	263	2.9%	81	0.9%	802	8.8%	268	2.9%
Willingboro (T)	31,889	6.9%	5,707	17.9%	1,916	6.0%	538	1.7%	5,100	16.0%	2,685	8.4%
Woodland (T)	1,544	0.3%	319	20.7%	49	3.2%	0	0.0%	627	40.6%	363	23.5%
Wrightstown (B)	720	0.2%	58	8.1%	69	9.6%	5	0.7%	119	16.5%	13	1.8%
Burlington County Total	**461,860**	**100.0%**	**78,093**	**16.9%**	**23,350**	**5.1%**	**9,103**	**2.0%**	**51,899**	**11.2%**	**27,947**	**6.1%**

Source: U.S. Census Bureau 2020, 2021

Note: Persons per household = 2.6

a. (B) = borough; (C) = city; (T) = township

TETRA TECH

Impact on General Building Stock

No structures are anticipated to be directly affected by a drought event. However, droughts contribute to conditions conducive to wildfires and reduce fire-fighting capabilities. Approximately 35 percent of the County's land is forested. Due to Burlington County's largely undeveloped nature, fuel is plentiful for wildfires, particularly in the Pine Barrens. In Burlington County, fuel tends to be most plentiful in areas where development densities are lowest; this works to reduce possible property damages and loss of life. Risk to life and property is greatest in those areas where forested areas adjoin urbanized areas (high density residential, commercial, and industrial) also known as the wildfire urban interface. Therefore, all assets in and adjacent to, the wildfire urban interface zone, including population, structures, critical facilities, lifelines, and businesses are considered vulnerable to wildfire. Refer Section 4.3.9 for the Wildfire risk assessment.

Impact on Critical Facilities

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

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 steam flows are lowest (NJDEP 2021). Burlington County water supplies are primarily sourced from groundwater, while the remaining supply is sourced from surface water. Table 4.3.3-7 provides the drinking water suppliers for Burlington County (US EPA 2023):

Table 4.3.3-7. Drinking Water Suppliers in Burlington County

Name	Population Served	Source Type
Albert C Wagner Youth Co	2,500	Ground water
Allenwood Estates, LLC	135	Ground water
Aqua Nj - California Village	300	Ground water
Aqua Nj - Hanover Mobile Village	285	Ground water
Aqua Nj - Spartan Village	471	Ground water
Blueberry Estates	75	Ground water
Bordentown Water Department	15,821	Ground water
Burlington City Water De	9,835	Surface water
Burlington Twp W Dept	22,594	Surface water purchased
Buttonwood Mobile Home Park	55	Ground water
Cedar Grove Apartments	96	Ground water
Estaugh Corp T/A Medford Leas	450	Ground water
Evesham MUA	45,538	Surface water purchased
Fawn Lake Village	300	Ground water

Name	Population Served	Source Type
Fenimore Trailer Park	88	Ground water
Fenimore Woods Mobile Home Park	40	Ground water
Fieldsboro Water Department	650	Ground water purchased
Florence Twp W Dept	11,214	Ground water
Hanover East Apartments	96	Ground water
Hilltop Mobile Village	200	Ground water
Jbmdl-Dix Main System	18,420	Surface water
Jbmdl-McGuire AFB	12,227	Ground water
Maple Shade Water Department	19,400	Surface water purchased
Maplewood Apartments	55	Ground water
Medford Twp Dept Of Muni	17,272	Ground water
Millstream Apts.	128	Ground water
Mobile Estates Of Southa	700	Ground water
Moorestown Water Dept	20,700	Surface water purchased
Mt Laurel Twp Mua	41,743	Surface water purchased
New Lisbon Development Ctr	2,014	Ground water
Nj American Water - Homestead	2,420	Ground water
Nj American Water - Mount Holly	47,427	Surface water purchased
Nj American Water - Sunbury	888	Ground water
Nj American Water - Vincentown	598	Ground water
Oakview Leisure Village	250	Ground water
Pemberton Borough Water	1,610	Ground water
Pemberton Township Water - Lake Valley	3,500	Ground water
Pemberton Twp Dept Main	12,378	Ground water
Pemberton Twp Water Dept - Pemberton Hei	650	Ground water purchased
Pemberton Twp Water - New Lisbon	500	Ground water
Pinefield Apartments	120	Ground water
Pinelands Water Co	4,926	Ground water
Pineview Terrace Incorporated	300	Ground water
Richards Mobile Home Courts	100	Ground water
Souths Mobile Home Park	110	Ground water
Wagon Wheel Estates	84	Ground water
Willingboro MUA	35,000	Ground water
Wrightstown MUA	748	Ground water

Source: US EPA 2023

Water systems and thus distribution to the population may also be impacted by other hazards such as extreme weather events. A good example is Superstorm Sandy where storm surge damaged critical water supply infrastructure along the coast and high winds impacted energy distribution across the State which in turn impacted the ability to supply water. As a result, NJDEP has developed new guidance aimed to ensure that repairs, reconstruction, new facilities, and operations/maintenance are focused on enhancing the resilience of critical infrastructure (NJDEP 2021).

Impact on 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 (NJ Department of Environmental Protection 2017).

A prolonged drought can have a serious economic impact on a community. One impact of drought is its impact on water supply. When drought conditions persist with little to no relief, water restrictions may be put into place by local or state governments. These restrictions may include placing limitations on when or how frequently 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 (NC State University 2013).

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

Direct impacts of drought include reduced crop yield, increased fire hazard, reduced water levels, and damage to wildlife and fish habitat. The many impacts of drought can be listed as economic, environmental, or social. Direct and indirect losses include the following (FAO 2019):

- Damage to crop quality and crop losses.
- Insect infestation leading to crop and tree losses.
- Plant diseases leading to loss of agricultural crops and trees.
- Reduction in outdoor recreational activities.

When a drought occurs, the agricultural industry is most at risk in terms of economic impact and damage. For example, crops may not mature leading to a lessened crop yield, wildlife and livestock may become undernourished, land values could decrease, and ultimately there could be a financial loss for the farmer (IPCC 2016). Based on the 2017 Census of Agriculture, there were 915 farms in Burlington County, a 9 percent increase from the 2012 reports. The average farm size was 105 acres. Burlington County farms had a total market value of products sold of approximately $91 million in crop sales and approximately $7.5 million in livestock sales (USDA 2019). Table 4.3.3-8 summarizes the acreage of agricultural land exposed to the drought hazard.

Table 4.3.3-8. Agricultural Land in Burlington County in 2017

Number of Farms	Land in Farms (acres)	Total Cropland (percent)	Pastureland (percent)	Irrigated Land (acres)
915	96,256	52	7	12,434

Source: USDA 2019

Impact on Environment

Droughts can impact the environment because these events can trigger wildfires, increase insect infestations, and exacerbate the spread of disease (IPCC 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. As a result, these types of habitats can be negatively impacted after long periods of dryness (NJDEP 2017).

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 plans and animals. 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 (NC State University 2013).

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, and
- Reduction in the ability to perform outdoor activities, which could result in loss of tourism and recreation opportunities.

Further Changes that May Impact Vulnerability

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

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

Projected Development

As discussed in Section 3 (County Profile), areas targeted for future growth and development have been identified across Burlington County. The New Jersey Water Supply Plan indicates seasonal outdoor water use is rising and is attributable to continued suburbanization and increases in residential and commercial lawn and landscape maintenance. Changes in water demands by commercial/industrial users will depend on future development of this water type use and how effectively efficiency techniques are implemented (NJDEP 2017).

Projected Changes in Population

Potable water use is the second largest water use sector and largest consumptive use in New Jersey. As such, population projections, per capital water use and percent non-residential water use by water system are important factors to consider when assessing future water needs. Burlington County has experienced an increase in its population since 2010. According to the U.S. Census Bureau, the County's population increased by approximately

3-percent between 2010 and 2020 (U.S. Census Bureau 2020). 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, Burlington County is projected to have a population of 460,400 by 2024, 464,900 by 2029, and 472,700 by 2034 (State of New Jersey 2017). Increases in population may create greater strain on water resources in those communities, throughout Burlington County and the region.

Climate Change

As discussed above, most studies project that the State of New Jersey will see an increase in average annual temperatures. Additionally, the State is projected to experience more frequency 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 for future changes.

Change of Vulnerability Since 2019 HMP

When examining the change in the County's vulnerability to drought events from the 2019 HMP to this update, it is important to look at each entity that is exposed and vulnerable. The total population across the County has experienced a slight increase, which can place a greater stress on the water supply during a drought event. In terms of the agricultural industry for Burlington County, there has been a 9 percent increase in the number of farms since the 2012 USDA report (USDA 2019).

4.3.4 Earthquake

2024 HMP Changes

- New and updated figures from federal and state agencies are incorporated.
- Previous occurrences were updated with events that occurred between 2018 and 2023.

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

Hazard Description

An earthquake is the sudden movement of the Earth's surface caused by the release of stress accumulated within or along the edge of the Earth's tectonic plates, a volcanic eruption, or a human-caused explosion (FEMA 2001). Most earthquakes occur at the boundaries where tectonic plates meet (faults); less than 10 percent of earthquakes occur within plate interiors. New Jersey is in an area where the rarer plate interior-related earthquakes occur. As plates continue to move and plate boundaries change geologically over time, weakened boundary regions become part of the interiors of the plates. These zones of weakness within the continents can cause earthquakes in response to stresses that originate at the edges of the plate or in the deeper crust (Shedlock 1997).

The location of an earthquake is commonly described by its focal depth and the geographic position of its epicenter. The focal depth of an earthquake is the depth from the Earth's surface to the region where an earthquake's energy originates, also called the focus or hypocenter. The epicenter of an earthquake is the point on the Earth's surface directly above the hypocenter (Shedlock 1997). 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 (USGS 2021), an earthquake hazard is any disruption associated with an earthquake that may affect residents' normal activities. This includes surface faulting, ground shaking, landslides, liquefaction, tectonic deformation, tsunamis, and seiches; each of these terms is defined below; however, not all occur within the Burlington County planning area (USGS 2012):

- *Surface faulting*: Displacement that reaches the earth's surface during a slip along a fault. Commonly occurs with shallow earthquakes—those with an epicenter less than 20 kilometers.
- *Ground motion (shaking):* The movement of the Earth's surface from earthquakes or explosions. Ground motion or shaking is produced by waves that are generated by a sudden slip on a fault or sudden pressure at the explosive source and travel through the Earth and along its surface.
- *Landslide*: A movement of surface material down a slope.
- *Liquefaction*: A process by which water-saturated sediment temporarily loses strength and acts as a fluid, like the wet sand near the water at the beach. Earthquake shaking can cause this effect.
- *Tectonic Deformation*: A change in the original shape of a material caused by stress and strain.
- *Tsunami*: A sea wave of local or distant origin that results from large-scale seafloor displacements associated with large earthquakes, major sub-marine slides, or exploding volcanic islands.
- *Seiche*: The sloshing of a closed body of water, such as a lake or bay, from earthquake shaking.

Location

Earthquakes are most likely to occur in the northern parts of New Jersey, where significant faults are concentrated; however, low-magnitude events can and do occur in many other areas of the State. The National Earthquake Hazard Reduction Program (NEHRP) developed five soil classifications defined by their shear-wave velocity that impact the severity of an earthquake. The soil classification system ranges from A to E, as noted in Table 4.3.4-1, where A represents hard rock that reduces ground motions from an earthquake and E represents soft soils that amplify and magnify ground shaking and increase building damage and losses.

Table 4.3.4-1. 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 2021

The New Jersey Department of Transportation (NJDOT) compiled a report on seismic design consideration for bridges in New Jersey, dated March 2012 (Anil Agrawal 2012). In the report, NJDOT classifies the seismic nature of soils according to the American Association of State Highway and Transportation Officials (AASHTO) Guide Specifications for Bridge Seismic Design. For the purpose of seismic analysis and design, sites can be 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 with an additional class F); refer to Table 4.3.4-2.

Table 4.3.4-2 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: Anil Agrawal 2012

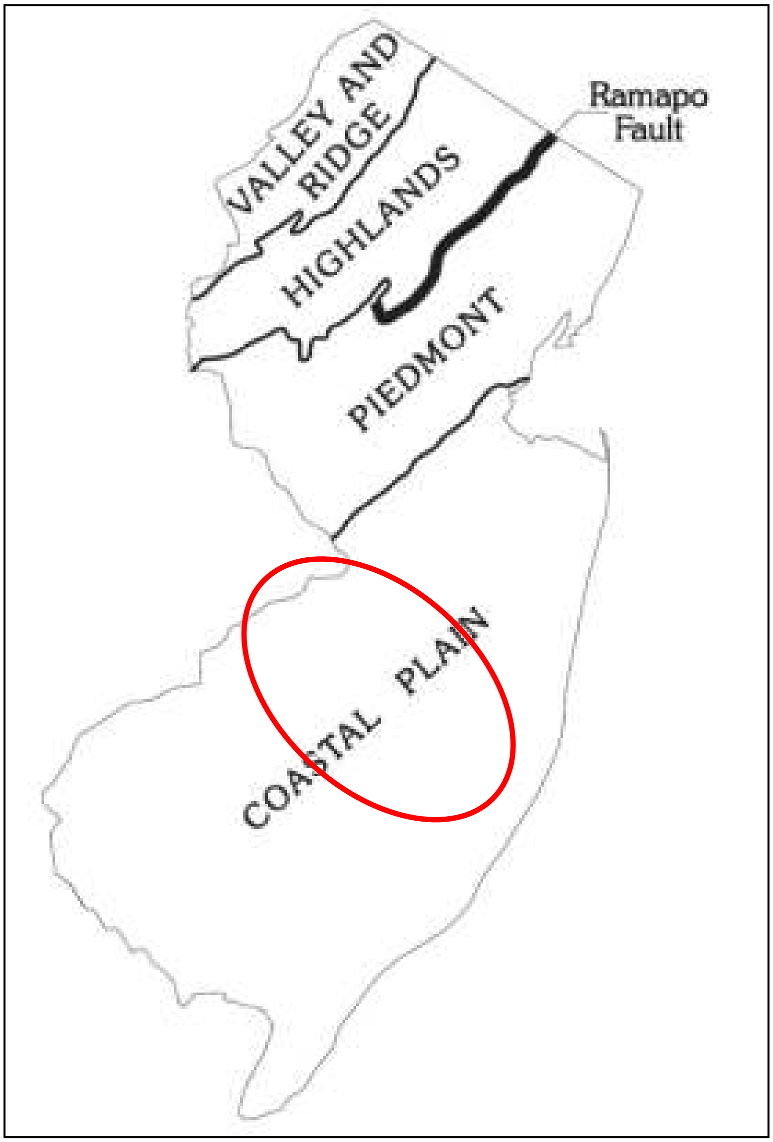
NJDOT also developed a Geotechnical Database Management System that uses logs from soil borings across the state used to classify soil sites. Through this analysis, NJDOT developed a map of soil site classes according to ZIP codes in New Jersey where each ZIP code was assigned a class based on its predominant soil condition. In Burlington County, most ZIP codes were rated as either Category C or D (NJOEM 2019).

Liquefaction has been responsible for tremendous amounts of damage in historical earthquakes around the world. Shaking behavior and liquefaction susceptibility of soils are determined by their grain size, thickness, compaction, and degree of saturation. These properties, in turn, are determined by the geologic origin of the soils and their topographic position. In terms of liquefaction susceptibility, the majority of Burlington County has low to no susceptibility (NJDEP 2021).

Liquefaction occurs in saturated soils. When liquefaction occurs, it reduces the strength of the soil and its ability to support foundations for buildings and bridges. Shaking from earthquakes often triggers an increase in water pressure which can trigger landslides and the collapse of dams. For information regarding dam failures, refer to Section 4.3.1 (Dam Failure). Earthquakes also contribute to landslide hazards. Earthquakes create stresses that make weak slopes fail. Earthquakes of magnitude 4.0 or greater have been known to trigger landslides.

Fractures or fracture zones along with rocks on adjacent sides have broken and moved upward, downward, or horizontally are known as faults (Volkert 2015). Movement can take place at faults and cause an earthquake. Earthquake epicenters in eastern North America and the New Jersey area, however, do not typically occur on known faults. The faults in these areas are the result of tectonic activity from over 200 million years ago. One of the most well-known faults in the State is the Ramapo Fault, which separates the Piedmont and Highlands Physiographic Provinces. As indicated in Figure 4.3.4-1, Burlington County might feel the effects of an earthquake along the Ramapo Fault; however, the fault itself is not located within County borders (Volkert 2015).

Figure 4.3.4-1. Physiographic Provinces of New Jersey and the Ramapo Fault Line



Note: Burlington County's location is indicated by the red oval

Source: NJDEP 2009

Extent

An earthquake's magnitude and intensity are used to describe the size and severity of the event (NJOEM 2019). Magnitude describes the size at the focal point of an earthquake, and intensity describes the overall severity of shaking felt during the event. The earthquake's magnitude is a measure of the energy released at the source of the earthquake. Magnitude was formerly expressed by ratings on the Richter scale but is now commonly expressed using the moment magnitude (Mw) scale. This scale is based on the total moment release of the earthquake (the product of the distance a fault moved, and the force required to move it) (USGS 2012). The most commonly used intensity scale is the modified Mercalli intensity scale. Ratings of the scale, as well as the perceived shaking and damage potential for structures, are shown in Table 4.3.4-3. The modified Mercalli intensity scale is generally represented visually using shake maps, which show the expected ground shaking at any given location produced by an earthquake with a specified magnitude and epicenter An earthquake has only one magnitude and one epicenter, but it produces a range of ground shaking at sites throughout the region, depending on the distance from the earthquake, the rock and soil conditions at sites, and variations in the propagation of seismic waves from the earthquake due to complexities in the structure of the earth's crust. A USGS shake map shows the variation of ground shaking in a region immediately following significant earthquakes. Table 4.3.4-4 displays the MMI scale and its relationship to the areas peak ground acceleration (PGA).

Table 4.3.4-3. Modified Mercalli Intensity Scale

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

Source: USGS 2021

Table 4.3.4-4. Modified Mercalli Intensity and PGA Equivalents

Modified Mercalli Intensity	Acceleration (%g) (PGA)	Perceived Shaking	Potential Damage
I	<.17	Not Felt	None
II	.17 – 1.4	Weak	None
III	.17 – 1.4	Weak	None

Modified Mercalli Intensity	Acceleration (%g) (PGA)	Perceived Shaking	Potential Damage
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
Note: PGA = Peak Ground Acceleration

The ground experiences acceleration as it shakes during an earthquake. The peak ground acceleration (PGA) is the largest acceleration recorded by a monitoring station during an earthquake. PGA is a measure of how hard the earth shakes in a given geographic area. It is expressed as a percentage of the acceleration due to gravity (%g). Horizontal and vertical PGA varies with soil or rock type. Earthquake hazard assessment involves estimating the annual probability that certain ground accelerations will be exceeded, and then summing the annual probabilities over a time period of interest. Damage levels experienced in an earthquake vary with the intensity of ground shaking and with the seismic capacity of structures, as noted in Table 4.3.4-5.

Table 4.3.4-5. Damage Levels Experienced in Earthquakes

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

Source: NJOEM 2019
Note: %g Peak Ground Acceleration

National maps of earthquake shaking hazards provide information for creating and updating seismic design requirements for building codes, insurance rate structures, earthquake loss studies, retrofit priorities, and land use planning. After thorough review of the studies, professional organizations of engineers update the seismic-risk maps and seismic design requirements contained in building codes. The USGS updated the National Seismic Hazard Maps in 2022 and are currently working on a 2023 update.

A probabilistic assessment was conducted for the 500- and 2,500-year mean return period (MRP) in Hazus 6.0 to analyze the earthquake hazard for Burlington 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 4.3.4-2 and Figure 4.3.4-3 illustrate the geographic distribution of PGA (%g) for the 500- and 2,500-year MRP events by Census-tract.

Figure 4.3.4-2 Peak Ground Acceleration (PGA) 500-Year MRP for Burlington County

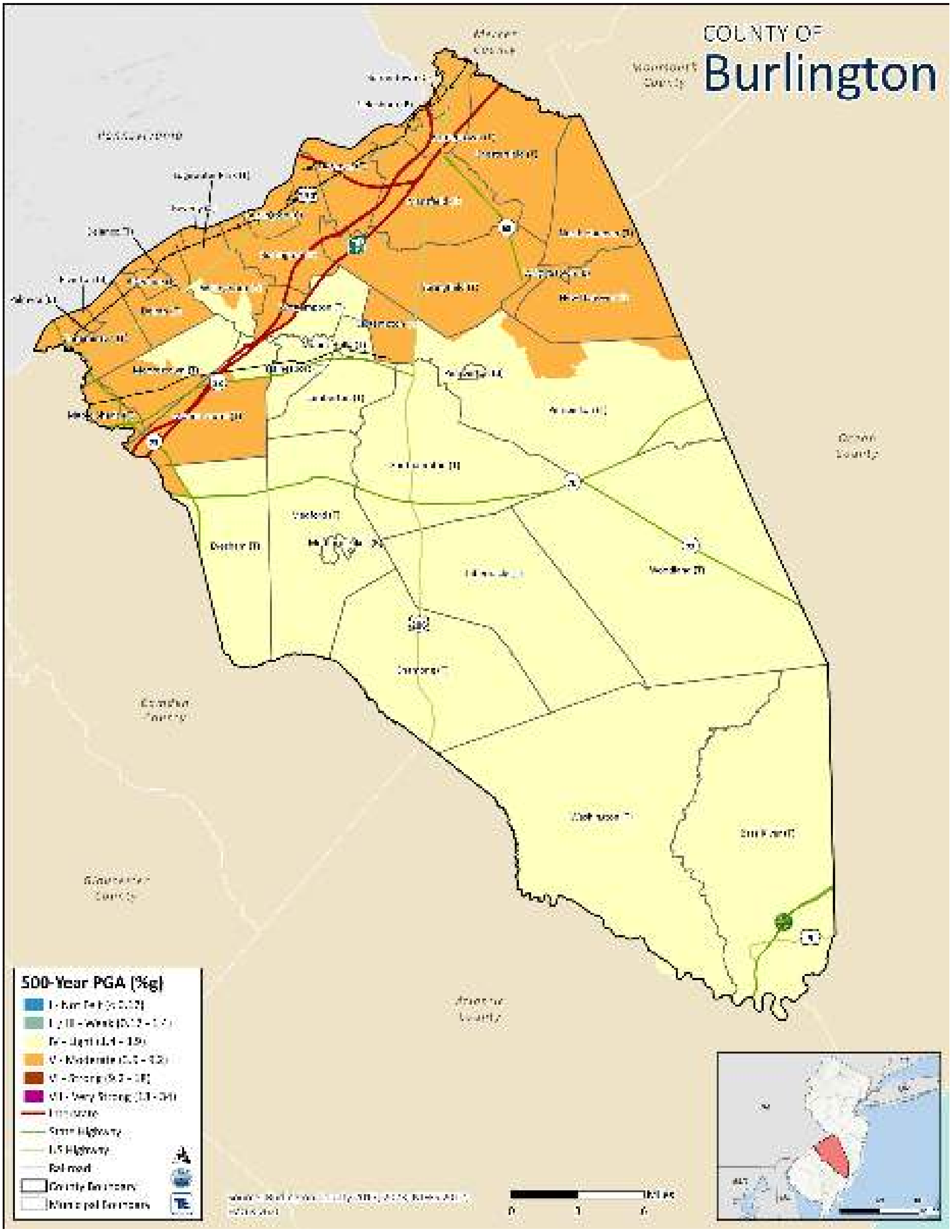
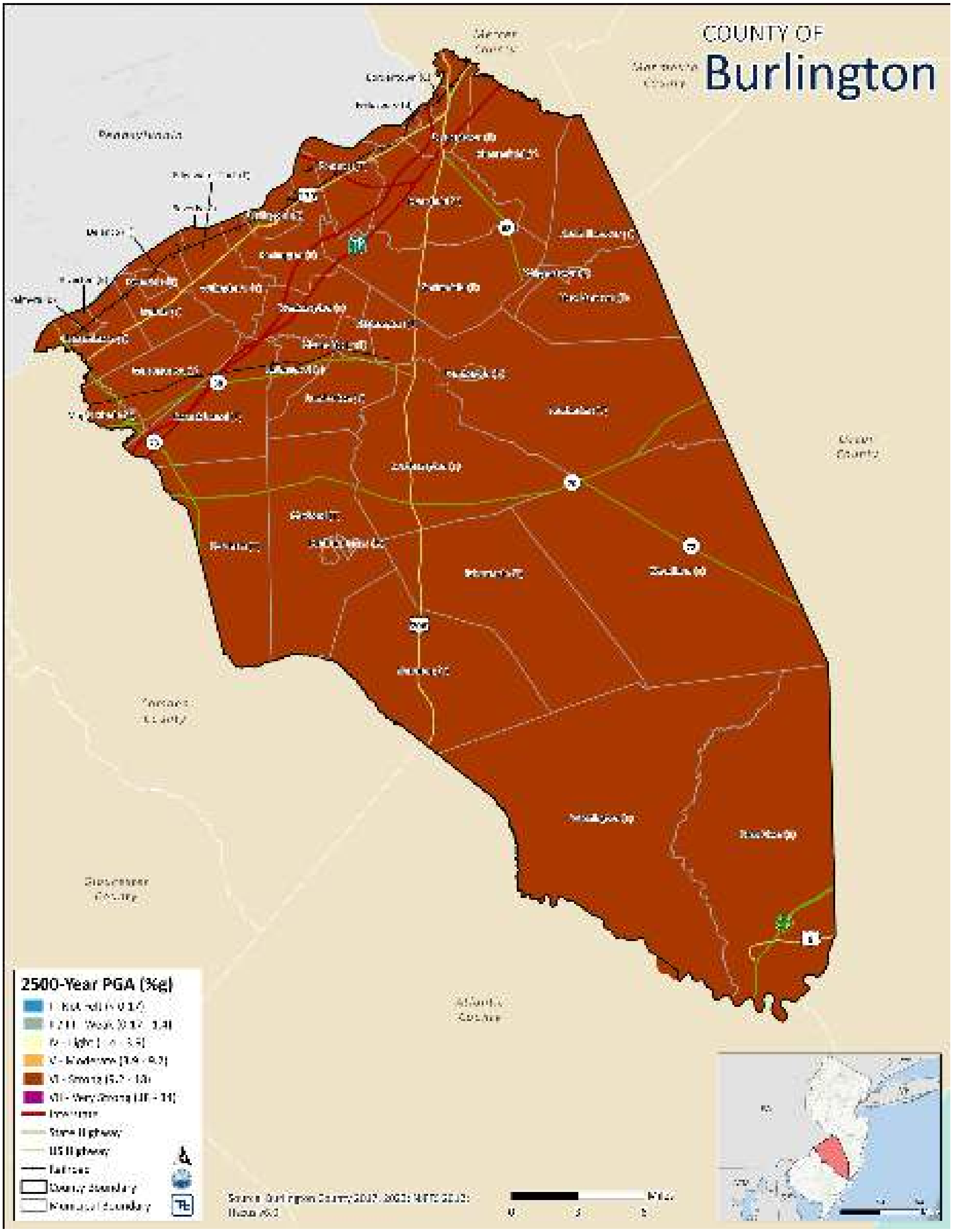


Figure 4.3.4-3 Peak Ground Acceleration (PGA) 2,500-Year MRP for Burlington County



Previous Occurrences and Losses

FEMA Major Disasters and Emergency Declarations

Between 1954 and 2023, the State of New Jersey was not included in any FEMA earthquake-related major disaster (DR) or emergency (EM) declarations (FEMA 2023).

U.S. Department of Agriculture Disaster Declarations

The Secretary of Agriculture from the U.S. Department of Agriculture (USDA) is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in counties that are contiguous to a designated county. Between 2018 and 2023, Burlington County was not included in any earthquake-related agricultural disaster declaration (USDA n.d.).

Previous Events

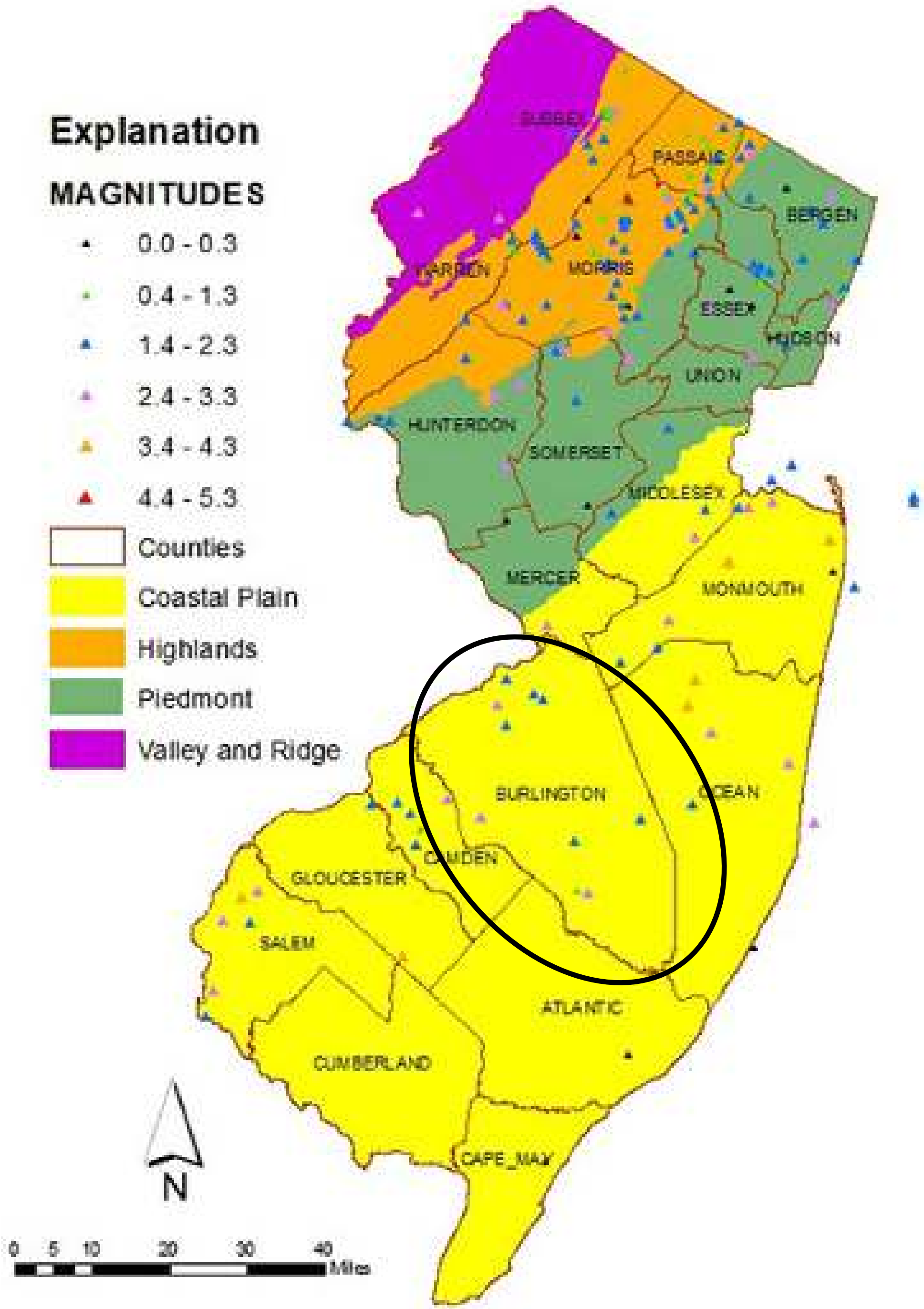
Historically, New Jersey and Burlington County have not experienced a major earthquake. However, there have been a number of earthquakes of relatively low intensity. The majority of earthquakes that have occurred in New Jersey have occurred along faults in the central and eastern Highlands, with the 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. The strongest earthquake with an epicenter in Burlington County was a 3.0 quake in Medford Lakes in 1980.

According to the New Jersey Geological and Water Survey (NJGWS), records for the New York City area, which have been kept for 300 years, provide good information for estimating the frequency of earthquakes in New Jersey. Earthquakes with a maximum intensity of VII have occurred in the New York City area in 1737, 1783, and 1884. One intensity VI, four intensity V's, and at least three intensity III shocks have also occurred in the New York area over the last 300 years (Stover 1993). Figure 4.3.4-4 illustrates earthquake events where the epicenters were located in Burlington County. The figure shows that 10 earthquakes had epicenters in the County.

In Burlington County, between 2018 and 2023, there were three earthquakes that had an epicenter in the County. In addition, a 4.4 quake in Dover, Delaware in 2017 was felt in Burlington County. For events prior to 2013, refer to Appendix G (Supplementary Data). Please note that many sources were researched for historical information regarding earthquake events in Burlington County; therefore, not all earthquake events that have impacted the County may be included. Additionally, not all sources may have been identified or researched. Loss and impact information could vary depending on the source.

For the 2024 HMP update, known earthquake events that impacted Burlington County between August 2018 and May 2023 are listed in Table 4.3.4-6. For events prior to August 2018, refer to the 2020 Burlington County HMP.

Figure 4.3.4-4 Earthquakes with Epicenters in New Jersey, 1783 to 2019



Source: NJGWS 2019
Note: The black circle indicates the location of Burlington County. Several earthquakes have had epicenters in Burlington County.

Table 4.3.4-6. Earthquake Incidents in Burlington County, 2018 to 2023

Date of Event	Event Type	Location	Declaration Number	Burlington County Designated?	Description
June 21, 2018	1.6 Earthquake	Tabernacle Township	N/A	N/A	A "microquake" was centered near Southampton. No damage was reported.
September 17, 2018	1.2 Earthquake	Washington Township	N/A	N/A	No losses and/or damage reported for this event
June 9, 2021	2.4 Earthquake	Borough of Tuckerton	N/A	N/A	Burlington County residents felt ground shake from a nearby 2.4 magnitude earthquake in the Borough of Tuckerton, Ocean County.

Source: NJGWS 2019; FEMA 2023; USGS 2023

Probability of Future Occurrence

Earthquakes cannot be predicted and may occur any time of the day or year. Major earthquakes are infrequent in the State and may occur only once every few hundred years or longer, but the consequences of major earthquakes would be very high. Based on the historic record, the future probability of damaging earthquakes impacting Burlington County is low.

According to USGS and NJGWS, Burlington County has experienced 10 earthquakes with epicenters in the County. The table below shows these statistics, as well as the annual average number of events and the percent chance of earthquakes occurring in Burlington County in future years (NJGWS 2019). In addition to earthquakes centered within the County, numerous earthquakes located outside of the County have also directly and indirectly impacted Burlington County. However, since impacts of these earthquakes are difficult to quantify, they are not considered in Table 4.3.4-7.

Table 4.3.4-7. Probability of Future Occurrence of Earthquake Events

Hazard Type	Occurrences Between 1877 and 2023	% Chance of Occurring in Any Given Year	Recurrence Interval (in years) (# Years/Number of Events)
Earthquakes with Epicenter Inside County	10	6.85%	14.6

Source: NJGWS 2023

In Section 4.4 (Hazard Ranking), the identified hazards of concern for Burlington County were ranked. The probability of occurrence, or likelihood of the event, is one parameter used for hazard rankings. Based on historical records and input from the Steering Committee and Planning Committee, the probability of occurrence for impactful earthquake events in the County is considered 'unlikely'.

Climate Change Impacts

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 (1.9 °C) increase in the State's average temperature, which is faster than the rest of the Northeast region (2 °F [1.1 °C]) and the world (1.5 °F [0.8 °C]) (IPCC 2014). This warming trend is expected to continue. By 2050, temperatures in New Jersey are expected to increase by 4.1 to 5.7 °F (2.3 °C to 3.2 °C) (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, New Jersey 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. New Jersey will experience more intense rain events, less snow, and more rainfalls. Also, small decreases in the amount of precipitation may occur in the summer months, resulting in greater potential for more frequent and prolonged droughts (NJDEP 2020).

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 make it unlikely that glacier retreat will increase the occurrence of earthquake in Burlington 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).

Vulnerability Assessment

A probabilistic assessment was conducted for the 500-year and 2,500-year MRP events through a Level 2 analysis in Hazus v6 to analyze the earthquake hazard and provide a range of loss estimates. Refer to Section 4.2 (Methodology and Tools) for additional details on the methodology used to assess earthquake risk.

Impact on Life, Health, and Safety

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

According to the 2020 U.S. Census, Burlington County had a population of 461,860 people. 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.

According to the 1999-2003 summary report *Earthquake Risks and Mitigation in the New York / New Jersey / Connecticut Region*, a strong correlation exists between structural building damage and number of injuries and fatalities from an earthquake event. Further, the time of day also exposes different sectors of the community to the hazard. For example, Hazus considers the residential occupancy at its maximum at 2:00 a.m., where the educational, commercial, and industrial sectors are at their maximum at 2:00 p.m., with peak commute time at 5:00 p.m. Whether directly impacted or indirectly impact, the entire population will have to deal with the consequences of earthquakes to some degree. Business interruption could prevent people from working, road closures could isolate populations, and loss of functions of utilities could impact populations that suffered no direct damage from an event itself. Overall, Hazus estimates that there are no fatalities caused by the 500-year MRP event, but a total of 23 injuries and 2 hospitalizations (Table 4.3.4-8). The 2,500-year MRP event totals 5 causalities, 248 injuries, and 32 hospitalizations (Table 4.3.4-9). For both events, the 2:00 p.m. time of day has the greatest impact on the County's population.

Table 4.3.4-8. Earthquake Population Impacts Based on Time of Day, 500-Year MRP

Level of Severity	Impacts by Time of Day - 500-Year MRP		
	2:00 AM	2:00 PM	5:00 PM
Non-Hospitalized Injuries	2	16	5
Hospitalizations	0	2	0
Fatalities	0	0	0

Source: Hazus 6.0

Table 4.3.4-9. Earthquake Population Impacts Based on Time of Day, 2,500-Year MRP

Level of Severity	Impacts by Time of Day - 2,500-Year MRP		
	2:00 AM	2:00 PM	5:00 PM
Non-Hospitalized Injuries	32	155	61
Hospitalizations	2	24	6
Fatalities	0	4	1

Source: Hazus 6.0

As a result of a significant earthquake 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 zero displaced households and zero persons seeking short-term sheltering caused by the 500-year MRP event. Further, Hazus estimates that there will be 7 households displaced and 0 persons seeking short-term sheltering caused by the 2,500-year MRP event (Table 4.3.4-10).

Socially Vulnerable Populations

Populations considered most vulnerable to earthquake events are those located in/near the built environment, particularly those near unreinforced masonry construction. Of these most vulnerable populations, socially vulnerable populations, including the elderly (persons over age 65) and individuals living below the poverty threshold, are most susceptible. Factors leadings to this higher susceptibility include decreased mobility and financial ability to react or respond during a hazard, and the location and construction quality of their housing. According to the 2021 5-year ACS estimates, there are 27,947 total persons living below the poverty level, 78,093 persons over the age of 65 years, 23,350 persons under the age of 5 years, 9,103 non-English speakers, and 51,899 persons with a disability in Burlington County, as displayed in Table 4.3.4-11.

Table 4.3.4-10. Estimated Displaced Households and Persons Seeking Shelter Caused by the 500-Year and 2,500-Year MRP Earthquake Events

Jurisdiction	500-Year MRP Earthquake Event Displaced Households	500-Year MRP Earthquake Event Persons Seeking Short-Term Sheltering	2,500-Year MRP Earthquake Event Displaced Households	2,500-Year MRP Earthquake Event Persons Seeking Short-Term Sheltering
Bass River (T)	0	0	0	0
Beverly (C)	0	0	0	0
Bordentown (C)	0	0	0	0
Bordentown (T)	0	0	0	0
Burlington (C)	0	0	0	0
Burlington (T)	0	0	0	0
Chesterfield (T)	0	0	0	0
Cinnaminson (T)	0	0	0	0
Delanco (T)	0	0	0	0
Delran (T)	0	0	1	0
Eastampton (T)	0	0	0	0
Edgewater Park (T)	0	0	1	0
Evesham (T)	0	0	2	0
Fieldsboro (B)	0	0	0	0
Florence (T)	0	0	1	0
Hainesport (T)	0	0	0	0
Lumberton (T)	0	0	0	0
Mansfield (T)	0	0	0	0
Maple Shade (T)	0	0	0	0
Medford (T)	0	0	1	0
Medford Lakes (B)	0	0	0	0
Moorestown (T)	0	0	1	0
Mount Holly (T)	0	0	0	0
Mount Laurel (T)	0	0	0	0
New Hanover (T)	0	0	0	0
North Hanover (T)	0	0	0	0
Palmyra (B)	0	0	0	0
Pemberton (B)	0	0	0	0
Pemberton (T)	0	0	0	0
Riverside (T)	0	0	0	0
Riverton (B)	0	0	0	0
Shamong (T)	0	0	0	0
Southampton (T)	0	0	0	0
Springfield (T)	0	0	0	0
Tabernacle (T)	0	0	0	0
Washington (T)	0	0	0	0
Westampton (T)	0	0	0	0
Willingboro (T)	0	0	0	0
Woodland (T)	0	0	0	0
Wrightstown (B)	0	0	0	0
Burlington County Total	**0**	**0**	**7**	**0**

Source: Hazus v6.0

Notes: Values are rounded down

Table 4.3.4-11. Burlington County Socially Vulnerable Populations by Municipality

Jurisdiction[a]	Decennial Population 2020		American Community Survey 5-Year Population Estimates (2021)									
			Population Over 65		Population Under 5		Non-English Speaking Population		Population with Disability		Population Below Poverty Level	
	Jurisdiction Total	% of County Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total
Bass River (T)	1,355	0.3%	248	18.3%	67	4.9%	0	0.0%	175	12.9%	95	7.0%
Beverly (C)	2,499	0.5%	292	11.7%	183	7.3%	0	0.0%	249	10.0%	300	12.0%
Bordentown (C)	3,993	0.9%	772	19.3%	216	5.4%	16	0.4%	422	10.6%	227	5.7%
Bordentown (T)	11,791	2.6%	1,601	13.6%	472	4.0%	289	2.4%	1,092	9.3%	194	1.6%
Burlington (C)	9,743	2.1%	1,301	13.4%	661	6.8%	208	2.1%	1,251	12.8%	1,422	14.6%
Burlington (T)	23,983	5.2%	3,526	14.7%	1,497	6.2%	385	1.6%	2,366	9.9%	2,185	9.1%
Chesterfield (T)	9,422	2.0%	760	8.1%	578	6.1%	153	1.6%	423	4.5%	165	1.8%
Cinnaminson (T)	17,064	3.7%	3,103	18.2%	929	5.4%	208	1.2%	1,661	9.7%	584	3.4%
Delanco (T)	4,824	1.0%	1,297	26.9%	191	4.0%	42	0.9%	676	14.0%	322	6.7%
Delran (T)	17,882	3.9%	2,570	14.4%	1,047	5.9%	723	4.0%	1,548	8.7%	902	5.0%
Eastampton (T)	6,191	1.3%	557	9.0%	264	4.3%	0	0.0%	478	7.7%	488	7.9%
Edgewater Park (T)	8,930	1.9%	1,571	17.6%	700	7.8%	367	4.1%	1,465	16.4%	1,645	18.4%
Evesham (T)	46,826	10.1%	8,574	18.3%	2,237	4.8%	749	1.6%	4,504	9.6%	1,476	3.2%
Fieldsboro (B)	526	0.1%	82	15.6%	64	12.2%	0	0.0%	62	11.8%	36	6.8%
Florence (T)	12,812	2.8%	2,122	16.6%	645	5.0%	260	2.0%	1,460	11.4%	827	6.5%
Hainesport (T)	6,035	1.3%	1,327	22.0%	58	1.0%	0	0.0%	744	12.3%	250	4.1%
Lumberton (T)	12,803	2.8%	2,048	16.0%	661	5.2%	107	0.8%	1,490	11.6%	805	6.3%
Mansfield (T)	8,897	1.9%	2,506	28.2%	394	4.4%	330	3.7%	1,465	16.5%	181	2.0%
Maple Shade (T)	19,980	4.3%	2,897	14.5%	1,159	5.8%	694	3.5%	2,433	12.2%	1,971	9.9%
Medford (T)	24,497	5.3%	5,151	21.0%	1,085	4.4%	31	0.1%	2,775	11.3%	724	3.0%
Medford Lakes (B)	4,264	0.9%	879	20.6%	211	4.9%	0	0.0%	407	9.5%	26	0.6%
Moorestown (T)	21,355	4.6%	3,480	16.3%	837	3.9%	603	2.8%	1,654	7.7%	807	3.8%
Mount Holly (T)	9,981	2.2%	1,199	12.0%	454	4.5%	133	1.3%	1,624	16.3%	958	9.6%
Mount Laurel (T)	44,633	9.7%	8,299	18.6%	2,011	4.5%	889	2.0%	4,203	9.4%	1,689	3.8%
New Hanover (T)	6,367	1.4%	311	4.9%	214	3.4%	29	0.4%	192	3.0%	116	1.8%
North Hanover (T)	7,963	1.7%	532	6.7%	975	12.2%	125	1.6%	631	7.9%	481	6.0%
Palmyra (B)	7,438	1.6%	1,077	14.5%	190	2.6%	44	0.6%	961	12.9%	616	8.3%
Pemberton (B)	1,371	0.3%	282	20.6%	56	4.1%	47	3.4%	308	22.5%	140	10.2%

Jurisdiction[a]	Decennial Population 2020		American Community Survey 5-Year Population Estimates (2021)									
			Population Over 65		Population Under 5		Non-English Speaking Population		Population with Disability		Population Below Poverty Level	
	Jurisdiction Total	% of County Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total
Pemberton (T)	26,903	5.8%	4,306	16.0%	1,429	5.3%	1,092	4.1%	4,006	14.9%	2,518	9.4%
Riverside (T)	8,003	1.7%	1,039	13.0%	354	4.4%	754	9.4%	972	12.1%	1,257	15.7%
Riverton (B)	2,764	0.6%	554	20.0%	80	2.9%	5	0.2%	187	6.8%	72	2.6%
Shamong (T)	6,460	1.4%	1,313	20.3%	324	5.0%	0	0.0%	671	10.4%	136	2.1%
Southampton (T)	10,317	2.2%	3,153	30.6%	293	2.8%	125	1.2%	1,551	15.0%	589	5.7%
Springfield (T)	3,245	0.7%	479	14.8%	129	4.0%	65	2.0%	311	9.6%	160	4.9%
Tabernacle (T)	6,776	1.5%	1,524	22.5%	380	5.6%	0	0.0%	747	11.0%	233	3.4%
Washington (T)	693	0.2%	138	19.9%	8	1.2%	8	1.1%	87	12.6%	21	3.0%
Westampton (T)	9,121	2.0%	1,139	12.5%	263	2.9%	81	0.9%	802	8.8%	268	2.9%
Willingboro (T)	31,889	6.9%	5,707	17.9%	1,916	6.0%	538	1.7%	5,100	16.0%	2,685	8.4%
Woodland (T)	1,544	0.3%	319	20.7%	49	3.2%	0	0.0%	627	40.6%	363	23.5%
Wrightstown (B)	720	0.2%	58	8.1%	69	9.6%	5	0.7%	119	16.5%	13	1.8%
Burlington County Total	**461,860**	**100.0%**	**78,093**	**16.9%**	**23,350**	**5.1%**	**9,103**	**2.0%**	**51,899**	**11.2%**	**27,947**	**6.1%**

Source: U.S. Census Bureau 2020, 2021
Note: Persons per household = 2.6
a. (B) = borough; (C) = city; (T) = township

Impact on General Building Stock

The entire County's general building stock is considered at risk and exposed to this hazard. However, soft soils can amplify ground shaking to damaging levels even during a moderate earthquake.

There is a strong correlation between PGA and damage a building might undergo (FEMA 2022). The Hazus model is based on best available earthquake science and aligns with these statements. The Hazus probabilistic earthquake model was applied to analyze effects from the earthquake hazard on general building stock in Burlington County. Refer to Figure 4.3.4-2 and Figure 4.3.4-3, which illustrate the geographic distribution of PGA (%g) across the County for 500-year and 2,500-year MRP events at the Census-tract level.

A building's construction determines how well it can withstand the force of an earthquake. The New Jersey 2019 HMP indicates that unreinforced masonry buildings are most at risk during an earthquake because the walls are prone to collapse outward, whereas steel and wood buildings absorb more of the earthquake's energy (NJOEM 2019). Additional attributes that affect a building's capability to withstand an earthquake's force include its age, number of stories, and quality of construction. Hazus considers building construction and age of building as part of the analysis. Because a custom general building stock was used for this Hazus analysis, the building ages and building types from the inventory were incorporated into the Hazus model.

Potential building damage was evaluated by Hazus across the following damage categories: none, slight, moderate, extensive, and complete. Table 4.3.4-12 provides definitions of these five categories of damage for a light wood-framed building. Definitions for other building types are included in the Hazus technical manual documentation. The results of potential damage states for buildings in Burlington County categorized by general occupancy classes (i.e., residential, commercial, industrial, etc.) from Hazus are summarized in Table 4.3.4-13 for the 500-year MRP event. Hazus estimates that there will be $51,759,371 in damage to structures caused by the 500-year MRP event, with the estimated commercial damage being the most expensive at $23,253,044, or 44.9 percent of the total damage. Table 4.3.4-14 summarizes the damage to structures for the 2,500 MRP event, which estimates that there will be $881,536,806 in damage to structures caused by the 2,500-year MRP event, with the estimated commercial damage being the most expensive at $375,150,385, or 42.5 percent of the total damage.

Table 4.3.4-12. Example of Structural Damage State Definitions for a Light Wood-Framed Building

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

Source: FEMA 2022

Table 4.3.4-13. Estimated Building Damage by General Occupancy for the 500-Year MRP Earthquake Event

Jurisdiction	Total Replacement Cost Value	Estimated Building Damage from the 500-Year MRP				
		Total Estimated Damage		Estimated Damage by Occupancy Class		
		Value	% of Total Replacement Cost	Residential	Commercial	All Other Occupancies
Bass River (T)	$881,423,037	$234,441	<0.1%	$39,740	$148,946	$45,754
Beverly (C)	$1,218,790,333	$445,768	<0.1%	$105,354	$266,083	$74,331
Bordentown (C)	$2,794,074,193	$890,823	<0.1%	$150,411	$583,668	$156,744
Bordentown (T)	$5,866,485,430	$1,820,469	<0.1%	$394,071	$1,207,968	$218,431
Burlington (C)	$5,813,312,405	$2,633,761	<0.1%	$400,976	$1,575,949	$656,837
Burlington (T)	$8,819,483,895	$2,963,739	<0.1%	$745,076	$1,090,090	$1,128,573
Chesterfield (T)	$2,243,175,804	$690,068	<0.1%	$288,442	$186,231	$215,395
Cinnaminson (T)	$6,206,033,564	$1,666,695	<0.1%	$551,488	$686,391	$428,816
Delanco (T)	$1,777,428,934	$458,098	<0.1%	$165,644	$143,343	$149,112
Delran (T)	$5,342,639,406	$1,559,178	<0.1%	$504,638	$525,393	$529,147
Eastampton (T)	$1,223,958,808	$372,738	<0.1%	$211,435	$66,038	$95,265
Edgewater Park (T)	$2,391,677,740	$846,786	<0.1%	$339,185	$365,339	$142,263
Evesham (T)	$11,128,366,531	$3,505,170	<0.1%	$1,365,974	$1,608,588	$530,607
Fieldsboro (B)	$241,524,257	$172,580	0.1%	$27,843	$109,014	$35,723
Florence (T)	$6,582,323,116	$1,948,963	<0.1%	$560,368	$592,609	$795,986
Hainesport (T)	$3,283,651,920	$963,267	<0.1%	$218,113	$572,556	$172,597
Lumberton (T)	$4,304,673,748	$1,242,750	<0.1%	$413,863	$532,198	$296,689
Mansfield (T)	$3,398,330,024	$1,063,149	<0.1%	$456,196	$416,110	$190,843
Maple Shade (T)	$5,835,178,181	$1,893,833	<0.1%	$436,744	$1,237,826	$219,263
Medford (T)	$10,042,226,056	$3,236,385	<0.1%	$1,024,492	$1,568,192	$643,701
Medford Lakes (B)	$967,238,228	$162,862	<0.1%	$120,170	$21,332	$21,360
Moorestown (T)	$12,232,463,125	$3,826,191	<0.1%	$851,455	$1,715,996	$1,258,740
Mount Holly (T)	$3,763,298,318	$970,188	<0.1%	$213,017	$635,587	$121,584
Mount Laurel (T)	$15,418,468,979	$4,653,361	<0.1%	$1,303,152	$2,694,660	$655,549
New Hanover (T)	$2,868,939,587	$936,998	<0.1%	$18,260	$92,111	$826,627
North Hanover (T)	$2,404,670,347	$949,433	<0.1%	$206,091	$375,828	$367,513
Palmyra (B)	$2,133,107,140	$674,488	<0.1%	$251,627	$327,764	$95,097
Pemberton (B)	$736,141,491	$227,986	<0.1%	$51,043	$136,218	$40,725
Pemberton (T)	$6,973,242,839	$2,264,391	<0.1%	$854,878	$694,878	$714,635
Riverside (T)	$2,459,954,166	$741,549	<0.1%	$153,804	$509,364	$78,381
Riverton (B)	$1,096,729,598	$343,537	<0.1%	$123,436	$131,695	$88,406

Jurisdiction	Total Replacement Cost Value	Estimated Building Damage from the 500-Year MRP				
		Total Estimated Damage		Estimated Damage by Occupancy Class		
		Value	% of Total Replacement Cost	Residential	Commercial	All Other Occupancies
Shamong (T)	$2,504,926,736	$596,163	<0.1%	$273,458	$150,988	$171,717
Southampton (T)	$4,593,018,255	$1,226,863	<0.1%	$444,274	$555,135	$227,454
Springfield (T)	$2,140,517,320	$543,235	<0.1%	$138,127	$258,505	$146,603
Tabernacle (T)	$2,200,440,237	$608,890	<0.1%	$244,681	$182,182	$182,027
Washington (T)	$604,084,949	$175,178	<0.1%	$29,791	$111,155	$34,232
Westampton (T)	$4,620,292,645	$1,225,440	<0.1%	$230,074	$431,809	$563,557
Willingboro (T)	$8,789,434,159	$2,625,547	<0.1%	$1,495,989	$532,836	$596,721
Woodland (T)	$1,333,495,831	$254,615	<0.1%	$43,305	$161,553	$49,757
Wrightstown (B)	$748,872,423	$143,797	<0.1%	$27,187	$50,917	$65,694
Burlington County Total	**$167,984,093,755**	**$51,759,371**	**<0.1%**	**$15,473,872**	**$23,253,044**	**$13,032,456**

Source: Hazus *v6.0; Burlington County, 2023; NJOGIS 2023; Microsoft BING 2022; RS Means 2022*

Table 4.3.4-14. Estimated Buildings Damaged by General Occupancy for the 2,500-Year MRP Earthquake Event

Jurisdiction	Total Replacement Cost Value	Estimated Building Damage from the 2,500-Year MRP: Total Estimated Damage – Value	Total Estimated Damage – % of Total Replacement Cost	Estimated Damage by Occupancy Class – Residential	Commercial	All Other Occupancies
Bass River (T)	$881,423,037	$3,938,622	0.4%	$737,313	$2,386,994	$814,314
Beverly (C)	$1,218,790,333	$7,057,467	0.6%	$1,941,409	$4,013,448	$1,102,611
Bordentown (C)	$2,794,074,193	$15,916,991	0.6%	$3,188,174	$9,932,423	$2,796,394
Bordentown (T)	$5,866,485,430	$31,454,030	0.5%	$7,960,927	$19,917,971	$3,575,132
Burlington (C)	$5,813,312,405	$39,140,586	0.7%	$7,020,875	$23,625,616	$8,494,095
Burlington (T)	$8,819,483,895	$48,999,707	0.6%	$13,262,811	$16,397,202	$19,339,694
Chesterfield (T)	$2,243,175,804	$12,360,662	0.6%	$5,248,969	$2,888,193	$4,223,500
Cinnaminson (T)	$6,206,033,564	$31,665,738	0.5%	$11,519,683	$11,876,653	$8,269,402
Delanco (T)	$1,777,428,934	$8,854,247	0.5%	$3,504,212	$2,444,552	$2,905,483
Delran (T)	$5,342,639,406	$27,325,629	0.5%	$10,839,670	$9,042,769	$7,443,190
Eastampton (T)	$1,223,958,808	$6,146,710	0.5%	$3,817,025	$1,044,944	$1,284,741
Edgewater Park (T)	$2,391,677,740	$13,325,692	0.6%	$5,864,624	$5,404,886	$2,056,182
Evesham (T)	$11,128,366,531	$58,035,678	0.5%	$25,072,008	$24,940,826	$8,022,843
Fieldsboro (B)	$241,524,257	$2,908,715	1.2%	$538,931	$1,739,069	$630,715
Florence (T)	$6,582,323,116	$35,558,033	0.5%	$10,653,567	$9,814,395	$15,090,072
Hainesport (T)	$3,283,651,920	$16,957,979	0.5%	$4,368,095	$9,502,839	$3,087,045
Lumberton (T)	$4,304,673,748	$21,694,563	0.5%	$7,567,165	$8,472,048	$5,655,350
Mansfield (T)	$3,398,330,024	$17,937,156	0.5%	$8,386,822	$6,266,306	$3,284,027
Maple Shade (T)	$5,835,178,181	$32,776,759	0.6%	$8,939,707	$20,537,795	$3,299,257
Medford (T)	$10,042,226,056	$51,136,276	0.5%	$19,279,018	$23,994,141	$7,863,118
Medford Lakes (B)	$967,238,228	$3,446,135	0.4%	$2,728,012	$405,135	$312,988
Moorestown (T)	$12,232,463,125	$66,459,286	0.5%	$18,067,726	$28,892,314	$19,499,245
Mount Holly (T)	$3,763,298,318	$18,131,268	0.5%	$4,609,959	$11,177,957	$2,343,352
Mount Laurel (T)	$15,418,468,979	$81,443,165	0.5%	$25,125,660	$44,687,732	$11,629,773
New Hanover (T)	$2,868,939,587	$16,325,358	0.6%	$336,407	$1,520,163	$14,468,788
North Hanover (T)	$2,404,670,347	$15,624,259	0.6%	$3,423,468	$6,057,734	$6,143,057
Palmyra (B)	$2,133,107,140	$11,752,072	0.6%	$4,826,484	$5,183,711	$1,741,877
Pemberton (B)	$736,141,491	$3,864,931	0.5%	$992,729	$2,260,643	$611,558
Pemberton (T)	$6,973,242,839	$35,423,287	0.5%	$15,233,801	$11,032,284	$9,157,202
Riverside (T)	$2,459,954,166	$13,182,719	0.5%	$3,273,083	$8,576,477	$1,333,158
Riverton (B)	$1,096,729,598	$5,900,639	0.5%	$2,552,066	$2,203,554	$1,145,019

Jurisdiction	Total Replacement Cost Value	Estimated Building Damage from the 2,500-Year MRP				
		Total Estimated Damage		Estimated Damage by Occupancy Class		
		Value	% of Total Replacement Cost	Residential	Commercial	All Other Occupancies
Shamong (T)	$2,504,926,736	$10,271,087	0.4%	$5,118,913	$2,396,926	$2,755,248
Southampton (T)	$4,593,018,255	$21,008,555	0.5%	$8,390,112	$8,545,846	$4,072,597
Springfield (T)	$2,140,517,320	$10,552,497	0.5%	$2,804,660	$4,271,476	$3,476,361
Tabernacle (T)	$2,200,440,237	$9,558,756	0.4%	$4,396,197	$2,786,816	$2,375,743
Washington (T)	$604,084,949	$2,942,541	0.5%	$552,630	$1,781,267	$608,644
Westampton (T)	$4,620,292,645	$22,618,432	0.5%	$4,911,716	$7,479,990	$10,226,726
Willingboro (T)	$8,789,434,159	$43,141,855	0.5%	$27,693,057	$8,236,406	$7,212,392
Woodland (T)	$1,333,495,831	$4,276,863	0.3%	$803,308	$2,588,904	$884,652
Wrightstown (B)	$748,872,423	$2,421,861	0.3%	$453,490	$821,978	$1,146,392
Burlington County Total	**$167,984,093,755**	**$881,536,806**	**0.5%**	**$296,004,485**	**$375,150,385**	**$210,381,936**

Source: Hazus *v6.0; Burlington County, 2023; NJOGIS 2023; Microsoft BING 2022; RS Means 2022*

Building damage as a result of the 500-year and 2,500-year MRP earthquakes was estimated for each municipality using Hazus. Table 4.3.4-15 summarizes estimated total building and content losses caused by the 500-year MRP event by building occupancy class. No buildings will be completely destroyed by the 500-year MRP event; however, up to 3 will be severely damaged and 129 moderately damaged. The majority of the losses are estimated to the residential occupancy class. Table 4.3.4-16 summarizes estimated total building and content losses caused by the 2,500-year MRP event by occupancy classes. Up to 5 buildings will be completely destroyed by the 2,500-year MRP event and up to 141 will be severely damaged. The majority of the losses are estimated to the residential occupancy class.

Historically, Building Officials Code Administration (BOCA) regulations in the northeast states were developed to address local concerns, including heavy snow loads and wind. Seismic requirements for design criteria are not as stringent as those of the west coast of the United States, which rely on the more seismically focused Uniform Building Code. As such, a smaller earthquake in the northeast can cause more structural damage than if it would occur in the west.

Table 4.3.4-15. Estimated Building Damage (Structure and Contents) from the 500-year MRP Earthquake Event

Occupancy Class	Total Number of Buildings in Occupancy	Severity of Expected Damage	500-Year MRP	
			Building Count	Percent Buildings in Occupancy Class
Residential Exposure (Single and Multi-Family Dwellings)	135,116	None	134,062	99.2%
		Minor	970	0.7%
		Moderate	84	0.1%
		Severe	0	0.0%
		Destruction	0	0.0%
Commercial Buildings	6,297	None	6,161	97.8%
		Minor	111	1.8%
		Moderate	24	0.4%
		Severe	1	<0.1%
		Destruction	0	0.0%
Industrial Buildings	1,170	None	1,140	97.4%
		Minor	23	2.0%
		Moderate	6	0.5%
		Severe	1	<0.1%
		Destruction	0	0.0%
Government, Religion, Agricultural, and Education Buildings	6,722	None	6,593	98.1%
		Minor	112	1.7%
		Moderate	15	0.2%
		Severe	1	<0.1%
		Destruction	0	0.0%

Source: Hazus v6.0

TETRA TECH

Table 4.3.4-16. Estimated Building Damage (Structure and Contents) from the 500-year MRP Earthquake Event

Occupancy Class	Total Number of Buildings in Occupancy	Severity of Expected Damage	2,500-Year MRP Building Count	2,500-Year MRP Percent Buildings in Occupancy Class
Residential Exposure (Single and Multi-Family Dwellings)	135,116	None	124,011	91.8%
		Minor	9,453	7.0%
		Moderate	1,570	1.2%
		Severe	82	0.1%
		Destruction	0	0.0%
Commercial Buildings	6,297	None	5,350	85.0%
		Minor	619	9.8%
		Moderate	292	4.6%
		Severe	34	0.5%
		Destruction	2	<0.1%
Industrial Buildings	1,170	None	982	83.9%
		Minor	119	10.2%
		Moderate	60	5.1%
		Severe	8	0.7%
		Destruction	1	0.1%
Government, Religion, Agricultural, and Education Buildings	6,722	None	5,826	86.7%
		Minor	709	10.6%
		Moderate	169	2.5%
		Severe	17	0.2%
		Destruction	2	<0.1%

Source: Hazus v6.0

Impact on Critical Facilities

All critical facilities in Burlington County are considered exposed to the earthquake hazard. Refer to subsection "Critical Facilities and Lifelines" in Section 3 (County Profile) of this HMP for a complete inventory of critical facilities in Burlington County.

The Hazus earthquake model was used to assign the range or average probability of each damage state category to the critical facilities and lifelines in Burlington County for the 500-year and 2,500-year MRP events. In addition, Hazus estimates the time to restore critical facilities to fully functional use. Results are presented as a probability of being functional at specified time increments (days after the event). For example, Hazus might estimate that a facility has 5 percent chance of being fully functional on Day 3, and a 95 percent chance of being fully functional on Day 90. For percent probability of sustaining damage, the minimum and maximum damage estimated value for that facility type is presented.

As a result of a 500-year MRP event, Hazus estimates that critical facilities will be nearly 100 percent functional with negligible damage. Therefore, the impact on critical facilities is not significant for the 500-year event. Similarly for the 2,500-year MRP event, functionality will only reach as low as 79.9 percent. Table 4.3.4-17 and Table 4.3.4-18 summarize the damage state probabilities for critical facilities during the 500-year and 2,500-year MRP events, respectively.

Table 4.3.4-17. Estimated Damage and Loss of Functionality for Critical Facilities and Utilities in Burlington County for the 500-Year MRP Earthquake Event

	Percent Probability of Sustaining Damage 500-Year MRP					Percent Functionality			
	None	Slight	Moderate	Extensive	Complete	Day 1	Day 7	Day 30	Day 90
Essential Facilities									
Medical Facilities	99.0% - 99.9%	<0.1% - 0.9%	<0.1%	0.0%	0.0%	99% - 99.8%	99.9%	99.9%	99.9%
Emergency Operations Center	96.3% - 97.6%	1.8% - 2.8%	0.5% - 0.9%	<0.1% - 0.1%	0.0%	96.2% - 97.6%	98.9% - 99.3%	99.8% - 99.9%	99.9%
Police Stations	96.3% - 97.7%	1.7% - 2.8%	0.5% - 0.9%	<0.1% - 0.1%	0.0%	96.2% - 97.7%	98.9% - 99.4%	99.8% - 99.9%	99.9%
Fire Stations	96.2% - 98.1%%	1.4% - 2.8%	0.4% - 0.9%	<0.1% - 0.1%	0.0%	96.2% - 98.1%	98.9% - 99.5%	99.8% - 99.9%	99.9%
Schools	96.2% - 97.8%	1.7% - 2.8%	0.5% - 0.9%	<0.1% - 0.1%	0.0%	96.2% - 97.8%	98.9% - 99.4%	99.8% - 99.9%	99.9%
Utilities									
Communications	99.3% - 99.4%	0.6% - 0.7%	<0.1%	0.0%	0.0%	99.9%	99.9%	99.9%	99.9%
Electric Power	97.3% - 98.2%	1.1% - 1.6%	0.6% - 0.9%	0.1%	0.0%	98.2% - 98.7%	99.9%	99.9%	99.9%
Natural Gas	97.3%	1.6%	0.9%	0.2%	0.0%	98.5%	99.7%	99.9%	99.9%
Potable Water	97.2% - 98.5%	0.9% - 1.7%	0.5% - 1.0%	0.1% - 0.2%	0.0%	98.4% - 99.3%	99.8 - 99.9%	99.9%	99.9%
Waste Water	97.2 % - 98.7%	0.8% - 1.7%	0.4% - 1.0%	0.1% - 0.2%	0.0%	97.8% - 99%	99.7% - 99.8%	99.8% - 99.9%	99.9%
Transportation									
Airport	99% - 99.6%	0.4% - 0.9%	<0.1% - 0.3%	0.0%	0.0%	99.9%	99.9%	99.9%	99.9%
Highway Bridges	100.0%	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%	100.0%	100.0%
Light Rail Facility	99.0% - 99.3%	0.6% - 0.9%	<0.1%	0.0%	0.0%	99.9%	99.9%	99.9%	99.9%
Rail Facility	99.0% - 99.3%	0.6% - 0.9%	<0.1%	0.0%	0.0%	99.9%	99.9%	99.9%	99.9%

Source: Hazus v6.0

Table 4.3.4-18. Estimated Damage and Loss of Functionality for Critical Facilities and Utilities in Burlington County for the 500-Year MRP Earthquake Event

	Percent Probability of Sustaining Damage 2,500-year					Percent Functionality			
	None	Slight	Moderate	Extensive	Complete	Day 1	Day 7	Day 30	Day 90
Essential Facilities									
Medical Facilities	90.5% - 96.9%	2.4% - 8.7%	0.5% - 1.8%	0.0% - 0.1%	0.0% - <0.1%	90.5% - 96.9%	97.9% - 99.2%	99.8% - 99.9%	99.9%
Emergency Operations Center	79.9% - 85.1%	9.8% - 12.7%	4.3% - 6.1%	0.7% - 1.1%	0.1%	79.9% - 85.1%	92.3% - 94.7%	98.7% - 99.2%	99.2% - 99.5%
Police Stations	79.9% - 85.6%	9.6% - 1.3%	4.1% - 6.1%	0.7% - 1.1%	0.1%	79.9% - 85.6%	92.3% - 94.9%	98.7% - 99.2%	99.2% - 99.5%
Fire Stations	79.9% - 87.1%	8.7% - 12.7%	3.6% - 6.1%	0.6% - 1.1%	<0.1% - 0.1%	79.9% - 87%	92.3% - 95.5%	98.7% - 99.3%	99.2% - 99.6%
Schools	79.9% - 85.6%	9.6% - 12.7%	4.1% - 6.1%	0.7% - 1.1%	0.1%	79.9% - 85.6%	92.3% - 94.9%	98.7% - 99.2%	99.2% - 99.5%
Utilities									
Communications	91.9% - 92.7%	6.8% - 7.5%	0.5% - 0.6%	0.0%	0.0%	99.6%	99.9%	99.9%	99.9%
Electric Power	83.8% - 86.4%	6.9% - 8.0%	5.4% - 6.5%	1.3% - 1.7%	0.0%	88.4% - 90.3%	99.1% - 99.2%	99.9%	99.9%
Natural Gas	83.7%	8.1%	6.5%	1.7%	0.0%	90.3%	98.2%	99.8%	99.9%
Potable Water	83.4% - 87.9%	6.2% - 8.2%	4.7% - 6.7%	1.1% - 1.7%	0.0%	90.3% - 94.6%	98.3% - 99.1%	99% - 99.9%	99.9%
Waste Water	83.4% - 88.7%	5.9% - 8.2%	4.4% - 6.7%	1.0% - 1.7%	0.0%	86.9% - 91.2%	97.6% - 98.6%	98.5% - 99.1%	98.8% - 99.9%
Transportation									
Airport	90.5% - 95.0%	4.7% - 8.7%	0.3% - 0.8%	0.0%	0.0%	99.4% - 99.8%	99.9%	99.9%	99.9%
Highway Bridges	99.9%	0.0%	0.0%	0.0%	0.0%	99.9%	99.9%	99.9%	99.9%
Light Rail Facility	90.5% - 92%	7.4% - 8.7%	0.6% - 0.8%	0.0%	0.0%	99.4% - 99.5%	99.9%	99.9%	99.9%
Rail Facility	90.5% - 92%	7.4% - 8.7%	0.6% - 0.8%	0.0%	0.0%	99.4% - 99.5%	99.9%	99.9%	99.9%

Source: Hazus v6.0

Impact on Economy

Earthquakes also have impacts on the economy, including loss of business function, damage to inventory, relocation costs, wage loss, and rental loss due to the repair/replacement of buildings. Hazus estimates building-related economic losses, including income losses (wage, rental, relocation, and capital-related losses) and capital stock losses (structural, non-structural, content, and inventory losses). Economic losses estimated by Hazus are summarized in Table 4.3.4-19. Hazus estimates quite a difference in losses between the 500-year and 2,500-year MRP events. Inventory losses for the 500-year MRP event are $4,189,200, 4.2 percent of the 2,500-year MRP event's $99,572,300 inventory losses. Similarly, wage losses for the 500-year MRP event are $1,559,700, 9.7 percent of the 2,500-year MRP event's $15,945,700 wage losses.

Table 4.3.4-19. Economic Losses for the 500-Year and 2,500 MRP Earthquake Event

MRP	Inventory Loss	Relocation Loss	Building and Content Losses	Wages Losses	Rental Losses	Capital-Related Loss
500-year	$4,189,200	$6,098,900	$23,764,200	$1,559,700	$3,228,100	$458,800
2,500-year	$99,572,300	$78,583,600	$404,146,300	$15,945,700	$38,473,900	$5,386,500

Source: Hazus v6.0

Although the Hazus analysis did not compute damage estimates for individual roadway segments and railroad tracks, assumedly these features would undergo damage due to ground failure, resulting in interruptions of regional transportation and of distribution of materials. Losses to the community that would result from damage to lifelines could exceed costs of repair.

Earthquake events can also significantly affect road bridges, many of which provide the only access to certain neighborhoods. Because softer soils generally follow floodplain boundaries, bridges that cross watercourses should be considered vulnerable. Another key factor in degree of vulnerability is age of facilities and infrastructure, which correlates with standards in place at times of construction.

Hazus also estimates the volume of debris that may be generated as a result of an earthquake event to enable the study region to prepare and rapidly and efficiently manage debris removal and disposal. Debris estimates are divided into two categories: (1) reinforced concrete and steel that require special equipment to break it up before it can be transported, and (2) brick, wood, and other debris that can be loaded directly onto trucks with bulldozers (FEMA 2022).

For the 500-year MRP event, Hazus estimates that 13,050 tons of debris will be generated. For the 2,500-year MRP event, Hazus estimates a total of 130,598 tons of debris will be generated county-wide. Table 4.3.4-20 summarizes the estimated debris generated as a result of these events by municipality.

Impact on Environment

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

Table 4.3.4-20. Estimated Debris Generated by the 500-Year and 2,500-Year MRP Earthquake Events

Jurisdiction	Estimated Debris Created During the 500-Year MRP Earthquake Event		Estimated Debris Created During the 2,500-Year MRP Earthquake Event	
	Brick/Wood (tons)	Concrete/Steel (tons)	Brick/Wood (tons)	Concrete/Steel (tons)
Bass River (T)	38	20	271	280
Beverly (C)	68	42	518	623
Bordentown (C)	123	83	1,037	1,222
Bordentown (T)	251	159	2,135	2,370
Burlington (C)	496	263	3,432	3,776
Burlington (T)	485	264	3,871	3,970
Chesterfield (T)	72	28	675	428
Cinnaminson (T)	231	134	2,033	2,059
Delanco (T)	65	35	579	538
Delran (T)	386	130	2,726	1,751
Eastampton (T)	70	19	543	266
Edgewater Park (T)	118	63	941	936
Evesham (T)	547	260	4,450	3,963
Fieldsboro (B)	21	16	175	240
Florence (T)	269	131	2,253	2,013
Hainesport (T)	140	91	1,157	1,395
Lumberton (T)	139	92	1,286	1,462
Mansfield (T)	133	63	1,138	942
Maple Shade (T)	300	182	2,419	2,782
Medford (T)	634	273	4,499	3,784
Medford Lakes (B)	28	6	255	82
Moorestown (T)	877	360	6,332	5,205
Mount Holly (T)	136	89	1,171	1,318
Mount Laurel (T)	693	400	5,979	6,236
New Hanover (T)	122	88	991	1,369
North Hanover (T)	164	79	1,251	1,155
Palmyra (B)	75	52	703	834
Pemberton (B)	58	22	392	304
Pemberton (T)	577	166	3,938	2,179
Riverside (T)	110	71	945	1,074
Riverton (B)	77	26	547	359
Shamong (T)	108	33	831	460
Southampton (T)	167	90	1,409	1,331
Springfield (T)	51	34	511	531
Tabernacle (T)	139	41	929	528
Washington (T)	28	15	203	209
Westampton (T)	244	117	1,901	1,691
Willingboro (T)	531	141	3,727	1,815
Woodland (T)	41	22	295	304
Wrightstown (B)	24	12	185	179
Burlington County Total	**8,837**	**4,213**	**68,633**	**61,965**

Source: Hazus v6.0

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

Cascading Impacts on Other Hazards

Earthquakes can cause large and sometimes disastrous landslides and mudslides. Any steep slope is vulnerable to slope failure, often as a result of loss of cohesion in clay-rich soils. Unless properly secured, hazardous materials can be released, causing significant damage to the environment and people.

Earthen dams and levees are highly susceptible to seismic events and the impacts of their eventual failures can be considered secondary risks for earthquakes. The most common mode of earthquake-induced dam failure is slumping or settlement of earth-fill dams where the fill has not been property compacted. If the slumping occurs when the dam is full, then overtopping of the dam, with rapid erosion leading to dam failure is possible. Dam failure is also possible if strong ground motions heavily damage concrete dams. Earthquake-induced landslides into reservoirs have also caused dam failures. Dam failures are further discussed in Section 4.3.1 (Dam Failure) of this Plan update.

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

As per the United States Search and Rescue Task force, tsunamis are formed as a result of earthquakes, volcanic eruptions, or landslides that occur under the ocean. When these events occur, huge amounts of energy are released as a result of quick, upward bottom movement. A wave is formed when huge volumes of ocean water are pushed upward. A large earthquake can lift large portions of the seafloor, which will cause the formation of huge waves (US SAR Task Force n.d).

Further Changes that May Impact Vulnerability

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

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

Projected Development

As discussed and illustrated in Section 3 (County Profile), areas targeted for future growth and development have been identified across the County. The New Jersey Pinelands Commission has identified Pinelands Management Area Boundaries, including regional growth areas and rural development areas that may also provide insight to where development and growth may occur in the County. In addition, each community was requested to provide recent and anticipated new development and infrastructure projects; summarized in Section 9 (Jurisdictional Annexes).

Development built in areas with softer NEHRP soil classes, liquefaction, and landslide-susceptible areas may experience shifting or cracking in the foundation during earthquakes because of the loose soil characteristics of these soil classes. However, current building codes require seismic provisions that should render new construction less vulnerable to seismic impacts than older, existing construction that may have been built to lower construction standards.

Projected Changes in Population

Burlington County has experienced an increase in its population since 2010. According to the U.S. Census Bureau, the County's population increased by approximately 3 percent between 2010 and 2020 (U.S. Census Bureau 2020). 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, Burlington County is projected to have a population of 460,400 by 2024, 464,900 by 2029, and 472,700 by 2034 (State of New Jersey 2017). Persons that move into older buildings may increase their overall vulnerability to earthquakes. As noted earlier, if moving into new construction, current building codes require seismic provisions that should render new construction less vulnerable to seismic impacts.

Climate Change

Because the impacts of climate change on earthquakes are not well understood, a change in the County's vulnerability as the climate continues to change is difficult to determine. However, climate change has the potential to magnify secondary impacts of earthquakes. As a result of the climate change projections discussed above, the County's assets located on areas of saturated soils and on or at the base of steep slopes, are at a higher risk of landslides/mudslides because of seismic activity.

Change of Vulnerability Since 2019 HMP

Overall, the entire County continues to be vulnerable to earthquakes. For the 2024 HMP, the building inventory was updated using RS Means 2022 values, which is more current and reflects replacement cost versus the building stock improvement values reported in the 2019 HMP. Additional building stock updates include updates to the critical facility inventory provided by Burlington County. Updated hazard areas were used as well; since the 2019 HMP, an updated version of Hazus was released (v5.1). This updated model includes longer historical records to pull from to generate probabilistic events.

TETRA TECH

4.3.5 Extreme Temperature

2024 HMP Changes

- The extreme temperature hazard was previously located in the Severe Weather hazard profile; it now has its own, separate hazard profile.
- New and updated figures from federal and state agencies are incorporated.
- Previous occurrences were updated with events that occurred between 2018 and 2022.

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

Hazard Description

Extreme Cold

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

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

- *Wind chill* is not the actual temperature but rather how wind and cold feel on exposed skin. As the wind increases, heat is carried away from the body at an accelerated rate, driving down the body temperature.
- *Frostbite* is damage to body tissue caused by extreme cold. A wind chill of -20°F will cause frostbite in just 30 minutes. Frostbite can cause a loss of feeling and a white or pale appearance in extremities.
- *Hypothermia* is a condition brought on when the body temperature drops to less than 95°F, and it can be deadly. Warning signs of hypothermia include uncontrollable shivering, memory loss, disorientation, incoherence, slurred speech, drowsiness, and apparent exhaustion (NWS 2022).

Extreme Heat

Extreme heat is defined as temperatures that hover 10 degrees or more above the average high temperature for a region and that last for several weeks (CDC 2016). Humid or muggy conditions occur when a "dome" of high atmospheric pressure traps hazy, damp air near the ground. A heat wave is a period of abnormally and uncomfortably hot and unusually humid weather. A heat wave will typically last two or more days (NOAA 2009). There is no universal definition of a heat wave because the term is relative to the usual weather in a particular area.

The term heat wave is applied both to routine weather variations and to extraordinary spells of heat which may occur only once a century (Meehl 2004).

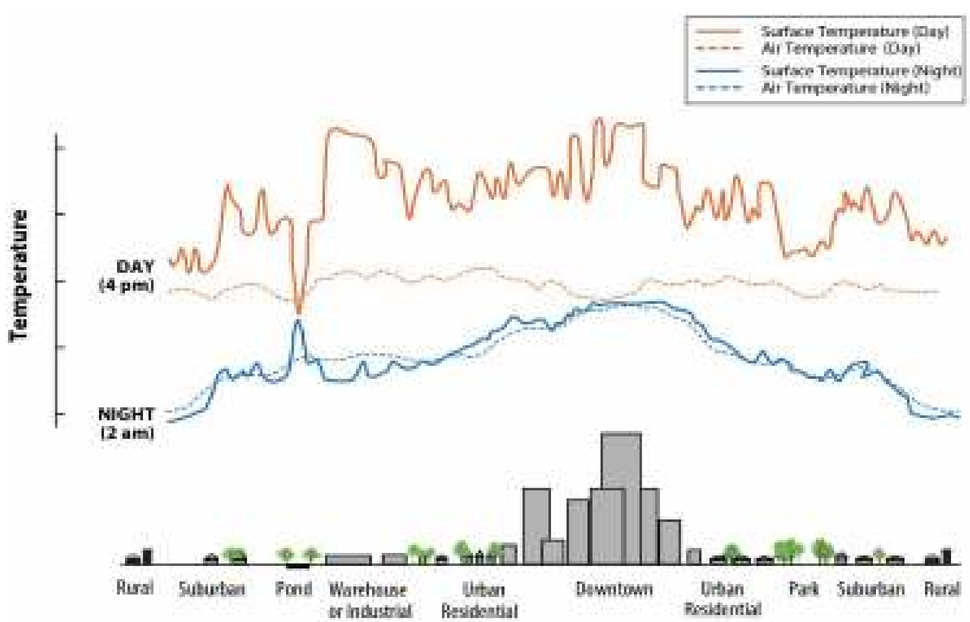
Urbanized areas and urbanization create an exacerbated type of risk during an extreme heat event, compared to rural and suburban areas. As defined by the U.S. Census, urban areas are classified as all territory, population, and housing units located within urbanized areas and urban clusters. The term urbanized area denotes an urban area of 50,000 or more people. Urban areas with at least 2,500 but fewer than 50,000 people are called urban clusters (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 (EPA 2019).

The term 'heat island' describes built up areas that are hotter than nearby rural areas. The annual mean air temperature of a city with more than one million people can be between 1.8 ºF and 5.4ºF warmer than its surrounding areas. In the evening, the difference in air temperatures can be as high as 22ºF. Heat islands occur on the surface and in the atmosphere. On a hot, sunny day, the sun can heat dry, exposed urban surfaces to temperatures 50ºF to 90ºF hotter than the air. Heat islands can affect communities by increasing peak energy demand during the summer, air conditioning costs, air pollution and greenhouse gas emissions, heat-related illness and death, and water quality degradation (EPA 2019).

As shown in Figure 4.3.5-1, 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 4.3.5-1. Heat Island Effect Diagram



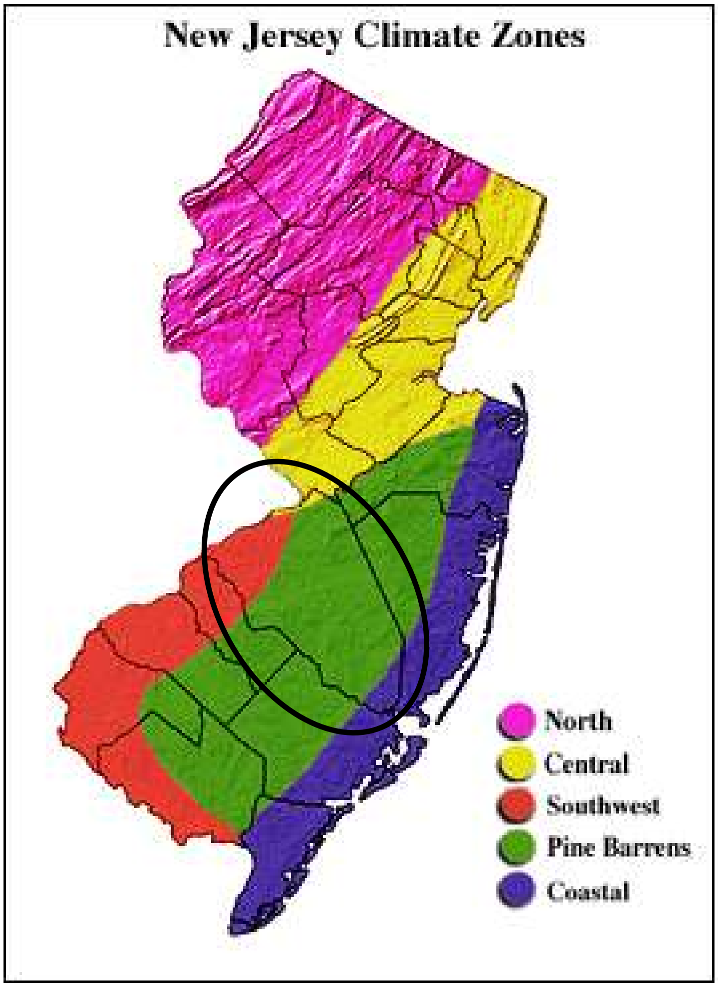
Source: US EPA 2023

Location

According to the Office of the New Jersey State Climatologist, New Jersey has five distinct climate regions. 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 regions. The five regions include: Northern, Central, Pine Barrens, Southwest, and Coastal (ONJSC 2021). Figure 4.3.5-2 depicts these regions. A majority of Burlington County is located within the Pine Barrens Region, with other portions in the Southwest, Coastal, and Central Climate Regions.

The Southwest Climate Region is located along the southwestern border of the State, stretching from Trenton all the way to the Delaware Bay. The region is relatively suburban with pockets of urbanized areas, especially in the central region along the Delaware River, across from Philadelphia. Due to the proximity to the Delaware Bay, this region adds a maritime influence on the climate, having some of the highest average daily temperatures as well as higher nighttime temperatures. In general, the region is drier than other parts of the State, and given its more inland characteristics, is not prone to major coastal storms. That being said, the region does have significant humidity during the summer, and making the high temperatures feel even hotter than recorded (Rutgers University 2019).

Figure 4.3.5-2. Climate Regions of New Jersey



Source: Rutgers University 2019

Note: The black oval indicates the location of Burlington County. The County is located in the Southwest, Pine Barrens, Central, and Coastal Zones.

The Pine Barrens Zone, which covers much of the central portion of the County, has lower temperatures than the neighboring Southwest Region due to solar radiation absorbed during the day and radiated back into space during the night. Compared to its surrounding regions, Pine Barrens Zone is 15-20 degrees cooler. In general, the region has porous and sandy soils which allow water to be absorbed quickly, causing the zone to be relatively dry, making it vulnerable to forest fires (Rutgers University 2019).

Burlington County has a sliver of its land in the northern part of the County located in the Central Zone. This region has many urban locations with large amounts of pollutants produced by the high volume of automobile traffic and industrial processes. The concentration of buildings and paved surfaces serve to retain more heat, thereby affecting the local temperatures with the "heat island effect". Areas in the south of the Central Zone tend to have nearly twice as many days with temperatures above 90 degrees than the 15-20 commonly observed in the central portion of the State (Rutgers University 2019).

The southern tip of the County is located in the Coastal Zone. The Coastal Zone is influenced by the relationship between land and sea. In autumn and early winter, when the ocean is warmer than the land surface, the Coastal Zone will experience warmer temperatures than interior regions of the State. In the spring months, ocean breezes keep temperatures along the coast cooler. Being adjacent to the Atlantic Ocean, with its high heat capacity (compared to land), seasonal temperature fluctuations tend to be more gradual and less prone to extremes. Sea breezes play a major role in the coastal climate. When the land is warmed by the sun, heated air rises, allowing cooler air at the ocean surface to spread inland. Sea breezes often penetrate 5-10 miles inland, but under more favorable conditions, can affect locations 25-40 miles inland. They are most common in spring and summer (Rutgers University 2019).

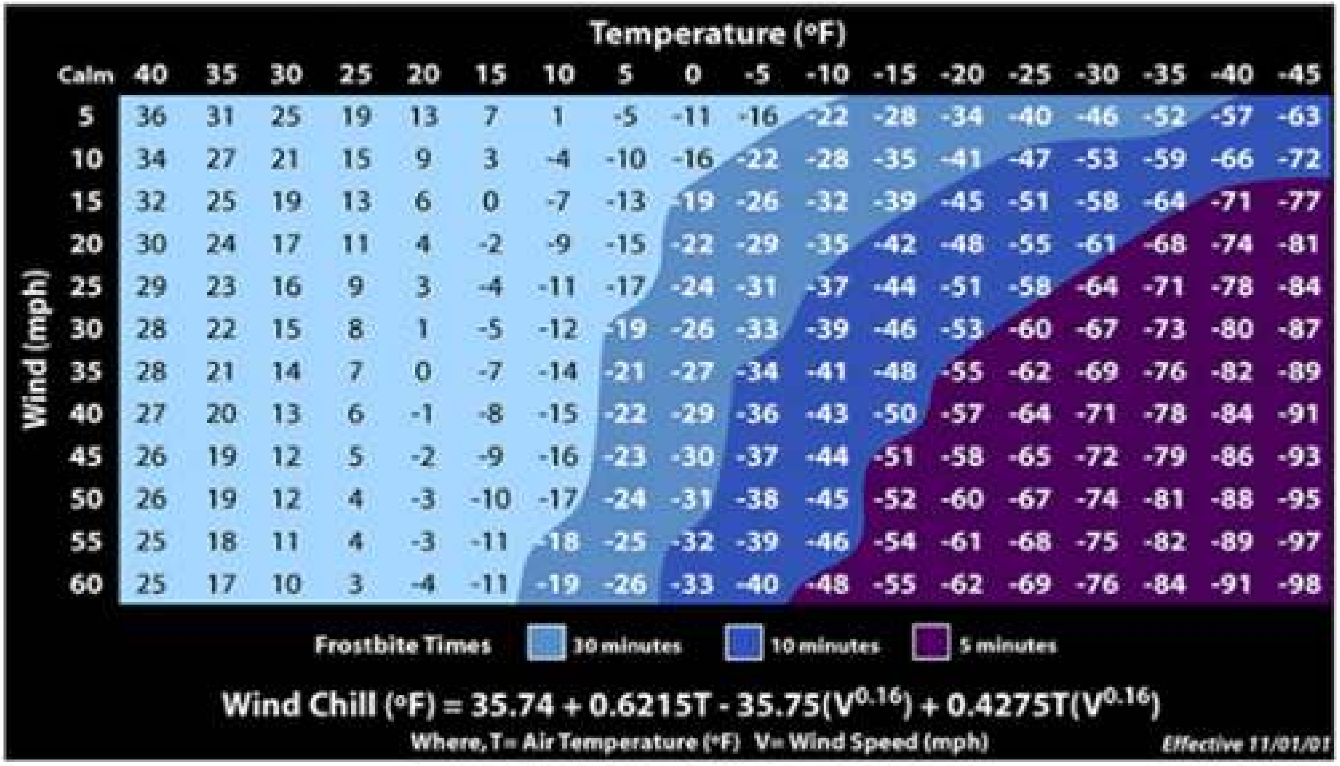
Extent

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.

Extreme Cold

The extent (severity or magnitude) of extreme cold temperatures is generally measured through the wind chill temperature index. The index uses advances in science, technology, and computer modeling to provide an accurate, understandable, and useful formula for calculating the dangers from wind chill. Wind chill temperature is presented in Figure 4.3.5-3.

Figure 4.3.5-3. Wind Chill Index



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

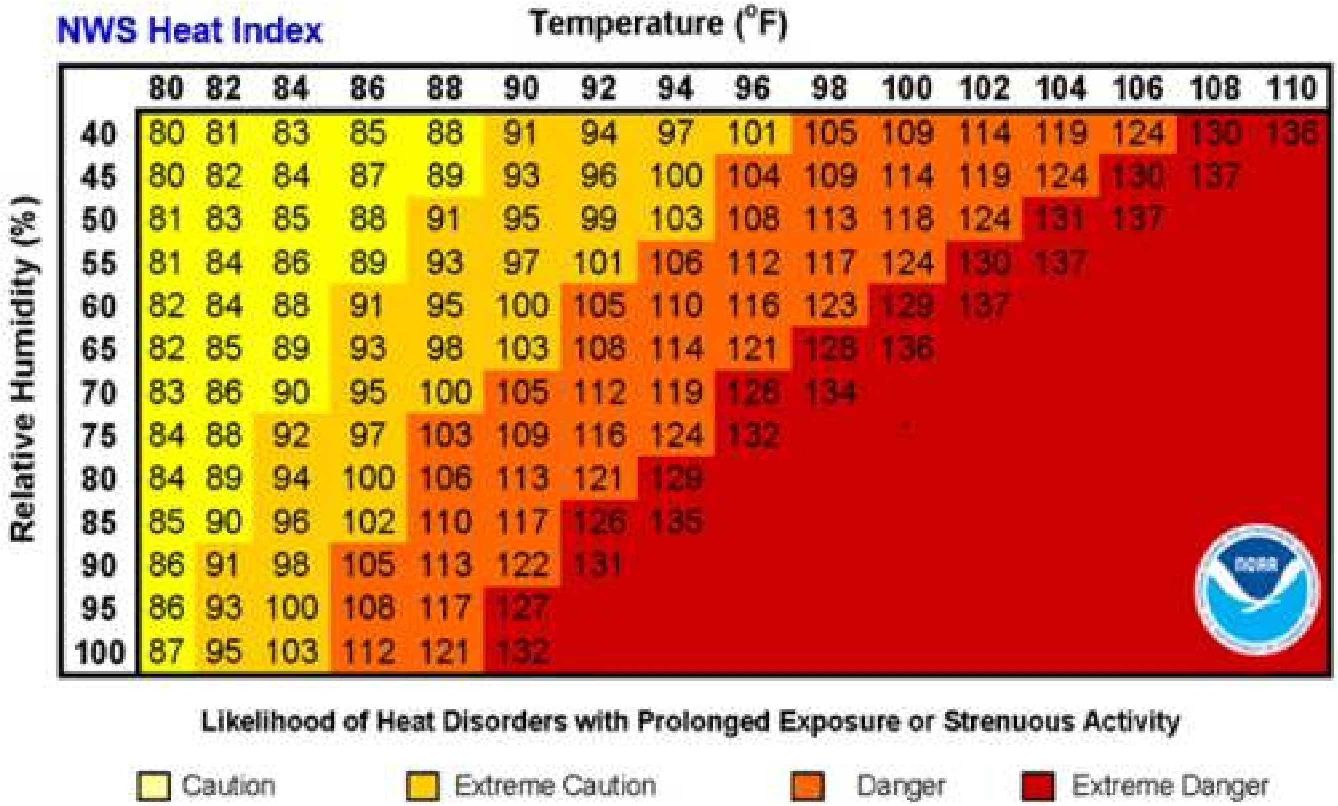
Source: NWS 2019

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).

Extreme Heat

The extent of extreme heat temperatures is generally measured through the Heat Index, identified in Figure 4.3.5-4. 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.

Figure 4.3.5-4. NWS Heat Index Chart – Shaded Areas



Source: NWS 2023

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).

Previous Occurrences and Losses

FEMA Major Disasters and Emergency Declarations

Between May 1953 and May 2023, neither Burlington County nor the State of New Jersey was included in any major disaster (DR) or emergency (EM) declarations due to extreme temperatures. However, during that period, FEMA included Burlington County in 10 DR or EM declarations classified as one or a combination of the following disaster types: blizzard, severe winter storm, snowstorm, snow, ice storm, and winter storm (see Section 4.3.8). Additionally, during that same time period FEMA included Burlington County in two drought-related DR or EM declarations (see Section 4.3.3). Detailed information about the declared disasters since 1953 is provided in Section 3 (County Profile).

U.S. Department of Agriculture Disaster Declarations

Agriculture-related heat/cold disasters are quite common. Usually, they occur along with other weather events such as drought, winter storms, frosts, and even flooding. Overall, it is difficult to separate the agricultural loss caused by extreme temperatures from their partner weather events (drought, winter storm, etc.). However, on a cumulative scale these events can cause significant damage.

The Secretary of Agriculture from the U.S. Department of Agriculture (USDA) is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in counties that are contiguous to a designated county. As shown in Table 4.3.5-1, between August 2018 and May 2023, Burlington County was included in five extreme temperature-related agricultural disaster declarations.

Table 4.3.5-1. USDA Declarations for Extreme Temperature Events in Burlington County

Date of Event	Event Type	Declaration Number	Burlington County Included in Declaration?	Description
April 1 –September 29, 2015	Drought	S3930	Yes	Excessive Heat and Drought
July 16 –September 29, 2015	Drought	S3932	Yes	Excessive Heat and Drought
April 1 –September 10, 2016	Drought	S4071	Yes	Combined effects of Freeze, Excessive Heat, and Drought
June 18 –September 5, 2022	Excessive Heat	S5347	Yes	Drought and Excessive Heat
July 1, 2022 – Continuing	Excessive Heat	S5348	Yes	Drought and Excessive Heat

Source: USDA 2023

Previous Events

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

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

For the 2024 HMP update, known extreme temperature events that impacted Burlington County between August 2018 and May 2023 are listed in Table 4.3.5-2. For events prior to 2018, refer to the 2018 Burlington County HMP.

Table 4.3.5-2. Extreme Temperature Incidents in Burlington County, 2018 to 2023

Date of Event	Event Type	Declaration Number	Burlington County Included in Declaration?	Description
June 29-30, 2021	Excessive Heat	N/A	N/A	A multi-day excessive heat event occurred in Burlington County. High temperatures in the 90s combined with dew points in the upper 60s caused heat index values to reach 105°F on both June 29 and 30, with some localized 110°F values on the 30th. There were no property or crop damages reported from this event in Burlington County.

Date of Event	Event Type	Declaration Number	Burlington County Included in Declaration?	Description
August 11-12, 2021	Excessive Heat	N/A	N/A	A multi-day excessive heat event occurred with temperatures in the mid to upper 90s combined with dew point values near 70 caused widespread heat index values near to above 105°F on both August 11 and 12, with localized 110°F values. There were no property or crop damages reported from this event in Burlington County.
August 9, 2022	Excessive Heat	S5347, S5345, S5348	No	Temperatures reached the mid to upper 90s with dewpoints in the low to mid 70s, resulting heat index values rose to the mid to upper 100s across the region. Heat index values reached 105°F on August 9th, locally near 110°F. There were no property or crop damages reported from this event in Burlington County.
December 23-24, 2022	Cold/ Wind Chill	N/A	N/A	Temperatures fell into the single digits and teens with wind chills ranging from -5°F to -20°F in New Jersey. Wind chills as low as -10°F occurred based on area temperature and wind speed observations.

Source: NOAA NCEI 2023; FEMA 2023; USDA 2023

Probability of Future Occurrence

For the 2024 HMP update, the most up-to-date data was collected to calculate the probability of future occurrence of extreme temperature events for the County. Information from NOAA-NCEI storm events database was used to identify the number of extreme temperature events that occurred between 1950 and May 2023. Table 4.3.5-3 presents the probability of future events for extreme temperature in Burlington County.

Table 4.3.5-3. Probability of Future Occurrences of Extreme Temperature Events

Hazard Type	Number of Occurrences Between 1950 and 2023	% Chance of Occurring in Any Given Year
Cold/Wind Chill	26	35.62%
Heat	70	95.89%
Excessive Heat	28	38.35%
Extreme Cold / Wind Chill	2	2.73%
Total	**126**	**100%**

Source: NOAA NCEI 2023

Note: Disaster occurrences include federally declared disasters since the 1950 Federal Disaster Relief Act, and selected events since 1968. 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 underestimated.

In Section 4.4, the identified hazards of concern for the County were ranked (Table 4.4-2). The probability of occurrence, or likelihood of the event, is one parameter used for hazard rankings. Based on historical records and input from the Planning Team, the probability of occurrence for extreme temperatures in the County is considered 'frequent'.

Climate Change Impacts

Providing projections of future climate change for a specific region is challenging. Shorter term projections are more closely tied to existing trends making longer term projections even more challenging. The further out a prediction reaches the more subject to changing dynamics it becomes.

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 (1.9 °C) increase in the State's average temperature, which is faster than the rest of the Northeast region (2 °F [1.1 °C]) and the world (1.5 °F [0.8 °C]) (IPCC 2014). This warming trend is expected to continue. By 2050, temperatures in New Jersey are expected to increase by 4.1 to 5.7 °F (2.3 °C to 3.2 °C). 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 (5.6 °C) 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).

Vulnerability Assessment

To understand risk, a community must evaluate what assets are exposed and vulnerable. For the extreme temperature hazard, the entire County has been identified as exposed; therefore, all assets are potentially vulnerable. The following text estimated potential impacts of extreme temperatures on Burlington County.

Impact on Life, Health, and Safety

For the purposes of this HMP, the entire population of Burlington County (461,860) is exposed to extreme temperature events. Extreme temperature events have potential health impacts including injury and death. Meteorologists can accurately forecast extreme heat and cold event development and the severity of the associated conditions with several days of lead time. These forecasts provide an opportunity for public health and other officials to notify vulnerable populations, implement short-term emergency response actions, and focus on surveillance and relief efforts on those at greatest risk. Adhering to extreme temperature warnings and conducting appropriate mitigation and preparation measures can significantly reduce the risk of temperature-related deaths.

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

- *Wind chill* is not the actual temperature but rather how wind and cold feel on exposed skin. As the wind increases, heat is carried away from the body at an accelerated rate, driving down the body temperature.
- *Frostbite* is damage to body tissue caused by extreme cold. A wind chill of -20°F will cause frostbite in just 30 minutes. Frostbite can cause a loss of feeling and a white or pale appearance in extremities.
- *Hypothermia* is a condition brought on when the body temperature drops to less than 95°F, and it can be deadly. Warning signs of hypothermia include uncontrollable shivering, memory loss, disorientation, incoherence, slurred speech, drowsiness, and apparent exhaustion (NWS 2022).

Several health hazards are related to extreme heat temperatures and include heat exhaustion and heat stroke:

- *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* is the most serious heat-related illness. It 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 (CDC 2022)

Table 4.3.5-4 denotes the effects of prolonged exposure to direct sunlight on the human body during extreme heat events.

Table 4.3.5-4. Adverse Effects of Prolonged Exposure to Direct Sunlight

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

Source: NWS 2023

Socially Vulnerable Populations

According to the Centers for Disease Control and Prevention, populations most at risk to extreme cold and heat events include the following: 1) the elderly, who are less able to withstand temperatures extremes due to their age, health conditions, and limited mobility to access shelters; 2) infants and children up to four years of age; 3) individuals with chronic medical conditions (e.g., heart disease, high blood pressure), 4) low-income persons that cannot afford proper heating and cooling; and 5) the general public who may overexert during work or exercise during extreme heat events or experience hypothermia during extreme cold events (CDC 2022, CDC 2005).

The Centers for Disease Control and Prevention (CDC) 2020 Social Vulnerability Index (SVI) ranks U.S. Census tracts on socioeconomic status, household composition and disability, minority status and language, and housing and transportation. Burlington County's overall national score is 0.2648 and a state score of 0.3, both indicating that its communities have a low to medium level of social vulnerability (CDC 2018). This score indicates that some County residents in these communities might be more susceptible to impacts from extreme temperatures.

Low Income Populations

According to the 2021 5-year ACS estimates, there are 27,947 total persons living below the poverty level in Burlington County. Willingboro Township has the greatest population of individuals living in poverty (2,685).

Residents with low incomes might not have access to housing or their housing can be less able to withstand cold temperatures (e.g., homes with poor insulation and heating supply). Poor housing conditions, lack of adequate temperature control and inability to locate cooler shelter makes low-income populations particularly vulnerable to extreme heat and its associated health risks. According to the US Census Bureau's American Housing Survey, about 9 percent of American households lack air conditioning (US Census Bureau 2021).

Many individuals and families that are considered to be low-income reside in urban centers, which can undergo what is known as the urban heat island effect. This creates an area of higher temperatures compared to the surrounding areas that are less urbanized. As a result, daytime temperatures are higher and nighttime cooling is reduced which contributes to the prevalence of heat-related illnesses in these areas (National Geographic 2023).

Infants and Children

According to the 2021 5-year ACS estimates, there are 23,350 persons under the age of 5 years in Burlington County. As shown in Table 4.3.5-5, Evesham Township has the highest population under the age of 5 (2,237).

Infants and children under the age of four are considered to be more susceptible to the effects of high temperatures. Children often spend a significant amount of time outside recreationally and are not equipped to independently regulate their activity levels or understand when to rest or seek out hydration and cooling. Their body temperature rises three to five times faster than an adult, and they absorb heat faster due to their increased surface area relative to their mass (Columbia University 2023).

Older Adults

According to the 2021 5-year ACS estimates, there are 78,093 persons over the age of 65 years in Burlington County. In Burlington County, each municipality has areas of high concentration of elderly population with higher concentrations located in the more urban, densely populated areas of the County. As shown in Table 4.3.5-5, Evesham Township has the highest population over 65 (8,574).

Adults over the age of 65 are more likely than other subsets of the population to have pre-existing medical conditions and/or take specific medications that can affect their body's ability to control temperature, which can lower their threshold to tolerate heat. Older adults are also more likely to be more socially isolated due to physical disability, lack of transportation, and other factors attributed to age including dependence on durable medical equipment (AARP 2022).

People with Chronic Pre-Existing Health Issues

According to the 2021 5-year ACS estimates, there are 51,899 persons with a disability in Burlington County. Willingboro Township has the largest disabled population in the County (5,100).

Many types of illness can increase an individual's susceptibility to heat-related illness, including but not limited to respiratory disease, cardiovascular disease, mental illness, obesity, and diabetes. Many chronic conditions require medication for treatment, and many of these can cause dysregulation of body temperature that lessens the body's ability to tolerate high temperatures (CDC 2017).

Those who are Pregnant and Breastfeeding

Pregnancy and breastfeeding cause significant strain on the body. The parent is sharing a blood supply and any water intake with the fetus or baby, and this greatly increases the risk of dehydration or heat exhaustion if the body is not allowed time to cool and hydrate. Overheating during pregnancy can harm a fetus and result in slow growth and premature birth (CDC 2022).

Workers

Many occupations require work in all types of inclement weather, with extreme heat being one that impacts workers both indoors and outdoors. From construction and agricultural workers to bakers and warehouse managers, heat-related illness while on the job can be attributed to a number of factors outside of the existing environmental conditions, including wearing of any protective or safety gear and lack of efficient cooling (OSHA 2023).

Athletes and People Playing Sports

Intense exercise causes in a rapid rise in body temperature, which is greatly exacerbated by high environmental temperatures. Many activities also require specific equipment or protective gear, such as helmets and pads, which can be heavy and retain a significant amount of heat and moisture that will accelerate the speed at which heat exhaustion may occur (Academy of Nutrition and Dietetics 2022).

Table 4.3.5-5. Burlington County Socially Vulnerable Populations by Municipality

Jurisdiction[a]	Decennial Population 2020		American Community Survey 5-Year Population Estimates (2021)									
			Population Over 65		Population Under 5		Non-English Speaking Population		Population with Disability		Population Below Poverty Level	
	Jurisdiction Total	% of County Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total
Bass River (T)	1,355	0.3%	248	18.3%	67	4.9%	0	0.0%	175	12.9%	95	7.0%
Beverly (C)	2,499	0.5%	292	11.7%	183	7.3%	0	0.0%	249	10.0%	300	12.0%
Bordentown (C)	3,993	0.9%	772	19.3%	216	5.4%	16	0.4%	422	10.6%	227	5.7%
Bordentown (T)	11,791	2.6%	1,601	13.6%	472	4.0%	289	2.4%	1,092	9.3%	194	1.6%
Burlington (C)	9,743	2.1%	1,301	13.4%	661	6.8%	208	2.1%	1,251	12.8%	1,422	14.6%
Burlington (T)	23,983	5.2%	3,526	14.7%	1,497	6.2%	385	1.6%	2,366	9.9%	2,185	9.1%
Chesterfield (T)	9,422	2.0%	760	8.1%	578	6.1%	153	1.6%	423	4.5%	165	1.8%
Cinnaminson (T)	17,064	3.7%	3,103	18.2%	929	5.4%	208	1.2%	1,661	9.7%	584	3.4%
Delanco (T)	4,824	1.0%	1,297	26.9%	191	4.0%	42	0.9%	676	14.0%	322	6.7%
Delran (T)	17,882	3.9%	2,570	14.4%	1,047	5.9%	723	4.0%	1,548	8.7%	902	5.0%
Eastampton (T)	6,191	1.3%	557	9.0%	264	4.3%	0	0.0%	478	7.7%	488	7.9%
Edgewater Park (T)	8,930	1.9%	1,571	17.6%	700	7.8%	367	4.1%	1,465	16.4%	1,645	18.4%
Evesham (T)	46,826	10.1%	8,574	18.3%	2,237	4.8%	749	1.6%	4,504	9.6%	1,476	3.2%
Fieldsboro (B)	526	0.1%	82	15.6%	64	12.2%	0	0.0%	62	11.8%	36	6.8%
Florence (T)	12,812	2.8%	2,122	16.6%	645	5.0%	260	2.0%	1,460	11.4%	827	6.5%
Hainesport (T)	6,035	1.3%	1,327	22.0%	58	1.0%	0	0.0%	744	12.3%	250	4.1%
Lumberton (T)	12,803	2.8%	2,048	16.0%	661	5.2%	107	0.8%	1,490	11.6%	805	6.3%
Mansfield (T)	8,897	1.9%	2,506	28.2%	394	4.4%	330	3.7%	1,465	16.5%	181	2.0%
Maple Shade (T)	19,980	4.3%	2,897	14.5%	1,159	5.8%	694	3.5%	2,433	12.2%	1,971	9.9%
Medford (T)	24,497	5.3%	5,151	21.0%	1,085	4.4%	31	0.1%	2,775	11.3%	724	3.0%
Medford Lakes (B)	4,264	0.9%	879	20.6%	211	4.9%	0	0.0%	407	9.5%	26	0.6%
Moorestown (T)	21,355	4.6%	3,480	16.3%	837	3.9%	603	2.8%	1,654	7.7%	807	3.8%
Mount Holly (T)	9,981	2.2%	1,199	12.0%	454	4.5%	133	1.3%	1,624	16.3%	958	9.6%
Mount Laurel (T)	44,633	9.7%	8,299	18.6%	2,011	4.5%	889	2.0%	4,203	9.4%	1,689	3.8%
New Hanover (T)	6,367	1.4%	311	4.9%	214	3.4%	29	0.4%	192	3.0%	116	1.8%
North Hanover (T)	7,963	1.7%	532	6.7%	975	12.2%	125	1.6%	631	7.9%	481	6.0%
Palmyra (B)	7,438	1.6%	1,077	14.5%	190	2.6%	44	0.6%	961	12.9%	616	8.3%
Pemberton (B)	1,371	0.3%	282	20.6%	56	4.1%	47	3.4%	308	22.5%	140	10.2%

Jurisdiction[a]	Decennial Population 2020		American Community Survey 5-Year Population Estimates (2021)									
			Population Over 65		Population Under 5		Non-English Speaking Population		Population with Disability		Population Below Poverty Level	
	Jurisdiction Total	% of County Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total
Pemberton (T)	26,903	5.8%	4,306	16.0%	1,429	5.3%	1,092	4.1%	4,006	14.9%	2,518	9.4%
Riverside (T)	8,003	1.7%	1,039	13.0%	354	4.4%	754	9.4%	972	12.1%	1,257	15.7%
Riverton (B)	2,764	0.6%	554	20.0%	80	2.9%	5	0.2%	187	6.8%	72	2.6%
Shamong (T)	6,460	1.4%	1,313	20.3%	324	5.0%	0	0.0%	671	10.4%	136	2.1%
Southampton (T)	10,317	2.2%	3,153	30.6%	293	2.8%	125	1.2%	1,551	15.0%	589	5.7%
Springfield (T)	3,245	0.7%	479	14.8%	129	4.0%	65	2.0%	311	9.6%	160	4.9%
Tabernacle (T)	6,776	1.5%	1,524	22.5%	380	5.6%	0	0.0%	747	11.0%	233	3.4%
Washington (T)	693	0.2%	138	19.9%	8	1.2%	8	1.1%	87	12.6%	21	3.0%
Westampton (T)	9,121	2.0%	1,139	12.5%	263	2.9%	81	0.9%	802	8.8%	268	2.9%
Willingboro (T)	31,889	6.9%	5,707	17.9%	1,916	6.0%	538	1.7%	5,100	16.0%	2,685	8.4%
Woodland (T)	1,544	0.3%	319	20.7%	49	3.2%	0	0.0%	627	40.6%	363	23.5%
Wrightstown (B)	720	0.2%	58	8.1%	69	9.6%	5	0.7%	119	16.5%	13	1.8%
Burlington County Total	**461,860**	**100.0%**	**78,093**	**16.9%**	**23,350**	**5.1%**	**9,103**	**2.0%**	**51,899**	**11.2%**	**27,947**	**6.1%**

Source: U.S. Census Bureau 2020, 2021

Note: Persons per household = 2.6

Impact on 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 Burlington 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.

Impact on Critical Facilities

All critical facilities in the County are exposed to the extreme temperature hazard. Impacts to critical facilities are the same as 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 brownouts, due to increased usage of air conditioners and other energy-intensive appliances. Similarly, heavy snowfall and ice storms, associated with extreme cold temperature events, can cause power interruption. Backup power is recommended for critical facilities and infrastructure. Additionally, designating and developing emergency cooling or heating facilities can also enhance the resilience and safety of communities.

Impact on Economy

Extreme temperature events also have impacts on the economy, including loss of business function and damage to and loss of inventory. Business-owners can be faced with increased financial burdens due to unexpected repairs caused to the building (e.g., pipes bursting), higher than normal utility bills, or business interruption due to power failure (i.e., loss of electricity, telecommunications). In response to such vulnerabilities to the existing utility infrastructure, in July 2014 the State has established the New Jersey Energy Resilience Bank ("ERB" or the "Bank"), the first public infrastructure bank in the nation to focus on energy resilience (State of New Jersey 2021). The ERB is a direct and innovative approach to address significant energy infrastructure vulnerabilities arising in the aftermath of Superstorm Sandy. Utilizing $200 million through New Jersey's second Community Development Block Grant-Disaster Recovery (CDBG-DR) allocation, the ERB supports the development of distributed energy resources at critical facilities throughout the State that will enable them to remain operational during future outages.

Extreme heat and cold events can damage crops. Based on information from the 2017 Census of Agriculture, 915 farms were present in Burlington County, encompassing 191 acres of total farmland. The average farm size was 105 acres. Burlington County farms had a total market value of products sold of approximately $91 million in crop sales and approximately $7.5 million in livestock sales (USDA 2019).

Impact on Environment

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

Cascading Impacts on Other Hazards

Extreme temperature events can exacerbate the drought hazard (reference Section 4.3.3), increase the potential risk of wildfires (reference Section 4.3.9), and escalate severe storm (reference Section 4.3.7) and severe winter weather (reference Section 4.3.8) 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.

Further Changes that May Impact Vulnerability

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

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

Projected Development

The ability of new development to withstand extreme temperature impacts lies in sound land use practices and consistent enforcement of codes and regulations for new construction. As a relatively suburban county, Burlington County is fortunate to have areas of greenery which decrease the overall county's vulnerability to heat waves. However, as the County increases development, preservation of such spaces can become more difficult. New development will change the landscape where buildings, roads, and other infrastructure potentially replace open land and vegetation. Surfaces that were once permeable and moist are now impermeable and dry. These changes cause urban areas to become warmer than the surrounding areas forming (heat islands as described above). Specific areas of recent and new development are indicated in tabular form and/or on the hazard maps included in the jurisdictional annexes in Volume II, Section 9 (Jurisdictional Annexes) of this plan.

Projected Changes in Population

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, Burlington County is projected to have a population of 460,400 by 2024, 464,900 by 2029, and 472,700 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 less densely populated areas of the County may require utility system upgrades to keep up with utility demands (e.g., water, electric) during extreme temperature events to prevent increased stresses on these systems. Additionally, by increasing development, green space preservation will need to continue to be a priority to mitigate increased heat islands. Refer to Section 3 (County Profile) for a detailed discussion on population changes.

Climate Change

As discussed above, most studies project that the State of New Jersey will see an increase in average annual temperatures. As the climate warms, extreme cold events might decrease in frequency, while extreme heat events might increase in frequency; the shift in temperatures could also result in hotter extreme heat events. With increased temperatures, vulnerable populations could face increased vulnerability to extreme heat and its associated illnesses, such as heatstroke and cardiovascular and kidney disease. Additionally, as temperatures rise, more buildings, facilities, and infrastructure systems may exceed their ability to cope with the heat. Thus, building efficiency and upgrading heating and cooling technology/HVAC will become an increasingly important issue for businesses and homeowners over the coming years.

Change of Vulnerability Since 2019 HMP

Overall, the entire County remains vulnerable to extreme temperatures. As existing development and infrastructure continue to age, they can be at increased risk of failed utility systems (e.g., HVAC) if they are not properly maintained or upgraded. Similarly, an increase in the elderly population remaining in the County increases the vulnerable population.

4.3.6 Flood

2024 HMP Changes

- Dam failure has been removed from the flood hazard profile and is now its own hazard of concern (Section 4.3.1).
- Coastal flooding, erosion, and sea level rise have been added to the Flood hazard profile.
- New and updated figures from federal and state agencies are incorporated.
- Previous occurrences were updated with events that occurred between 2018 and 2023.

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

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 typically occurs during prolonged rainfalls over several days, intense rainfalls over a short period of time, or when an ice or debris jam causes a river or stream to overflow onto the surrounding area. Flooding can also result from the failure of a water control structure, such as a dam or levee (NWS 2019) (refer to Section 4.3.1 Dam Failure for more information). Flood 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 Section 4.3.7.

Flooding events are a common occurrence in the County. A variety of flood types, such as riverine, flash flooding, and stormwater and urban, can cause widespread damage, loss of life, injury, and severe water damage to residential and commercial buildings, bridge and road closures, transit service disruptions, and damage to electrical and communication networks.

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
- Coastal flooding

For the purpose of this HMP and as deemed appropriate by the Burlington County Steering Committee, the main flood types of concern discussed in this section include riverine, flash, stormwater/urban, coastal, ice jam, erosion, and sea level rise. These types of floods are further discussed below.

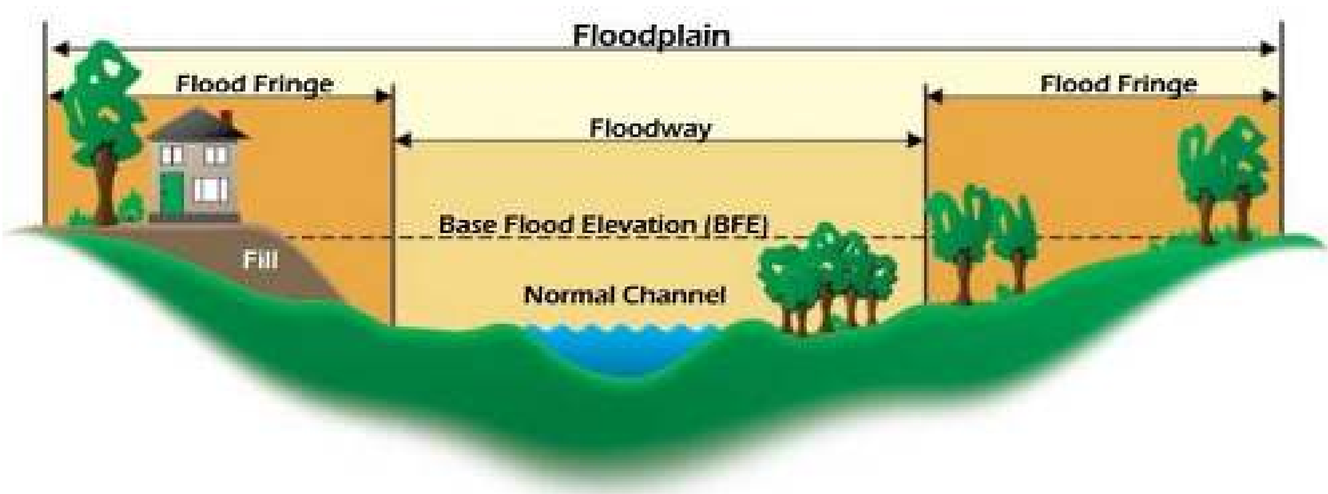
Riverine Flooding

Riverine floods are the most common flood type. They occur along a channel and include overbank and flash flooding. Channels are defined, ground features that carry water through and out of a watershed. They may be called rivers, creeks, streams, or ditches. When a channel receives too much water, the excess water flows over its banks and inundates low-lying areas (FEMA 2019).

Floodplains

A floodplain is flat land adjacent to a river, creek, or stream that is subject to periodic inundation (refer to Figure 4.3.6-1). The floodplain describes the area inundated by the "100-year" flood, or a flood that has a 1-percent chance in any given year of being equaled or exceeded. A floodplain is designated when floodwater exceeds the capacity of the main channel, or water escapes the channel through bank erosion.

Figure 4.3.6-1. Characteristics of a Floodplain



Source: FEMA 2022

A floodplain is made up of different sections:

- **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.
- **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 (FEMA 2019, US DHS 2019).

In Burlington County, floodplains line the rivers, streams, lakes, and wetlands of the County. The boundaries of the floodplains are altered as a result of changes in land use, the amount of impervious surface, placement of obstructing structures in floodways, changes in precipitation and runoff patterns, improvements in technology for measuring topographic features, and utilization of different hydrologic modeling techniques (USGS 2016).

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

Flood hazard areas are identified as Special Flood Hazard Area (SFHA). SFHA are defined as the area that will be inundated by the flood event having a 1-percent chance of being equaled to or exceeded in any given year. The 1-percent annual chance flood is also referred to as the base flood or 100-year flood. A 100-year floodplain is not a flood that will occur once every 100 years; the designation indicates a flood that has a 1-percent chance of being equaled or exceeded each year. Thus, the 100-year flood could occur more than once in a relatively short period of time. Similarly, the moderate flood hazard area (500-year floodplain) will not occur every 500 years but is an event with a 0.2-percent chance of being equaled or exceeded each year (FEMA 2020). The 1-percent annual chance floodplain establishes the area that has flood insurance and floodplain management requirements. The following are additional definitions relating to flood maps (FEMA 2020):

- Flood hazard areas identified on the Flood Insurance Rate Map are identified as a Special Flood Hazard Area (SFHA).
- SFHA = the area that will be inundated by the flood event having a 1-percent chance of being equaled or exceeded in any given year.
- 1-percent annual chance flood = the base flood or 100-year flood.
- SFHAs are labeled as Zone A, Zone AO, Zone AH, Zones A1-A30, Zone AE, Zone A99, Zone AR, Zone AR/AE, Zone AR/AO, Zone AR/A1-A30, Zone AR/A, Zone V, Zone VE, and Zones V1-V30.
- Zone B or Zone X (shaded) = Moderate flood hazard areas and are the areas between the limits of the base flood and the 0.2-percent-annual-chance (or 500-year) flood.
- Zone C or Zone X (unshaded) = Areas of minimal flood hazard, which are the areas outside the SFHA and higher than the elevation of the 0.2-percent-annual-chance flood, are labeled.

Areas outside of the SFHA also can be subject to flooding, such as stormwater/urban flooding or flash flooding.

Locations of flood zones in Burlington County as depicted on the FEMA preliminary Digital Flood Insurance Rate Map (DFIRM) are illustrated in Figure 4.3.6-2 and the total land area in the floodplain, exclusive of waterbodies, is summarized in Table 4.3.6-1. Refer to Section 9 for a map of each jurisdiction depicting the floodplains. Flood hazard zones occur throughout the County.

Flash Flooding

Flash floods are defined by the National Weather Service as "a flood caused by heavy or excessive rainfall in a short period of time, generally less than 6 hours. Flash floods are usually characterized by raging torrents after heavy rains that rip through riverbeds, urban streets, or mountain canyons sweeping everything before them. They can occur within minutes or a few hours of excessive rainfall. They can also occur even if no rain has fallen, for instance after a levee or dam has failed, or after a sudden release of water by a debris or ice jam." (NWS 2009).

Figure 4.3.6-2. FEMA Flood Hazard Areas in Burlington County

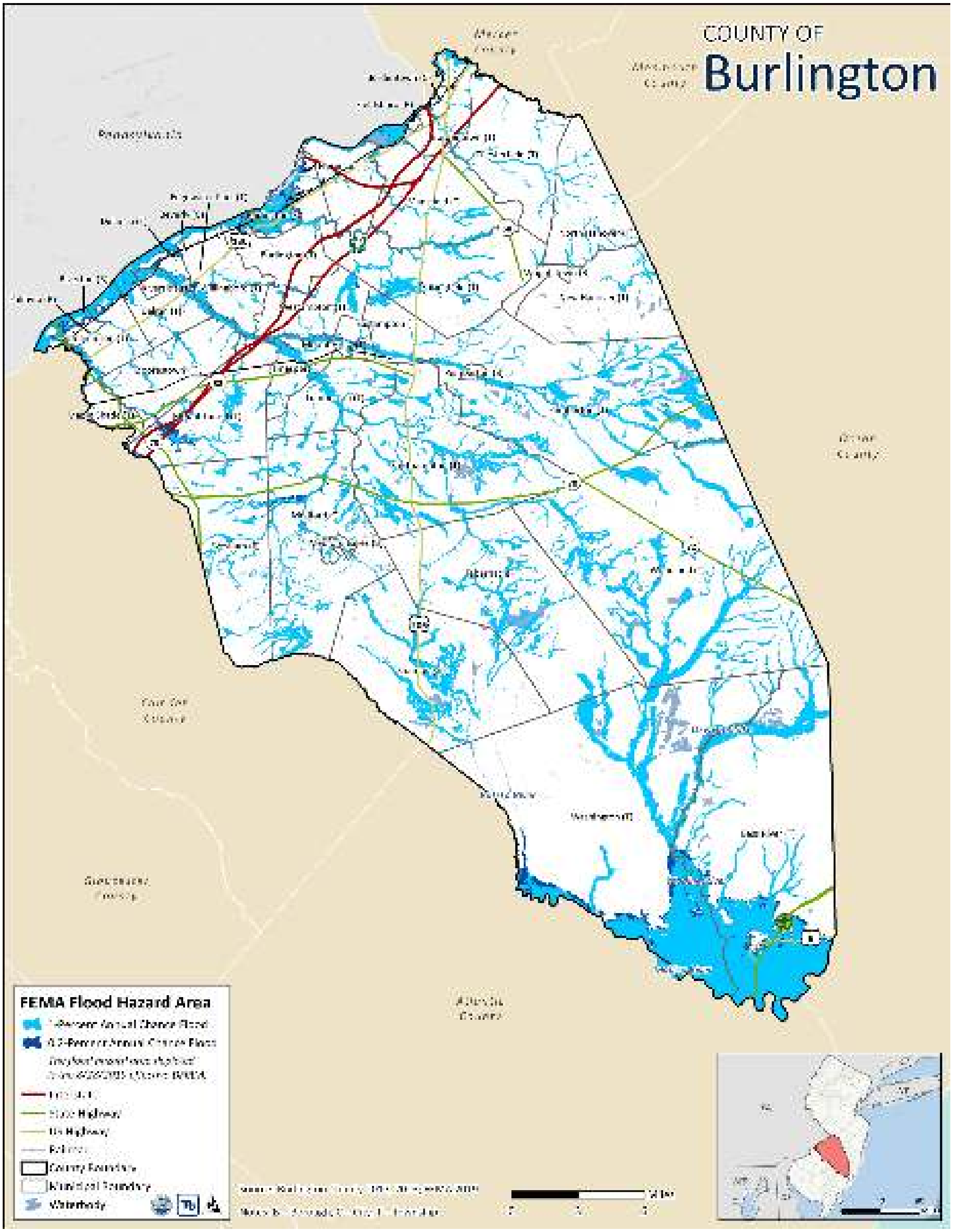


Table 4.3.6-1. Number of Acres in Burlington County Exposed to 1-Percent and 0.2-Percent Annual Chance Flood

		Land in Flood Hazard Areas (excluding water bodies)			
		1-Percent Annual Chance Flood		0.2-Percent Annual Chance Flood	
Jurisdiction	Total Land Area (acres)	Total Area (acres)	Percent of Total	Total Area (acres)	Percent of Total
Bass River (T)	45,870	11,125	24.3%	12,206	26.6%
Beverly (C)	347	47	13.5%	69	19.9%
Bordentown (C)	599	88	14.6%	94	15.6%
Bordentown (T)	4,847	659	13.6%	697	14.4%
Burlington (C)	1,618	1,107	68.4%	1,338	82.7%
Burlington (T)	8,580	533	6.2%	918	10.7%
Chesterfield (T)	13,867	864	6.2%	881	6.4%
Cinnaminson (T)	4,786	686	14.3%	893	18.7%
Delanco (T)	1,499	315	21.0%	539	36.0%
Delran (T)	4,239	530	12.5%	645	15.2%
Eastampton (T)	3,696	512	13.9%	554	15.0%
Edgewater Park (T)	1,860	5	0.3%	12	0.7%
Evesham (T)	18,642	1,713	9.2%	1,841	9.9%
Fieldsboro (B)	202	30	15.0%	34	16.9%
Florence (T)	6,235	323	5.2%	363	5.8%
Hainesport (T)	4,202	955	22.7%	1,049	25.0%
Lumberton (T)	8,186	1,305	15.9%	1,343	16.4%
Mansfield (T)	13,924	1,292	9.3%	1,298	9.3%
Maple Shade (T)	2,442	184	7.5%	259	10.6%
Medford (T)	24,676	3,145	12.7%	3,506	14.2%
Medford Lakes (B)	715	66	9.2%	69	9.7%
Moorestown (T)	9,405	817	8.7%	954	10.1%
Mount Holly (T)	1,744	226	13.0%	329	18.9%
Mount Laurel (T)	13,919	1,575	11.3%	2,052	14.7%
New Hanover (T)	14,011	499	3.6%	499	3.6%
North Hanover (T)	10,858	784	7.2%	785	7.2%
Palmyra (B)	1,196	307	25.6%	549	45.9%
Pemberton (B)	382	70	18.3%	79	20.8%
Pemberton (T)	37,863	5,958	15.7%	6,084	16.1%
Riverside (T)	940	254	27.0%	308	32.8%
Riverton (B)	427	54	12.7%	122	28.5%
Shamong (T)	28,011	3,783	13.5%	3,864	13.8%
Southampton (T)	27,233	4,930	18.1%	5,017	18.4%
Springfield (T)	18,706	2,266	12.1%	2,382	12.7%
Tabernacle (T)	30,367	3,043	10.0%	3,054	10.1%
Washington (T)	62,351	13,085	21.0%	14,465	23.2%
Westampton (T)	7,037	986	14.0%	1,044	14.8%
Willingboro (T)	4,898	468	9.6%	578	11.8%
Woodland (T)	58,775	8,310	14.1%	8,362	14.2%
Wrightstown (B)	1,328	5	0.4%	5	0.4%
Burlington County (Total)	**500,481**	**72,903**	**14.6%**	**79,141**	**15.8%**

Source: Burlington County 2023; FEMA 2019

Stormwater/Urban Flooding

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

High groundwater levels can be a concern and cause problems even where there is no surface flooding. Basements are susceptible to high groundwater levels. Seasonally high groundwater is common in many areas, while elsewhere high groundwater occurs only after a long period of above-average precipitation (USGS 2016).

Heavy rainfall that overwhelms a developed area's stormwater infrastructure causing flooding is commonly referred to as urban flooding. Urban flooding can be worsened by aging and inadequate infrastructure and over development of land. The growing number of extreme rainfall events that produce intense precipitation are resulting in increased urban flooding (Center for Disaster Resilience 2016). While 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 2008).

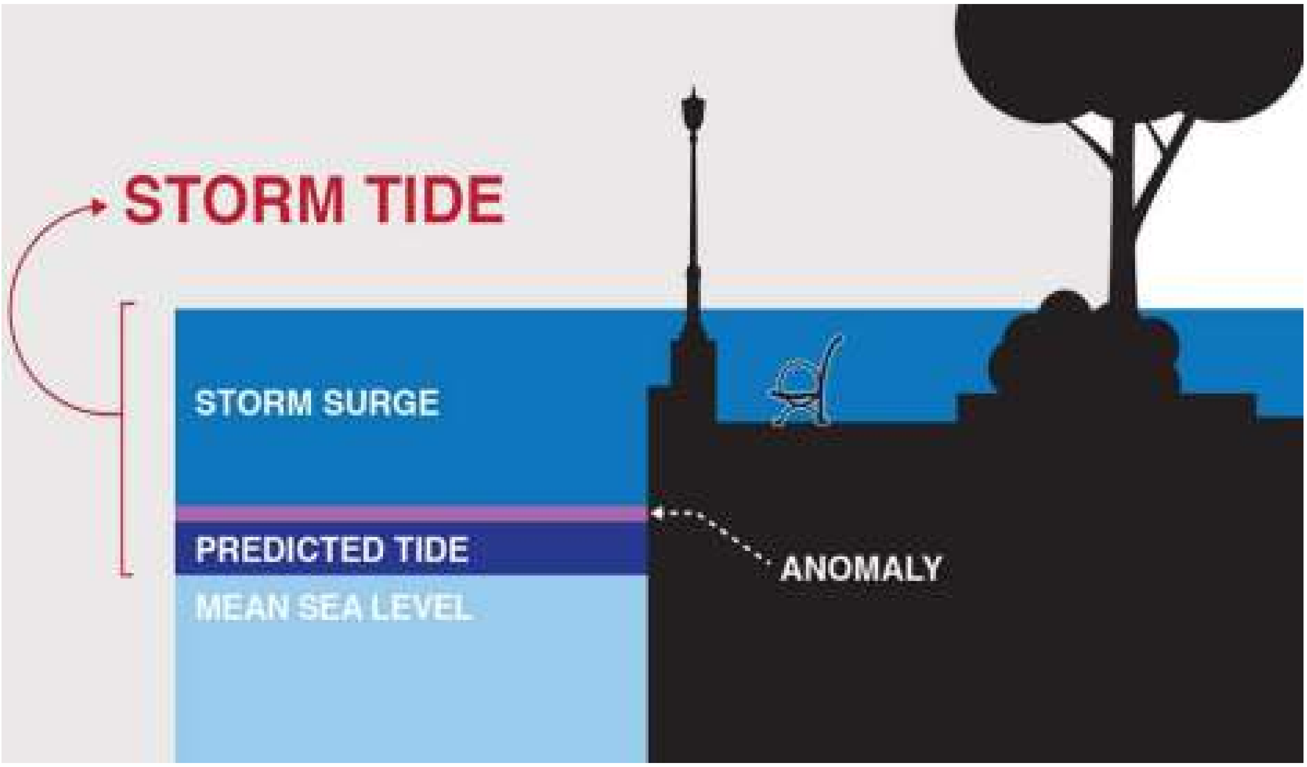
Coastal Flooding

Coastal areas can experience various kinds of flooding. Other types include moderate and major floods that can be caused by heavy rains (rain with a high rate of accumulation per unit of time), storm surges (water pushed on land by strong winds; see Figure 4.3.6-3), and wave action (the movement of waves) that occur during coastal storms (CDC 2017) (NOAA 2023) (US EPA 2023). The combination of these events can result in the total perceived coastal flooding event.

Sea Level Rise

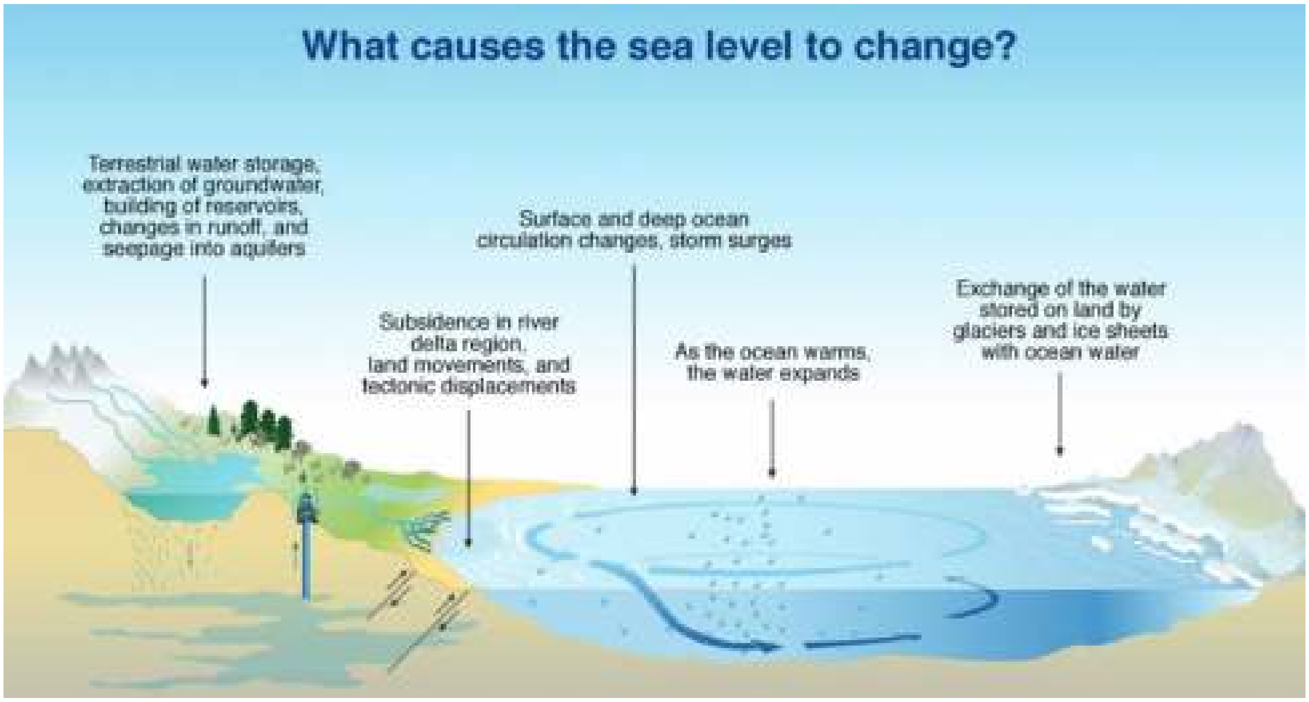
There are two types of sea level rise: global and relative (local). Global sea level rise refers to the increase currently observed in the average global sea level trend. This is primarily attributed to changes in ocean volume due to land ice melt and thermal expansion. The melting of glaciers and continental ice masses can contribute significant amounts of freshwater input to the earth's oceans. In addition, increases in global ocean temperature causes an expansion of seawater, increasing ocean volume (NASA 2020). Refer to Figure 4.3.6-4 for an illustration of what causes sea level to change.

Figure 4.3.6-3. Storm Tide Diagram



Source: NOAA 2023

Figure 4.3.6-4. Causes of Sea Level Change



Source: NASA 2020

Relative or local sea level is affected by global sea level fluctuations, changes in land elevation, winds, and ocean circulation. It refers to the height of the water as measured along the coast relative to a specific point on land. Tide stations measure local sea level rise. Water measurements at the 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 local sea level rise and vertical land motion (subsidence, glacial rebound, or large-scale tectonic motion). Since the heights of both the land and water change, the land-water interface can vary spatially and temporally and must be defined over time. Depending on the rates of vertical land motion relative to changes in sea level, observed local sea level trends may differ greatly from the average rate of global sea level rise and vary widely from one location to the next (NOAA 2022).

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 caused by liquid water, wind, or ice. Liquid water is the major agent of erosion on Earth. Rain, rivers, floods, lakes, and the ocean carry away bits of soil and sand and slowly wash away the sediment (National Geographic 2023).

Ice Jam Flooding

An ice jam occurs when pieces of floating ice are carried with a stream's current and accumulate behind any obstruction to the stream flow. Obstructions may include river bends, mouths of tributaries, points where the river slope decreases, as well as dams and bridges. The water held back by this obstruction can cause flooding upstream, and if the obstruction suddenly breaks, flash flooding can occur as well (NESEC 2021). The formation of ice jams depends on the weather and physical condition of the river and stream channels. They are most likely to occur where the channel slope naturally decreases, in culverts, and along shallows where channels may freeze solid. Ice jams and resulting floods can occur during at different times of the year: fall freeze-up from the formation of frazil ice; mid-winter periods when stream channels freeze solid, forming anchor ice; and spring breakup when rising water levels from snowmelt or rainfall break existing ice cover into pieces that accumulate at bridges or other types of obstructions (FEMA 2018).

Ice Jams At a Glance

- Freeze-up jams occur when floating ice may slow or stop due to a change in water slope as it reaches an obstruction to movement.
- Breakup jams occur during periods of thaw, generally in late winter and early spring.

Source: FEMA 2018

Location

Flooding potential is influenced by climatology, meteorology, and topography (elevations, latitude, and water bodies and waterways). Flooding potential for each type of flooding that affects Burlington County is described in the subsections below.

Riverine Flooding

Most flooding in Burlington County occurs during the summer and early fall months; however, floods have occurred at different times throughout the year. According to the County's Flood Insurance Study (FIS) report, multiple waterways have a history of flooding including the Assiscunk Creek, Bass River, Beaverdam Creek, Delaware River, East Branch, Jacks Run, Laurel Run, Masons Creek, Medford Lakes, Mullica River, Pennsauken Creek and its branches, Pompeston Creek, Rancocas Creek and its branches, Swede Run, and Wading River. Many of the bodies of water are the primary source for flooding; however, most flooding is due to indirect causes such as undersized culverts, tidal impacts from headwaters, and confluences with other waterbodies (FEMA 2019).

Flood Gages

The USGS National Water Information System collects surface water data from more than 850,000 stations across the country. The time-series data describes stream levels, streamflow (discharge), reservoir and lake levels, surface water quality, and rainfall. The data is collected by automatic recorders and manual field measurements at the gage locations. USGS uses stream gages to determine the severity of flood at different points along a body of water. There are numerous gages in Burlington County, in addition to others just outside of the County's boundary, that provide critical flood data for waterways affecting the County.

There are 11 stream gages in the County. Table 4.3.6-2 lists details about the stream gages in the County. The USGS website provides details about each of the gages (https://waterwatch.usgs.gov/index.php) and the gage heights of flooding events. The NWS provides flood stages for the gages (https://water.weather.gov/ahps/). Figure 4.3.6-5 displays the locations of the stream gages in the County.

Table 4.3.6-2. Gages in Burlington County

Gage Site Number	Site Name	Flood Stage Height (feet)	Record Flood Height (feet)
01464576	Delaware River at Burlington	9.3 feet	11.94 feet
01467005	North Branch Rancocas Creek at Iron Works Park Mount Holly	11.7 feet	Information Not Available
01465880	South Branch Rancocas Creek at Medford	12 feet	19.7 feet
01465850	South Branch Rancocas Creek at Vincentown	7 feet	12.34 feet
01467000	North Branch Rancocas Creek at Pemberton	2.5 feet	4.91 feet
01466900	Greenwood Branch at New Lisbon	5 feet	9.87 feet
01466500	McDonalds Branch at McDonald's Branch	None Defined	2.54 feet
01409810	West Branch Wading River at Jenkins	15 feet	16.85 feet
01409400	Mullica River near Batsto	5 feet	7.3 feet
01410150	East Branch Bass River at New Gretna	6 feet	7.28 feet
01410000	Oswego River at Harrisville	10.21 feet	14.83 feet

Source: NWS 2023; USGS 2023

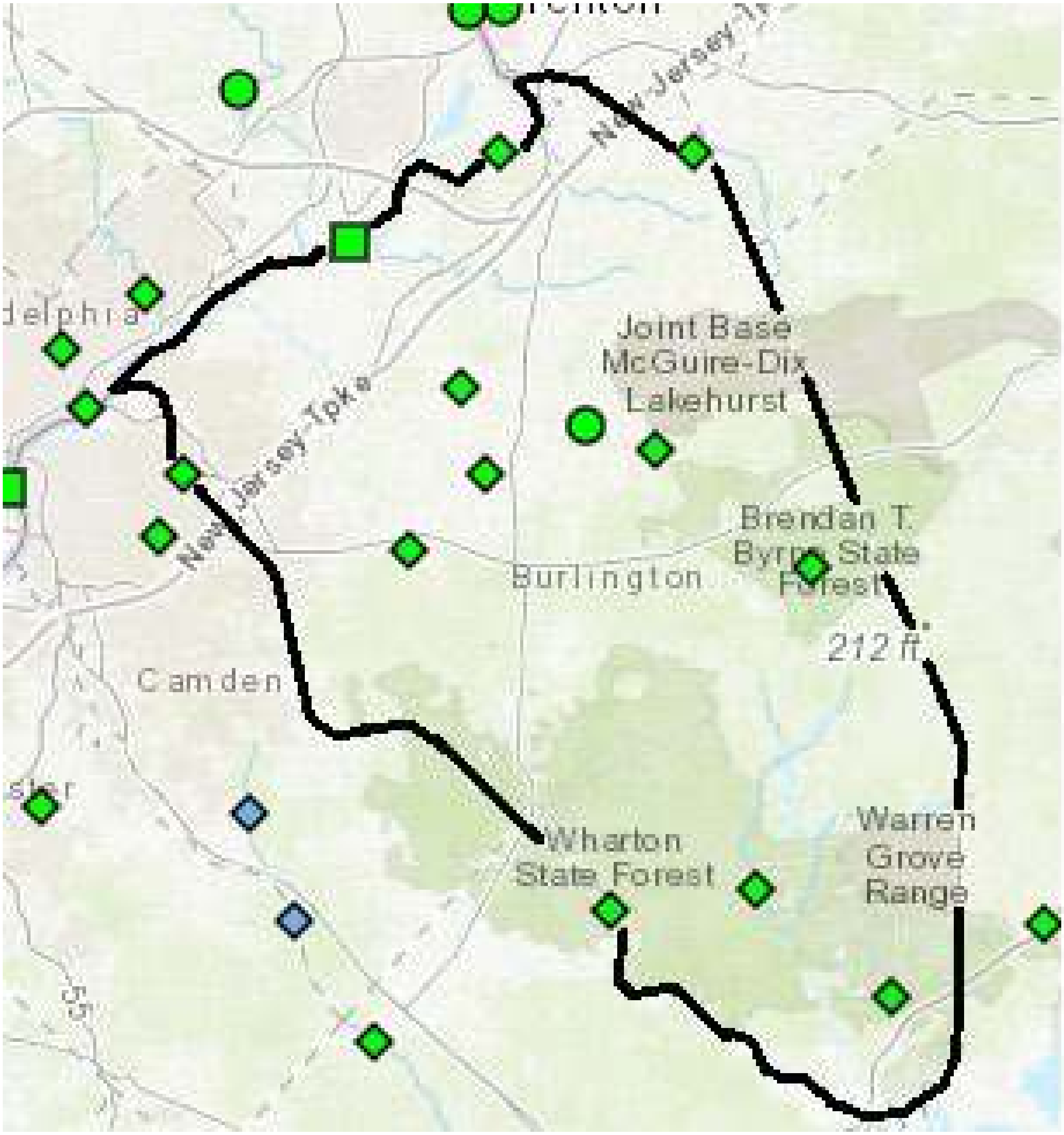
Flash Flooding

Flash flooding, like riverine flooding, occurs throughout the County, primarily along the bodies of water that flow through it.

Stormwater/Urban Flooding

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

Figure 4.3.6-5. Stream Gages in Burlington County



Source: NWS 2023

Coastal Flooding

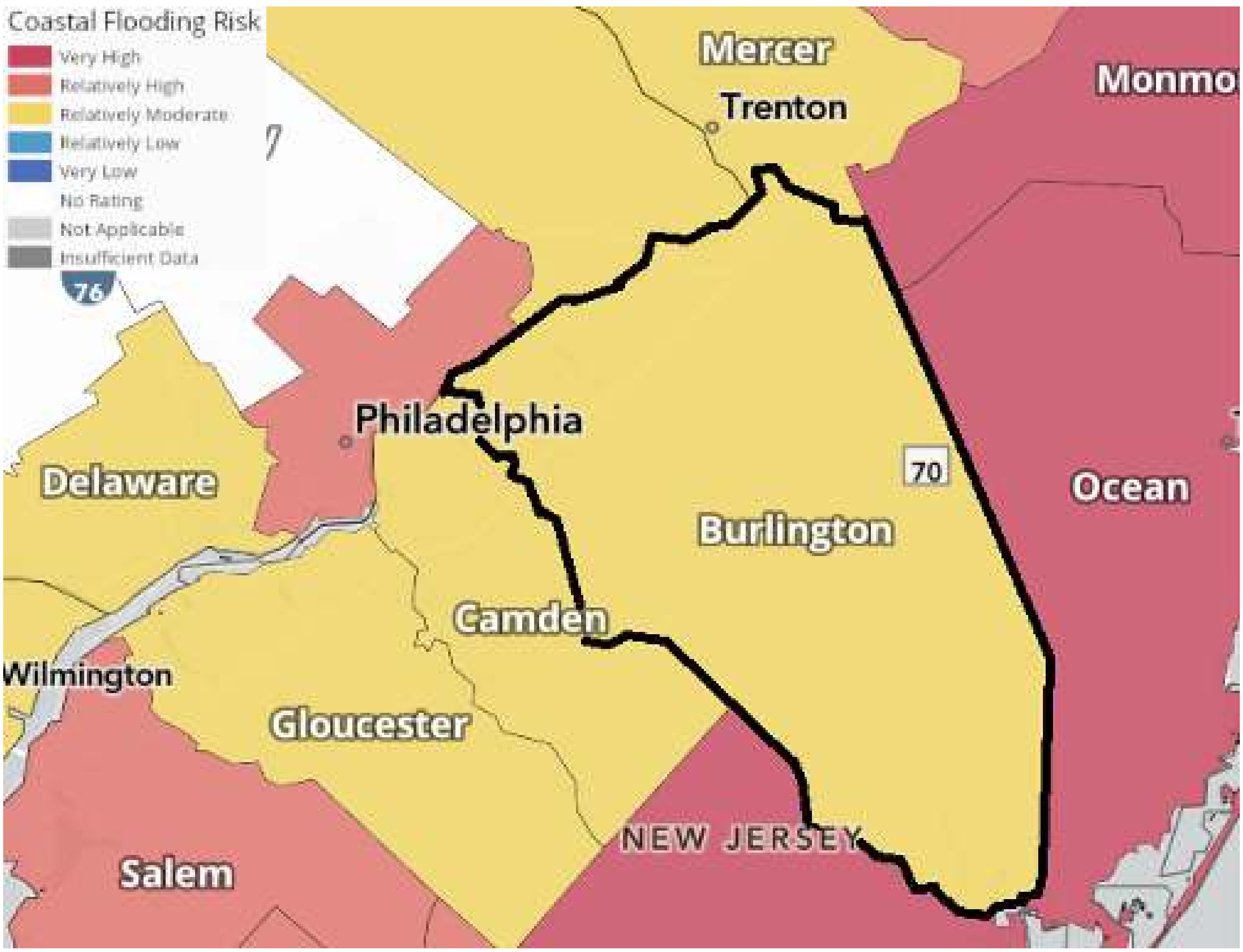
Portions of Burlington County experience coastal flooding from the Delaware River or Mullica River caused by extremely high tides and/or storm surge events. The reach of storm surge is dependent on the elevation of the land

and the height of the storm tide. Inland communities are also vulnerable to storm surge events as rising water levels can also affect river systems, causing storm surges to travel upstream resulting in the flooding of inland areas (NOAA 2023). Refer to Section 4.3.7 for discussions on storm surge.

According to the United States Environmental Protection Agency (EPA), the East Coast suffers the most frequent coastal flooding and has experienced the largest increases in the number of flood days. In the EPA's Climate Indicator: Coastal Flooding, when comparing data from 1950-1959 to data from 2011-2020, the County is experiencing, on average, 5.4 more average number of flood days per year (EPA 2022).

Figure 4.3.6-6 displays the Coastal Flood Risk Index for the United States (the black circle is representative of the County vicinity). According to the National Risk Index, on the county scale, the County has a relatively moderate risk to coastal flooding; on the census tract scale (Figure 4.3.6-7), the County ranges from a very low risk to a relatively high risk for coastal flooding (FEMA 2023).

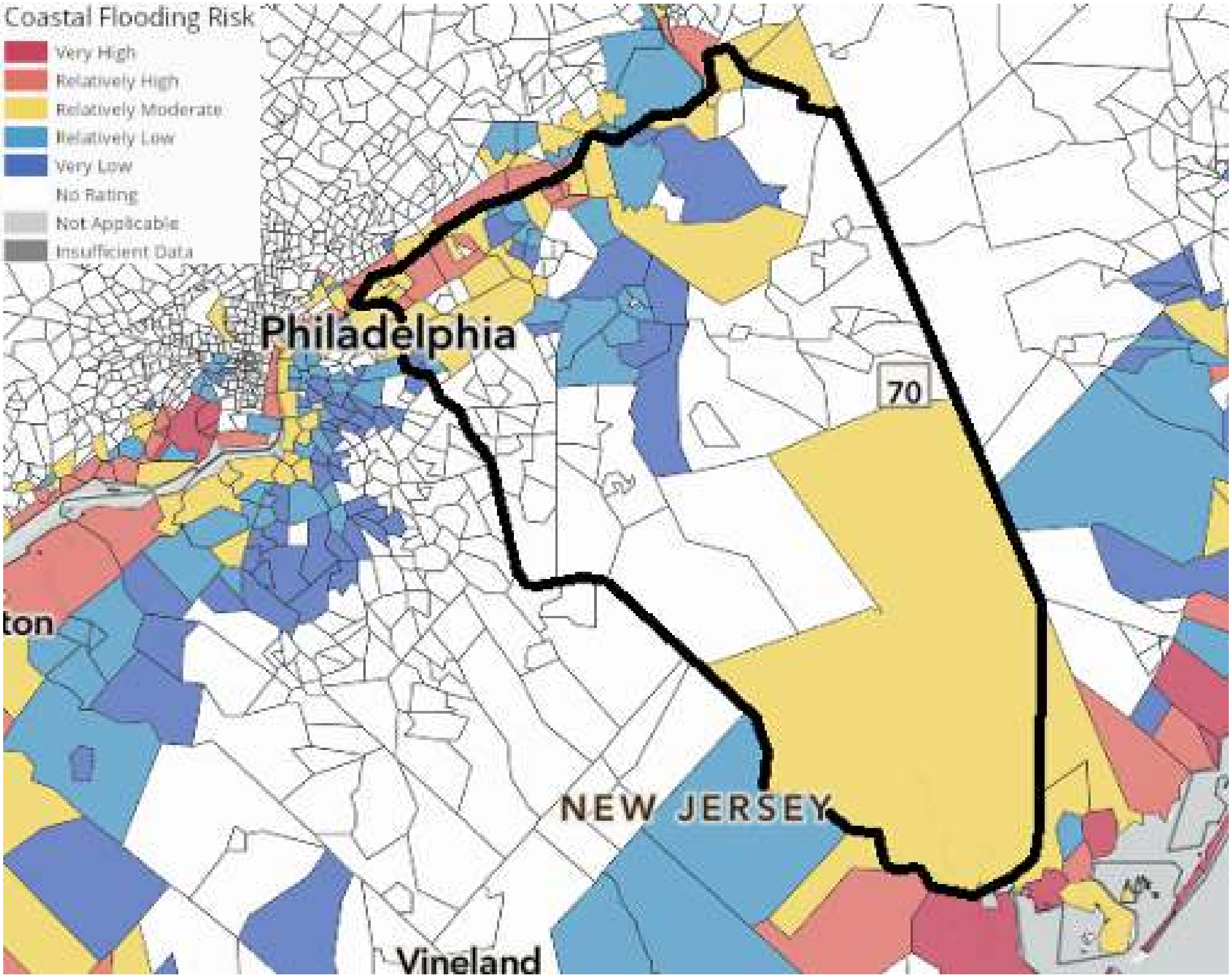
Figure 4.3.6-6. National Risk Index, Coastal Flood Risk Index Score Using the County Scale



Notes: Burlington County is outlined in black

Source: FEMA 2023

Figure 4.3.6-7. National Risk Index, Coastal Flood Risk Index Score Using the Census Tract Scale

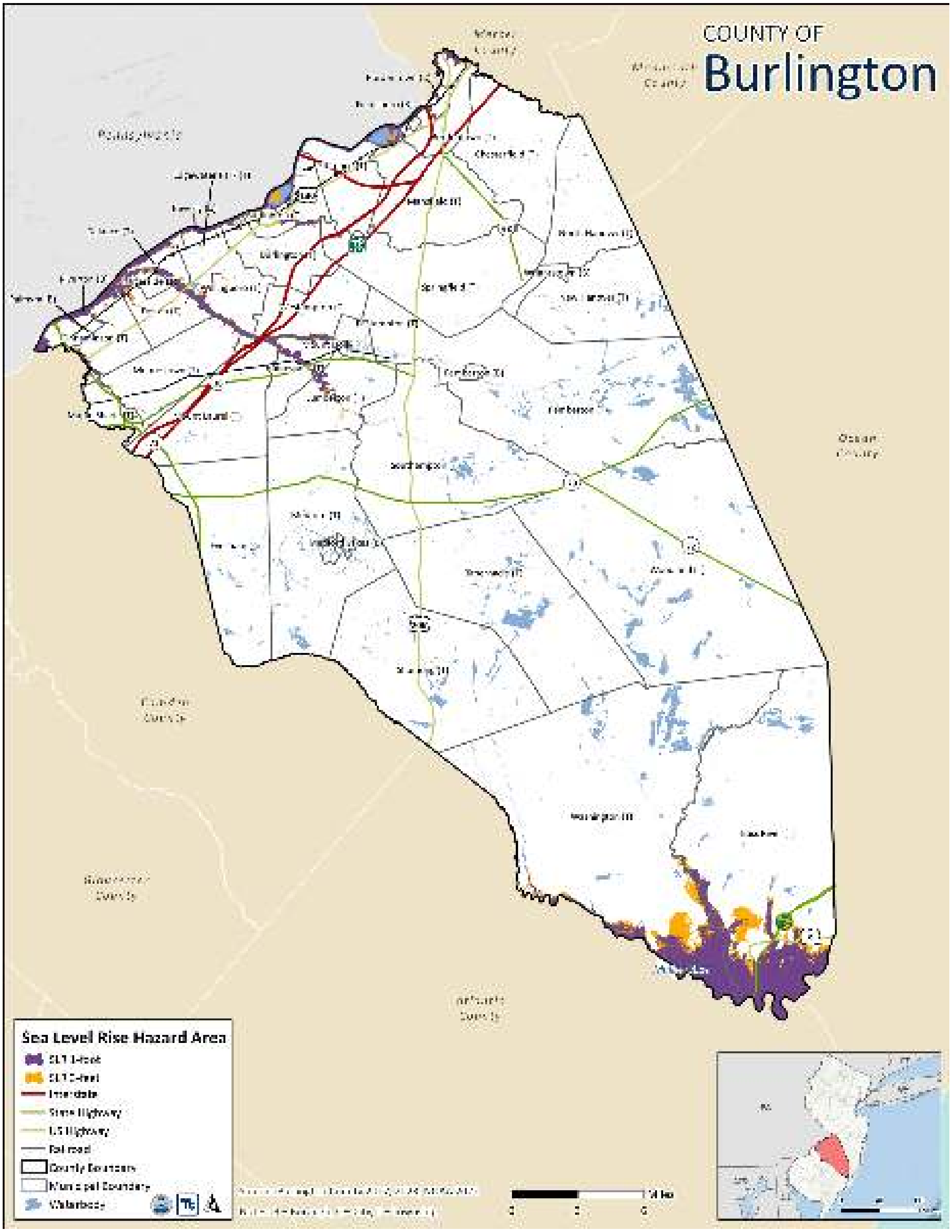


Source: FEMA 2023
Notes: Burlington County is outlined in black

Sea Level Rise

Similar to riverine flooding, the area most susceptible to sea level rise are those which border the Delaware River, the Mullica River, and their tributaries. As tidal rivers, the Delaware and Mullica Rivers are subject to elevated water levels due to sea level rise; refer to Figure 4.3.6-8. According to the 2020 New Jersey Scientific Report on Climate Change, by 2050, there is a 50 percent chance that sea-level rise will meet or exceed 1.4 feet and a 17 percent chance it will exceed 2.1 feet. Those levels increase to 3.3 and 5.1 feet by the end of the century (under a moderate emission scenario). Sunny day flooding, or nuisance flooding, a type of coastal flood, will occur more often across the entire coastal area of New Jersey due to sea-level rise. As the sea level rises, the starting elevation of flooding events will also rise. This means floods are likely to reach a higher elevation and push farther inland. As a result, the floodplain will expand, and the base flood elevation will rise (NJDEP 2020).

Figure 4.3.6-8. Sea Level Rise Hazard Areas in Burlington County



Erosion

Erosion in the County is limited to primarily coastal or fluvial (river and stream) erosion. While Burlington County has no open water on the Atlantic Ocean or Delaware Bay, it has two distinct areas that are at risk of coastal erosion: the western border along the Delaware River and the southeastern portion along Mullica River. Meanwhile, fluvial erosion may occur along all rivers, streams, and creeks that flow throughout the County.

Ice Jam Flooding

Ice jams are common in the northeast United States, and New Jersey is not an exception. According to USACE, New Jersey ranks 24th in the United States for total number of ice jam events, with 109 incidents documented between 1867 and 2023 (USACE 2022). Areas of New Jersey that include characteristics lending to ice jam flooding are the northern counties which border the Delaware River and its tributaries (i.e., Hunterdon, Warren, Sussex, and Mercer) and northern counties which border the Passaic River and its tributaries (i.e., Essex, Hudson, Passaic, and Bergen).

The Ice Jam Database, maintained by the Ice Engineering Group at the USACE Cold Regions Research and Engineering Laboratory (CRREL), currently consists of over 19,000 records from across the United States. According to the USACE-CRREL, Burlington County underwent has not been impacted by any historic ice jam incidents between 1780 and 2022 (USACE 2022).

Extent

The severity of a flood event is typically determined by a combination of several factors depending on the type of flooding event.

Riverine and Flash Flooding

The severity of riverine and flash flooding is determined by a combination of several factors including stream and river basin topography and physiography; precipitation and weather patterns; recent soil moisture conditions; and degree of vegetative clearing and impervious surface. Generally, floods are long-term events that may last for several days. Severity depends not only on the amount of water that accumulates in a period of time, but also on the land's ability to manage this water. One element is the size of rivers and streams in an area; but an equally important factor is the land's absorbency. When it rains, soil acts as a sponge. When the land is saturated or frozen, infiltration into the ground slows and any more water that accumulates must flow as runoff (Harris 2008).

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

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

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

Stormwater/ Urban Flooding

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

Coastal Flooding

Coastal flooding can cause impacts such as frequent road closures, reduced stormwater drainage capacity, and deterioration of infrastructure not designed to withstand frequent inundation or exposure to salt water. Coastal flooding can also affect human health by increasing the risk that drinking water and wastewater infrastructure will fail, putting people at risk of being exposed to pathogens and harmful chemicals (EPA 2022).

Coastal flooding can be categorized by the warnings, watches, and advisories issued by the National Weather Service (NWS). A coastal flood watch is issued when moderate-major coastal flooding is possible. A coastal flood warning is issued when moderate-major coastal flooding is actively occurring or imminent. A coastal flood advisory is issued when a minor or nuisance coastal flood is occurring or imminent for the area. All coastal flooding warnings, watches, and advisories have the potential to cause serious risk to both life and property in the County's coastal areas (NWS 2017).

Sea Level Rise

Sea level is measured by two main methods: tide gauges and satellite laser altimeters. Tide gauge stations from around the world have measured the daily high and low tides for over a century. Using data from these stations, scientists can calculate a global average of change. Since the early 1990s, sea level has been measured from space using laser altimeters. This method determines the height of the sea surface by measuring the return speed and intensity of a laser pulse directed at the ocean. The higher the sea level, the faster and stronger the return signal (NASA Earth Observatory 2020).

Erosion

The extent of erosion can be measured as the distance the shoreline retreats landward from the waterbody or the volume of sediment that is lost. Erosion can occur gradually over time or in episodic events, usually tied to floods.

Ice Jam Flooding

Ice jam flooding events often occur suddenly and are difficult to predict, allowing for little time to prepare for and warn of an event. Many factors will control the extent of an ice jam including the size of the snowpack, the rate of snowmelt, the size and flow of the river, and how quickly the jam releases (Rokaya 2018).

Previous Occurrences and Losses

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

FEMA Major Disasters and Emergency Declarations

Between May 1953 and June 2023, FEMA declared that the State of New Jersey experienced 38 flood-related disasters (DR) or emergencies (EM) classified as flooding, or as flooding with one or a combination of the following disaster types: Severe Storms; Severe Winter Storms; Inland and Coastal Flooding; Mudslides; Coastal Storm; High Tides; Heavy Rain; High Winds; and Hurricane or Tropical Storm. Generally, these disasters cover a wide region of the State; therefore, they may have impacted many counties. Burlington County was included in 15 of these flood-related declarations between 1954 and 2023, and three declarations since the 2019 Burlington County HMP. Table 4.3.6-3 lists declarations from May 1953 through June 2023 for this HMP update. Detailed information about the declared disasters since 1953 is provided in Section 3 (County Profile).

Table 4.3.6-3. FEMA Declarations for Flood Events in Burlington County

FEMA Declaration Number	Date of Declaration	Date of Event	Event Type	Event Title
DR-310-NJ	September 4, 1971	September 4, 1971	Flood	Severe Storms and Flooding
DR-477-NJ	July 23, 1975	July 23, 1975	Flood	Severe Storms and Inland and Coastal Flooding
EM-3148-NJ	September 17, 1999	September 16-18, 1999	Hurricane	Hurricane Floyd Emergency Declarations
DR-1530-NJ	July 16, 2004	July 12-23, 2004	Severe Storm	Severe Storms and Flooding
EM-3257-NJ	September 19, 2005	August 29 – October 1, 2005	Hurricane	Hurricane Katrina Evacuations
DR-1694-NJ	April 26, 2007	April 14-20, 2007	Severe Storm	Heavy Rains, Severe Storms, Hail, and Tornadoes
DR-1897-NJ	April 2, 2010	March 12 – April 15, 2010	Severe Storm	Heavy Rains and Flooding
EM-3332-NJ	August 27, 2011	August 26 – September 5, 2011	Hurricane	Hurricane Irene
DR-4021-NJ	August 31, 2011	August 26 – September 5, 2011	Hurricane	Hurricane Irene
EM-3354-NJ	October 28, 2012	October 26 – November 8, 2012	Hurricane	Hurricane Sandy
DR-4086-NJ	October 30, 2012	October 26 – November 8, 2012	Hurricane	Hurricane Sandy
DR-4231-NJ	July 22, 2015	June 23, 2015	Severe Storm	Severe Storm
DR-4264-NJ	March 14, 2016	January 22-24, 2016	Severe Storm	Severe Winter Storm and Snowstorm
DR-4368-NJ	June 8, 2018	March 6-7, 2018	Severe Storm	Severe Winter Storm and Snowstorm
DR-4574-NJ	December 11, 2020	August 4, 2020	Tropical Storm	New Jersey Tropical Storm Isaias
EM-3573-NJ	September 3, 2021	September 1-3, 2021	Hurricane	New Jersey Remnants of Hurricane Ida
DR-4614-NJ	September 3, 2021	September 1-3, 2021	Hurricane	New Jersey Remnants of Hurricane Ida

Source: FEMA 2023

U.S. Department of Agriculture Disaster Declarations

The Secretary of Agriculture from the U.S. Department of Agriculture (USDA) is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in counties that are contiguous to a designated county. Between August 2018 and June 2023, Burlington County was included in one flood-related agricultural disaster declaration, as listed in Table 4.3.6-4.

Table 4.3.6-4. USDA Declarations for Flood Events in Burlington County, August 2018 – June 2023

Date of Event	Event Type	Declaration Number	Description
April 1 – June 21, 2019	Flood, Flash Flood	S4519	Excessive rain, flash flooding, and flooding

Source: USDA 2023

Previous Events

For the 2024 HMP update, known flood events that impacted Burlington County between August 2018 and March 2023 are listed in Table 4.3.6-5. For events prior to August 2018, refer to the 2019 Burlington County HMP.

Table 4.3.6-5. Flood Incidents in Burlington County, 2018 to 2023

Date of Event	Event Type	Declaration Number	Burlington County Designated?	Description
August 13, 2018	Flash Flood	N/A	N/A	Heavy rain resulted in widespread flash flooding in Burlington County. Heavy rain resulted in widespread roadway flooding in Palmyra, Maple Shade, and Moorestown. Sections of Route 73 and Route 38 were closed due to flooding. There were no property or crop damages reported from this event in the County.
August 31, 2018	Flash Flood	N/A	N/A	Locally heavy rain produced flash flooding in parts of Burlington County on the morning of August 31. Rainfall totals of 2.5 to 5.5 inches fell in a short amount of time. Heavy rain produced flash flooding on Route 530 just east of Route 206 in Southampton Township. There were no property or crop damages reported from this event in the County.
September 9-11, 2018	Coastal Flood	N/A	N/A	A weather system caused widespread moderate coastal flooding. The flooding occurred across three consecutive high tide cycles. Moderate flooding occurred along the tidal waterways in Southeastern Burlington County. The tide gauge at Burlington reached 10.62 feet. There were no property or crop damages reported from this event in the County.
September 25, 2018	Flash Flood	N/A	N/A	A quick 1 to 2 inches of rain fell in Burlington County during the late afternoon and early evening of September 25. Widespread roadway flooding in Delran Township. There were no property or crop damages reported from this event in the County.
October 27, 2018	Coastal Flood	N/A	N/A	A weather system brought moderate to major coastal flooding and high winds to Burlington County. Moderate to major coastal flooding occurred along the tidal waterways of southeastern Burlington County. There was roadway flooding with water reaching some structures. There were several road closures along the Mullica River in Lower Bank and vicinity. There were no property or crop damages reported from this event in the County.
November 25-26, 2018	Coastal Flood	N/A	N/A	A coastal storm resulted in moderate tidal flooding along the Delaware River and its tidal tributaries. Some roads were flooded. The tide gauge at Burlington reached 10.78 feet. There were no property or crop damages reported from this event in the County.
May 29, 2019	Flash Flood	N/A	N/A	Strong to severe thunderstorms brought heavy rain; totals of 1 to 2 inches fell in a short amount of time, with some locally higher amounts reported. Widespread roadway flooding in Riverside and Delran. Many roads were impassable. There were no property or crop damages reported from this event in the County.

Date of Event	Event Type	Declaration Number	Burlington County Designated?	Description
June 19-20, 2019	Flash Flood	S4519	Yes	Showers and thunderstorms produced heavy rainfall and flash flooding. Rainfall amounts of 3 to nearly 6 inches were reported in Burlington County, causing significant flash flooding. Widespread roadway flooding occurred in Burlington City, Burlington Township, Pemberton Township, Southampton, Medford, Evesham, Maple Shade, and Moorestown, resulting in several road closures. A few vehicles were trapped temporarily in the flood waters. The Rancocas Creek experienced flooding in Pemberton Township, Mount Holly, and Medford. A total of 28 homes were evacuated in the Southampton Township. A state of emergency was declared by Governor Phil Murphy. There were no property or crop damages reported from this event in the County.
July 5, 2019	Flash Flood	N/A	N/A	Thunderstorms brought locally heavy rain; 1 to around 2 inches fell in spots. Heavy rain resulted in widespread roadway flooding in Pemberton Township. There were no property or crop damages reported from this event in the County.
July 6, 2020	Flash Flood	N/A	N/A	Thunderstorms brought heavy rain; totals were as high as 2 to 4 inches fell in parts of the State. Union Mill Road in Mount Laurel was closed due to flooding. Ramblewood Parkway in Mount Laurel was inundated. Flash flooding occurred in Moorestown. West Central Avenue was impassable. Marter Avenue was inundated. There were no property or crop damages reported from this event in the County.
August 4, 2020	Coastal Flood	DR-4574-NJ	Yes	Tropical Storm Isaias caused moderate tidal flooding. There was roadway flooding in some of the tidal areas of northwestern Burlington County along the Delaware River and its tidal tributaries. There were no property or crop damages reported from this event in the County.
August 12, 2020	Flash Flood	N/A	N/A	Thunderstorms brought locally heavy rain; totals were as high as 2 to 4 inches. Several water rescues took place in Maple Shade. NJ Route 38 was closed near South Lenola Road in Maple Shade. There were no property or crop damages reported from this event in the County.
June 9, 2021	Flash Flood	N/A	N/A	Thunderstorms brought locally heavy rain; totals of 2 to 3 inches occurred in the far northwestern part of Burlington County. Widespread roadway flooding occurred in Edgewater Park. There were no property or crop damages reported from this event in the County.
July 12, 2021	Flash Flood	N/A	N/A	Thunderstorms brought locally heavy rain; rainfall totals up to 5 to 8 inches occurred in Burlington County prompting the issuance of a Flash Flood Emergency. Widespread roadway flooding occurred in Florence Township, Burlington City, Burlington Township, Edgewater Park, Beverly, Palmyra, Delanco, and Riverside causing numerous road closures. There were several water rescues. There were no property or crop damages reported from this event in the County.

Date of Event	Event Type	Declaration Number	Burlington County Designated?	Description
July 21, 2021	Flash Flood	N/A	N/A	Thunderstorms brought locally heavy rain; there were rainfall totals up to 2 to 4 inches. Widespread roadway flooding occurred in Lumberton. There were no property or crop damages reported from this event in the County.
July 29, 2021	Flash Flood	N/A	N/A	Thunderstorms brought locally heavy rainfall, as much as 2 to 5 inches of rain fell in parts of the area. Beechwood Avenue and Pinewald Lane in Burlington Township became impassable due to flooding. There were no property or crop damages reported from this event in the County.
August 10, 2021	Flash Flood	N/A	N/A	Thunderstorms produced locally heavy rain in northern Burlington County. Rainfall totals were up to 2 to 4 inches. Flooding occurred at interchange 52 on Interstate 295 in Mansfield Township. The northbound ramp to Columbus Road was closed. Also, US Route 206 southbound was closed at Hedding Road in Mansfield Township. There were no property or crop damages reported from this event the County.
September 1-3, 2021	Coastal Flood, Flash Flood	EM-3573-NJ, DR-4614-NJ	Yes	Runoff from the heavy rain associated with Post Tropical Cyclone Ida produced moderate to major flooding along the tidal Delaware River on September 1 and 2, inundating adjacent roadways and properties. The tide gauge at Burlington, New Jersey tied its record level of 11.94 feet. NJ Route 73 in Palmyra was closed due to flooding. There were no property or crop damages reported from this event in the County.
October 28-29, 2021	Coastal Flood	N/A	N/A	A weather system caused moderate to major flooding along the tidal Delaware River and its tributaries between October 28 and 29. There were many road closures with the flood waters affecting numerous homes and businesses. The tide gauge at Burlington reached a level of 11.30 feet. There were no property or crop damages reported from this event in the County.
October 3-4, 2022	Coastal Flood	N/A	N/A	A weather system caused widespread roadway flooding and some property inundation occurred in the tidal areas of southeastern Burlington County. There were no property or crop damages reported from this event in the County.
December 23, 2022	Coastal Flood	N/A	N/A	A weather system produced tidal flooding in New Jersey, resulting in widespread roadway flooding in the tidal communities of northwestern Burlington County. The flood waters affected some vulnerable buildings. The tide gauge at Burlington reached 10.77 feet. There were no property or crop damages reported from this event in the County.
April 15, 2023	Flash Flood	N/A	N/A	Thunderstorms produced locally heavy rain, leading to rainfall totals as high as 2.0 to 3.5 inches. Larchmont Boulevard in Mount Laurel Township was closed at Willow Turn due to flooding. The water was up to 2 or 3 feet deep, and one vehicle became stranded. $3,000 in property damages were reported from this event in the County.

Source: NOAA NCEI 2023; FEMA 2023; USDA 2023

TETRA TECH

Probability of Future Occurrence

For the 2024 HMP update, the most up-to-date data was collected to calculate the probability of future occurrence of flood events for the County. Information from NOAA-NCEI storm events database, the 2020 State of New Jersey HMP, the 2020 Burlington County HMP, and the United States Army Corps of Engineers Cold Regions Research and Engineering Laboratory (USACE CRREL) were used to identify the number of flood events that occurred between January 1950 and March 2023. Table 4.3.6-6 presents the probability of future events for flood in Burlington County.

Table 4.3.6-6. Probability of Future Occurrences of Flood Events

Hazard Type	Occurrences Between 1950 and 2023	% Chance of Occurring in Any Given Year
Coastal Flood	53	72.60%
Flash Flood	52	71.23%
Flood	38	52.05%
Ice Jam	0	0
Total	**143**	**100%**

Source: NOAA 2023; USACE 2022; FEMA 2023

Note: Disaster occurrences include federally declared disasters since the 1950 Federal Disaster Relief Act, and selected events since 1968. 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 underestimated.

In Section 4.4, the identified hazards of concern for the County were ranked (Table 4.4-2). The probability of occurrence, or likelihood of the event, is one parameter used for hazard rankings. Based on historical records and input from the Planning Team, the probability of occurrence for flooding in the County is considered 'frequent'.

Climate Change Impacts

Providing projections of future climate change for a specific region is challenging. Shorter term projections are more closely tied to existing trends making longer term projections even more challenging. The further out a prediction reaches the more subject to changing dynamics it becomes.

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 (1.9 °C) increase in the State's average temperature, which is faster than the rest of the Northeast region (2 °F [1.1 °C]) and the world (1.5 °F [0.8 °C]). This warming trend is expected to continue. By 2050, temperatures in New Jersey are expected to increase by 4.1 to 5.7 °F (2.3 °C to 3.2 °C). 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 (5.6 °C) 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. Changes in winter temperatures could result in a change in the frequency of ice jam events (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, New Jersey 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. New Jersey will experience more intense rain events, less snow, and more rainfalls. 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).

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. Over the last 50 years, in 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).

Vulnerability Assessment

To assess Burlington County's risk to the flood hazard, a spatial analysis was conducted using the FEMA Risk Map effective dated 2019. The depth grid was developed for the 2023 Burlington County HMP using data from USGS's 1-meter-resolution Digital Elevation Model from 2021. 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 flood model.

Sea level rise 1-foot and 3-foot hazard data was source from NOAA. For this risk assessment, the sea level rise hazard area data was utilized to determine what assets are exposed. Population, general building stock, critical facility, and anticipated new development datasets were overlaid with the hazard area. Assets with their centroid in the hazard area were totaled to estimate the risk associated with impacts from sea level rise, in regard to building replacement cost value (RCV) and vulnerable populations. These results are summarized below.

Impact on Life, Health, and Safety

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

Exposure represents the population living in or near floodplain areas that could be impacted should a flood event occur. Additionally, exposure should not be limited to only those who reside in a defined hazard zone, but everyone who may be affected by the effects of a hazard event (e.g., people are at risk while traveling in flooded areas, or their access to emergency services is compromised during an event). The degree of that impact will vary and is not strictly measurable.

To estimate population exposure to the 1-percent and 0.2-percent annual chance flood events, the DFIRM flood boundaries were used. Based on the spatial analysis, there are an estimated 14,583 residents living in the 1-percent annual chance floodplain, or 3.2 percent of the County's total population. The City of Burlington has the greatest number of residents living in the floodplain, with approximately 6,237 residents living in the 1-percent annual chance floodplain. Based on the same analysis, there are an estimated 25,026 residents living in the 0.2-percent annual chance floodplain, or 5.4 percent of the County's total population. The City of Burlington has the greatest number of residents living in the floodplain, with approximately 7,548 residents living in the 0.2-percent annual chance floodplain. Table 4.3.6-7 summarizes the population exposed to the flood hazard by jurisdiction.

To estimate population exposure to sea level rise, the 1-foot and 3-foot hazard data was sourced from NOAA. Based on the spatial analysis, there are an estimated 225 residents living in the Sea Level Rise 1-foot Hazard Area, or <0.1-percent of the County's total population. The Township of Cinnaminson has the greatest number of residents living in the hazard area, with approximately 38 residents living in the Sea Level Rise 1-foot Hazard Area. Based on the same analysis, there are an estimated 677 residents living in the Sea Level Rise 3-foot Hazard Area, or 0.1-percent of the County's total population. The Township of Cinnaminson has the greatest number of residents living in the hazard area, with approximately 226 residents living in the Sea Level Rise 3-foot Hazard Area. Table 4.3.6-8 summarizes the population exposed to the hazard area by jurisdiction.

Using 2021 American Community Survey (ACS) data, Hazus estimates the potential sheltering needs as a result of a 1-percent annual chance flood event. For the 1-percent flood event, Hazus estimates 19,651 individuals will be displaced, and 2,204 people will seek short-term sheltering. These statistics, by jurisdiction and by flood zone, are presented in Table 4.3.6-9.

Socially Vulnerable Populations

Research has shown that some populations, while they may not have more hazard exposure, may experience exacerbated impacts and prolonged recovery if/when impacted. This is due to many factors, including their physical and financial ability to react or respond during a hazard. Of the population exposed, the most vulnerable include the economically disadvantaged and the population over age 65. Economically disadvantaged populations may be more vulnerable because they are likely to evaluate their risk and make decisions to evacuate based on net economic impacts on their families. The population over age 65 is also more vulnerable because they are more likely to seek or need medical attention that may not be available due to isolation during a flood event, and they may have more difficulty evacuating. According to the 2021 5-year ACS estimates, there are 27,947 total persons living below the poverty level, 78,093 persons over the age of 65 years, 23,350 persons under the age of 5 years, 9,103 non-English speakers, and 51,899 persons with a disability in Burlington County, as shown in Table 4.3.6-10.

The Centers for Disease Control and Prevention (CDC) 2020 Social Vulnerability Index (SVI) ranks U.S. Census tracts on socioeconomic status, household composition and disability, minority status and language, and housing and transportation. Burlington County's overall national score is 0.2648 and a state score of 0.3, both indicating that its communities have a low to medium level of social vulnerability (CDC 2020). This score indicates that some County residents may not have enough resources to respond to flood events.

Table 4.3.6-7. Estimated Population Exposed to the 1-percent and 0.2-percent Annual Chance Flood Event

Jurisdiction	Total Population (Decennial Population 2020)	Estimated Population in the Flood Hazard Area			
		1-Percent Annual Chance Flood		0.2-Percent Annual Chance Flood	
		Number	Percent of Total	Number	Percent of Total
Bass River (T)	1,355	440	32.5%	676	49.9%
Beverly (C)	2,499	26	1.0%	177	7.1%
Bordentown (C)	3,993	39	1.0%	48	1.2%
Bordentown (T)	11,791	38	0.3%	61	0.5%
Burlington (C)	9,743	6,237	64.0%	7,548	77.5%

Jurisdiction	Total Population (Decennial Population 2020)	Estimated Population in the Flood Hazard Area			
		1-Percent Annual Chance Flood		0.2-Percent Annual Chance Flood	
		Number	Percent of Total	Number	Percent of Total
Burlington (T)	23,983	202	0.8%	995	4.2%
Chesterfield (T)	9,422	9	0.1%	9	0.1%
Cinnaminson (T)	17,064	861	5.0%	1,559	9.1%
Delanco (T)	4,824	233	4.8%	1,255	26.0%
Delran (T)	17,882	518	2.9%	787	4.4%
Eastampton (T)	6,191	192	3.1%	213	3.4%
Edgewater Park (T)	8,930	9	0.1%	26	0.3%
Evesham (T)	46,826	284	0.6%	380	0.8%
Fieldsboro (B)	526	3	0.5%	3	0.5%
Florence (T)	12,812	21	0.2%	21	0.2%
Hainesport (T)	6,035	153	2.5%	177	2.9%
Lumberton (T)	12,803	410	3.2%	434	3.4%
Mansfield (T)	8,897	8	0.1%	8	0.1%
Maple Shade (T)	19,980	93	0.5%	301	1.5%
Medford (T)	24,497	308	1.3%	537	2.2%
Medford Lakes (B)	4,264	164	3.8%	171	4.0%
Moorestown (T)	21,355	321	1.5%	459	2.1%
Mount Holly (T)	9,981	306	3.1%	996	10.0%
Mount Laurel (T)	44,633	307	0.7%	1,431	3.2%
New Hanover (T)	6,367	173	2.7%	173	2.7%
North Hanover (T)	7,963	54	0.7%	54	0.7%
Palmyra (B)	7,438	470	6.3%	2,444	32.9%
Pemberton (B)	1,371	3	0.2%	6	0.4%
Pemberton (T)	26,903	868	3.2%	1,002	3.7%
Riverside (T)	8,003	463	5.8%	948	11.8%
Riverton (B)	2,764	80	2.9%	580	21.0%
Shamong (T)	6,460	93	1.4%	102	1.6%
Southampton (T)	10,317	258	2.5%	288	2.8%
Springfield (T)	3,245	22	0.7%	22	0.7%
Tabernacle (T)	6,776	16	0.2%	18	0.3%
Washington (T)	693	181	26.2%	283	40.8%
Westampton (T)	9,121	126	1.4%	137	1.5%
Willingboro (T)	31,889	578	1.8%	681	2.1%
Woodland (T)	1,544	15	1.0%	18	1.2%
Wrightstown (B)	720	0	0.0%	0	0.0%
Burlington County (Total)	**461,860**	**14,583**	**3.2%**	**25,026**	**5.4%**

Source: Burlington County, 2023; NJOGIS 2023; Microsoft BING 2022; U.S. Census Bureau 2020; FEMA 2019

Table 4.3.6-8. Estimated Population Exposed to the 1-Foot and 3-Foot Sea Level Rise

Jurisdiction	Total Population (Decennial Population 2020)	Estimated Population in Sea Level Rise Inundation Area			
		1-Foot Sea Level Rise		3-Foot Sea Level Rise	
		Number	Percent of Total	Number	Percent of Total
Bass River (T)	1,355	21	1.6%	51	3.8%
Beverly (C)	2,499	0	0.0%	0	0.0%
Bordentown (C)	3,993	4	0.1%	4	0.1%
Bordentown (T)	11,791	15	0.1%	19	0.2%

Jurisdiction	Total Population (Decennial Population 2020)	Estimated Population in Sea Level Rise Inundation Area			
		1-Foot Sea Level Rise		3-Foot Sea Level Rise	
		Number	Percent of Total	Number	Percent of Total
Burlington (C)	9,743	11	0.1%	18	0.2%
Burlington (T)	23,983	0	0.0%	0	0.0%
Chesterfield (T)	9,422	9	0.1%	9	0.1%
Cinnaminson (T)	17,064	38	0.2%	226	1.3%
Delanco (T)	4,824	6	0.1%	12	0.2%
Delran (T)	17,882	0	0.0%	91	0.5%
Eastampton (T)	6,191	0	0.0%	0	0.0%
Edgewater Park (T)	8,930	4	<0.1%	4	<0.1%
Evesham (T)	46,826	0	0.0%	0	0.0%
Fieldsboro (B)	526	3	0.5%	3	0.5%
Florence (T)	12,812	0	0.0%	0	0.0%
Hainesport (T)	6,035	8	0.1%	13	0.2%
Lumberton (T)	12,803	32	0.2%	60	0.5%
Mansfield (T)	8,897	0	0.0%	0	0.0%
Maple Shade (T)	19,980	8	<0.1%	8	<0.1%
Medford (T)	24,497	0	0.0%	0	0.0%
Medford Lakes (B)	4,264	0	0.0%	0	0.0%
Moorestown (T)	21,355	30	0.1%	33	0.2%
Mount Holly (T)	9,981	0	0.0%	7	0.1%
Mount Laurel (T)	44,633	0	0.0%	4	<0.1%
New Hanover (T)	6,367	0	0.0%	0	0.0%
North Hanover (T)	7,963	0	0.0%	0	0.0%
Palmyra (B)	7,438	10	0.1%	16	0.2%
Pemberton (B)	1,371	0	0.0%	0	0.0%
Pemberton (T)	26,903	0	0.0%	0	0.0%
Riverside (T)	8,003	0	0.0%	10	0.1%
Riverton (B)	2,764	3	0.1%	3	0.1%
Shamong (T)	6,460	0	0.0%	0	0.0%
Southampton (T)	10,317	0	0.0%	0	0.0%
Springfield (T)	3,245	0	0.0%	0	0.0%
Tabernacle (T)	6,776	0	0.0%	0	0.0%
Washington (T)	693	18	2.6%	39	5.6%
Westampton (T)	9,121	0	0.0%	22	0.2%
Willingboro (T)	31,889	6	<0.1%	24	0.1%
Woodland (T)	1,544	0	0.0%	0	0.0%
Wrightstown (B)	720	0	0.0%	0	0.0%
Burlington County (Total)	**461,860**	**225**	**<0.1%**	**677**	**0.1%**

Source: Burlington County, 2023; NJOGIS 2023; Microsoft BING 2022; U.S. Census Bureau 2020; NOAA 2022

Table 4.3.6-9. Estimated Population Displaced or Seeking Short-Term Shelter from the 1-Percent Annual Chance Flood Event

Jurisdiction	Total Population (American Community Survey 2021)	Estimated Displaced Population	Estimated Persons Seeking Short-Term Sheltering
Bass River (T)	1,355	386	30
Beverly (C)	2,499	116	17
Bordentown (C)	3,993	41	8

Jurisdiction	Total Population (American Community Survey 2021)	Estimated Displaced Population	Estimated Persons Seeking Short-Term Sheltering
Bordentown (T)	11,791	139	32
Burlington (C)	9,743	7,292	430
Burlington (T)	23,983	237	34
Chesterfield (T)	9,422	16	3
Cinnaminson (T)	17,064	1,165	37
Delanco (T)	4,824	342	46
Delran (T)	17,882	530	102
Eastampton (T)	6,191	127	22
Edgewater Park (T)	8,930	1	0
Evesham (T)	46,826	777	205
Fieldsboro (B)	526	16	2
Florence (T)	12,812	43	7
Hainesport (T)	6,035	183	6
Lumberton (T)	12,803	349	48
Mansfield (T)	8,897	43	17
Maple Shade (T)	19,980	382	76
Medford (T)	24,497	650	86
Medford Lakes (B)	4,264	273	1
Moorestown (T)	21,355	496	115
Mount Holly (T)	9,981	582	120
Mount Laurel (T)	44,633	826	187
New Hanover (T)	6,367	17	5
North Hanover (T)	7,963	33	14
Palmyra (B)	7,438	967	54
Pemberton (B)	1,371	10	4
Pemberton (T)	26,903	1,099	188
Riverside (T)	8,003	510	57
Riverton (B)	2,764	118	2
Shamong (T)	6,460	166	26
Southampton (T)	10,317	374	51
Springfield (T)	3,245	49	3
Tabernacle (T)	6,776	34	9
Washington (T)	693	198	6
Westampton (T)	9,121	261	32
Willingboro (T)	31,889	779	115
Woodland (T)	1,544	17	5
Wrightstown (B)	720	8	2
Burlington County (Total)	**461,860**	**19,651**	**2,204**

Source: Hazus v6.0

Table 4.3.6-10. Burlington County Socially Vulnerable Populations by Municipality

	Decennial Population 2020		American Community Survey 5-Year Population Estimates (2021)									
			Population Over 65		Population Under 5		Non-English Speaking Population		Population with Disability		Population Below Poverty Level	
Jurisdiction[a]	Jurisdiction Total	% of County Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total
Bass River (T)	1,355	0.3%	248	18.3%	67	4.9%	0	0.0%	175	12.9%	95	7.0%
Beverly (C)	2,499	0.5%	292	11.7%	183	7.3%	0	0.0%	249	10.0%	300	12.0%
Bordentown (C)	3,993	0.9%	772	19.3%	216	5.4%	16	0.4%	422	10.6%	227	5.7%
Bordentown (T)	11,791	2.6%	1,601	13.6%	472	4.0%	289	2.4%	1,092	9.3%	194	1.6%
Burlington (C)	9,743	2.1%	1,301	13.4%	661	6.8%	208	2.1%	1,251	12.8%	1,422	14.6%
Burlington (T)	23,983	5.2%	3,526	14.7%	1,497	6.2%	385	1.6%	2,366	9.9%	2,185	9.1%
Chesterfield (T)	9,422	2.0%	760	8.1%	578	6.1%	153	1.6%	423	4.5%	165	1.8%
Cinnaminson (T)	17,064	3.7%	3,103	18.2%	929	5.4%	208	1.2%	1,661	9.7%	584	3.4%
Delanco (T)	4,824	1.0%	1,297	26.9%	191	4.0%	42	0.9%	676	14.0%	322	6.7%
Delran (T)	17,882	3.9%	2,570	14.4%	1,047	5.9%	723	4.0%	1,548	8.7%	902	5.0%
Eastampton (T)	6,191	1.3%	557	9.0%	264	4.3%	0	0.0%	478	7.7%	488	7.9%
Edgewater Park (T)	8,930	1.9%	1,571	17.6%	700	7.8%	367	4.1%	1,465	16.4%	1,645	18.4%
Evesham (T)	46,826	10.1%	8,574	18.3%	2,237	4.8%	749	1.6%	4,504	9.6%	1,476	3.2%
Fieldsboro (B)	526	0.1%	82	15.6%	64	12.2%	0	0.0%	62	11.8%	36	6.8%
Florence (T)	12,812	2.8%	2,122	16.6%	645	5.0%	260	2.0%	1,460	11.4%	827	6.5%
Hainesport (T)	6,035	1.3%	1,327	22.0%	58	1.0%	0	0.0%	744	12.3%	250	4.1%
Lumberton (T)	12,803	2.8%	2,048	16.0%	661	5.2%	107	0.8%	1,490	11.6%	805	6.3%
Mansfield (T)	8,897	1.9%	2,506	28.2%	394	4.4%	330	3.7%	1,465	16.5%	181	2.0%
Maple Shade (T)	19,980	4.3%	2,897	14.5%	1,159	5.8%	694	3.5%	2,433	12.2%	1,971	9.9%
Medford (T)	24,497	5.3%	5,151	21.0%	1,085	4.4%	31	0.1%	2,775	11.3%	724	3.0%
Medford Lakes (B)	4,264	0.9%	879	20.6%	211	4.9%	0	0.0%	407	9.5%	26	0.6%
Moorestown (T)	21,355	4.6%	3,480	16.3%	837	3.9%	603	2.8%	1,654	7.7%	807	3.8%
Mount Holly (T)	9,981	2.2%	1,199	12.0%	454	4.5%	133	1.3%	1,624	16.3%	958	9.6%
Mount Laurel (T)	44,633	9.7%	8,299	18.6%	2,011	4.5%	889	2.0%	4,203	9.4%	1,689	3.8%
New Hanover (T)	6,367	1.4%	311	4.9%	214	3.4%	29	0.4%	192	3.0%	116	1.8%
North Hanover (T)	7,963	1.7%	532	6.7%	975	12.2%	125	1.6%	631	7.9%	481	6.0%
Palmyra (B)	7,438	1.6%	1,077	14.5%	190	2.6%	44	0.6%	961	12.9%	616	8.3%
Pemberton (B)	1,371	0.3%	282	20.6%	56	4.1%	47	3.4%	308	22.5%	140	10.2%

Jurisdiction[a]	Decennial Population 2020		American Community Survey 5-Year Population Estimates (2021)									
			Population Over 65		Population Under 5		Non-English Speaking Population		Population with Disability		Population Below Poverty Level	
	Jurisdiction Total	% of County Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total
Pemberton (T)	26,903	5.8%	4,306	16.0%	1,429	5.3%	1,092	4.1%	4,006	14.9%	2,518	9.4%
Riverside (T)	8,003	1.7%	1,039	13.0%	354	4.4%	754	9.4%	972	12.1%	1,257	15.7%
Riverton (B)	2,764	0.6%	554	20.0%	80	2.9%	5	0.2%	187	6.8%	72	2.6%
Shamong (T)	6,460	1.4%	1,313	20.3%	324	5.0%	0	0.0%	671	10.4%	136	2.1%
Southampton (T)	10,317	2.2%	3,153	30.6%	293	2.8%	125	1.2%	1,551	15.0%	589	5.7%
Springfield (T)	3,245	0.7%	479	14.8%	129	4.0%	65	2.0%	311	9.6%	160	4.9%
Tabernacle (T)	6,776	1.5%	1,524	22.5%	380	5.6%	0	0.0%	747	11.0%	233	3.4%
Washington (T)	693	0.2%	138	19.9%	8	1.2%	8	1.1%	87	12.6%	21	3.0%
Westampton (T)	9,121	2.0%	1,139	12.5%	263	2.9%	81	0.9%	802	8.8%	268	2.9%
Willingboro (T)	31,889	6.9%	5,707	17.9%	1,916	6.0%	538	1.7%	5,100	16.0%	2,685	8.4%
Woodland (T)	1,544	0.3%	319	20.7%	49	3.2%	0	0.0%	627	40.6%	363	23.5%
Wrightstown (B)	720	0.2%	58	8.1%	69	9.6%	5	0.7%	119	16.5%	13	1.8%
Burlington County Total	**461,860**	**100.0%**	**78,093**	**16.9%**	**23,350**	**5.1%**	**9,103**	**2.0%**	**51,899**	**11.2%**	**27,947**	**6.1%**

Source: U.S. Census Bureau 2020, 2021

Note: Persons per household = 2.6

a. (B) = borough; (C) = city; (T) = township

Impact on General Building Stock

Exposure to the flood hazard includes those buildings located in the flood zone or those that are built downstream in other flood inundation areas such as dam failure inundation areas. The potential damage is the modeled loss that could occur to the exposed inventory measured by the structural and content replacement cost value. There are an estimated 5,163 buildings in the 1-percent annual flood chance event, representing approximately 5.6-percent of the County's total general building stock inventory replacement cost value. The City of Burlington has the greatest number of its buildings located in the 1-percent annual chance floodplain (2,083 buildings or 65.8-percent of its total building stock). There are an estimated 8,739 buildings in the 0.2-percent annual flood chance event, representing approximately 8.4-percent of the County's total general building stock inventory replacement cost value. The City of Burlington also has the greatest number of its buildings located in the 0.2-percent annual chance floodplain (2,524 buildings or 79.7 percent of its total building stock). Refer to Table 4.3.6-11 and Table 4.3.6-12 for the estimated exposure of 1-percent and 0.2-percent flood events by jurisdiction. Refer to Table 4.3.6-13 for the Hazus estimated losses by jurisdiction, for residential, commercial, and other occupancy structures.

There are an estimated 90 buildings in the Sea Level Rise 1-foot Hazard Area, representing approximately 0.3-percent of the County's total general building stock inventory replacement cost value. The Township of Cinnaminson has the greatest number of its buildings located in the Sea Level Rise 1-foot Hazard Area (16 buildings or 0.3-percent of its total building stock). There are an estimated 272 buildings in the Sea Level Rise 3-foot Hazard Area, representing approximately 0.5-percent of the County's total general building stock inventory replacement cost value. The Township of Cinnaminson also has the greatest number of its buildings located in the Sea Level Rise 3-foot Hazard Area (88 buildings or 1.5 percent of its total building stock). Refer to Table 4.3.6-14 and Table 4.3.6-15 for the estimated exposure of Sea Level Rise 1-foot Hazard Area and Sea Level Rise 3-foot Hazard Area by jurisdiction.

Table 4.3.6-11. Estimated General Building Stock Exposure to the 1-percent Annual Chance Flood Event

			Estimated Building Stock in the Flood Hazard Area			
			Building Count		RCV	
Jurisdiction	Total Number of Buildings	Total RCV	Number	Percent of Total	Value	Percent of Total
Bass River (T)	719	$881,423,037	214	29.8%	$169,037,202	19.2%
Beverly (C)	939	$1,218,790,334	11	1.2%	$9,354,732	0.8%
Bordentown (C)	1,041	$2,794,074,193	17	1.6%	$90,199,587	3.2%
Bordentown (T)	3,389	$5,866,485,431	18	0.5%	$177,505,555	3.0%
Burlington (C)	3,165	$5,813,312,404	2,083	65.8%	$4,481,395,625	77.1%
Burlington (T)	6,525	$8,819,483,894	62	1.0%	$492,986,877	5.6%
Chesterfield (T)	2,673	$2,243,175,804	5	0.2%	$11,835,419	0.5%
Cinnaminson (T)	5,833	$6,206,033,564	305	5.2%	$416,595,502	6.7%
Delanco (T)	1,717	$1,777,428,934	86	5.0%	$93,509,357	5.3%
Delran (T)	5,008	$5,342,639,406	162	3.2%	$127,588,494	2.4%
Eastampton (T)	1,947	$1,223,958,808	59	3.0%	$28,992,376	2.4%
Edgewater Park (T)	2,210	$2,391,677,740	2	0.1%	$761,508	0.0%
Evesham (T)	13,368	$11,128,366,531	87	0.7%	$109,319,385	1.0%
Fieldsboro (B)	224	$241,524,257	2	0.9%	$763,122	0.3%
Florence (T)	4,084	$6,582,323,116	17	0.4%	$137,080,738	2.1%
Hainesport (T)	2,546	$3,283,651,920	64	2.5%	$74,410,795	2.3%
Lumberton (T)	3,724	$4,304,673,748	119	3.2%	$142,278,141	3.3%
Mansfield (T)	3,805	$3,398,330,024	8	0.2%	$37,805,775	1.1%
Maple Shade (T)	5,120	$5,835,178,181	30	0.6%	$116,303,890	2.0%
Medford (T)	8,792	$10,042,226,056	116	1.3%	$122,325,754	1.2%
Medford Lakes (B)	1,804	$967,238,228	69	3.8%	$40,874,766	4.2%
Moorestown (T)	7,173	$12,232,463,125	101	1.4%	$119,950,840	1.0%
Mount Holly (T)	2,987	$3,763,298,318	111	3.7%	$280,105,073	7.4%
Mount Laurel (T)	13,150	$15,418,468,979	104	0.8%	$220,401,579	1.4%
New Hanover (T)	1,068	$2,868,939,587	10	0.9%	$23,551,593	0.8%
North Hanover (T)	2,176	$2,404,670,347	12	0.6%	$42,065,137	1.7%
Palmyra (B)	2,482	$2,133,107,140	177	7.1%	$345,610,698	16.2%
Pemberton (B)	519	$736,141,491	2	0.4%	$33,848,254	4.6%
Pemberton (T)	9,729	$6,973,242,840	307	3.2%	$256,921,515	3.7%
Riverside (T)	2,532	$2,459,954,166	171	6.8%	$204,957,287	8.3%
Riverton (B)	989	$1,096,729,598	33	3.3%	$64,939,947	5.9%
Shamong (T)	2,494	$2,504,926,736	37	1.5%	$63,932,288	2.6%
Southampton (T)	5,368	$4,593,018,255	141	2.6%	$227,762,051	5.0%
Springfield (T)	1,826	$2,140,517,320	25	1.4%	$59,118,241	2.8%
Tabernacle (T)	2,938	$2,200,440,237	7	0.2%	$12,011,860	0.5%
Washington (T)	538	$604,084,949	134	24.9%	$183,685,861	30.4%
Westampton (T)	2,795	$4,620,292,645	42	1.5%	$72,408,555	1.6%
Willingboro (T)	10,830	$8,789,434,159	195	1.8%	$140,916,806	1.6%
Woodland (T)	782	$1,333,495,830	18	2.3%	$99,904,641	7.5%
Wrightstown (B)	296	$748,872,423	0	0.0%	$0	0.0%
Burlington County (Total)	**149,305**	**$167,984,093,756**	**5,163**	**3.5%**	**$9,333,016,825**	**5.6%**

Source: Burlington County, 2023; NJOGIS 2023; Microsoft BING 2022; RS Means 2022; FEMA 2019

Table 4.3.6-12. Estimated General Building Stock Exposure to the 0.2-percent Annual Chance Flood Event

Jurisdiction	Total Number of Buildings	Total RCV	Estimated Building Stock in the Flood Hazard Area: Building Count – Number	Building Count – Percent of Total	RCV – Value	RCV – Percent of Total
Bass River (T)	719	$881,423,037	353	49.1%	$404,896,475	45.9%
Beverly (C)	939	$1,218,790,334	67	7.1%	$37,821,622	3.1%
Bordentown (C)	1,041	$2,794,074,193	19	1.8%	$90,948,803	3.3%
Bordentown (T)	3,389	$5,866,485,431	24	0.7%	$186,865,286	3.2%
Burlington (C)	3,165	$5,813,312,404	2,524	79.7%	$5,431,535,489	93.4%
Burlington (T)	6,525	$8,819,483,894	291	4.5%	$705,722,334	8.0%
Chesterfield (T)	2,673	$2,243,175,804	5	0.2%	$11,835,419	0.5%
Cinnaminson (T)	5,833	$6,206,033,564	545	9.3%	$723,901,218	11.7%
Delanco (T)	1,717	$1,777,428,934	434	25.3%	$300,538,840	16.9%
Delran (T)	5,008	$5,342,639,406	250	5.0%	$229,629,371	4.3%
Eastampton (T)	1,947	$1,223,958,808	65	3.3%	$32,028,160	2.6%
Edgewater Park (T)	2,210	$2,391,677,740	6	0.3%	$4,441,964	0.2%
Evesham (T)	13,368	$11,128,366,531	114	0.9%	$119,457,441	1.1%
Fieldsboro (B)	224	$241,524,257	2	0.9%	$763,122	0.3%
Florence (T)	4,084	$6,582,323,116	20	0.5%	$140,766,260	2.1%
Hainesport (T)	2,546	$3,283,651,920	73	2.9%	$76,386,957	2.3%
Lumberton (T)	3,724	$4,304,673,748	125	3.4%	$144,842,568	3.4%
Mansfield (T)	3,805	$3,398,330,024	9	0.2%	$39,958,635	1.2%
Maple Shade (T)	5,120	$5,835,178,181	84	1.6%	$205,639,749	3.5%
Medford (T)	8,792	$10,042,226,056	206	2.3%	$217,672,351	2.2%
Medford Lakes (B)	1,804	$967,238,228	74	4.1%	$42,403,509	4.4%
Moorestown (T)	7,173	$12,232,463,125	149	2.1%	$247,864,833	2.0%
Mount Holly (T)	2,987	$3,763,298,318	364	12.2%	$983,902,307	26.1%
Mount Laurel (T)	13,150	$15,418,468,979	449	3.4%	$904,801,220	5.9%
New Hanover (T)	1,068	$2,868,939,587	10	0.9%	$23,551,593	0.8%
North Hanover (T)	2,176	$2,404,670,347	12	0.6%	$42,065,137	1.7%
Palmyra (B)	2,482	$2,133,107,140	831	33.5%	$876,378,465	41.1%
Pemberton (B)	519	$736,141,491	4	0.8%	$34,806,891	4.7%
Pemberton (T)	9,729	$6,973,242,840	353	3.6%	$273,690,194	3.9%
Riverside (T)	2,532	$2,459,954,166	317	12.5%	$295,077,480	12.0%
Riverton (B)	989	$1,096,729,598	210	21.2%	$218,947,608	20.0%
Shamong (T)	2,494	$2,504,926,736	40	1.6%	$65,814,405	2.6%
Southampton (T)	5,368	$4,593,018,255	156	2.9%	$233,263,378	5.1%
Springfield (T)	1,826	$2,140,517,320	25	1.4%	$59,118,241	2.8%
Tabernacle (T)	2,938	$2,200,440,237	8	0.3%	$12,786,740	0.6%
Washington (T)	538	$604,084,949	217	40.3%	$250,408,467	41.5%
Westampton (T)	2,795	$4,620,292,645	45	1.6%	$73,427,467	1.6%
Willingboro (T)	10,830	$8,789,434,159	240	2.2%	$216,700,504	2.5%
Woodland (T)	782	$1,333,495,830	19	2.4%	$100,285,395	7.5%
Wrightstown (B)	296	$748,872,423	0	0.0%	$0	0.0%
Burlington County (Total)	**149,305**	**$167,984,093,756**	**8,739**	**5.9%**	**$14,060,945,896**	**8.4%**

Source: Burlington County, 2023; NJOGIS 2023; Microsoft BING 2022; RS Means 2022; FEMA 2019

TETRA TECH

Table 4.3.6-13. Estimated Building Stock Loss Due to the 1-Percent Annual Chance Flood Event

Jurisdiction	Total Replacement Cost Value (RCV)	Estimated Loss Due to 1-Percent Annual Chance Flood			
		Total	Residential	Commercial	All Other Occupancy Classes
Bass River (T)	$881,423,037	$46,432,708	$27,562,235	$7,630,261	$11,240,212
Beverly (C)	$1,218,790,333	$687,688	$112,203	$575,485	$0
Bordentown (C)	$2,794,074,193	$31,133,684	$1,227,469	$28,904,424	$1,001,791
Bordentown (T)	$5,866,485,430	$62,567,059	$915,491	$57,168,374	$4,483,195
Burlington (C)	$5,813,312,405	$1,075,964,126	$245,485,834	$706,759,175	$123,719,117
Burlington (T)	$8,819,483,895	$85,526,649	$3,038,464	$14,333,958	$68,154,228
Chesterfield (T)	$2,243,175,804	$5,566,919	$281,586	$0	$5,285,333
Cinnaminson (T)	$6,206,033,564	$106,732,947	$25,898,200	$63,463,389	$17,371,358
Delanco (T)	$1,777,428,934	$20,706,329	$5,970,187	$13,751,513	$984,628
Delran (T)	$5,342,639,406	$21,959,018	$11,294,844	$10,577,115	$87,059
Eastampton (T)	$1,223,958,808	$6,059,035	$4,850,365	$1,094,075	$114,594
Edgewater Park (T)	$2,391,677,740	$351,044	$351,044	$0	$0
Evesham (T)	$11,128,366,531	$16,841,660	$2,929,604	$12,429,109	$1,482,946
Fieldsboro (B)	$241,524,257	$270,286	$225,791	$0	$44,495
Florence (T)	$6,582,323,116	$28,330,303	$913,284	$25,683,391	$1,733,628
Hainesport (T)	$3,283,651,920	$24,288,107	$4,671,896	$19,616,211	$0
Lumberton (T)	$4,304,673,748	$28,279,966	$15,919,770	$2,261,347	$10,098,849
Mansfield (T)	$3,398,330,024	$886,705	$214,831	$665,292	$6,581
Maple Shade (T)	$5,835,178,181	$10,587,928	$1,576,484	$5,989,482	$3,021,962
Medford (T)	$10,042,226,056	$19,540,088	$4,942,831	$10,139,806	$4,457,451
Medford Lakes (B)	$967,238,228	$2,523,039	$2,514,550	$0	$8,488
Moorestown (T)	$12,232,463,125	$24,688,779	$5,745,110	$18,943,669	$0
Mount Holly (T)	$3,763,298,318	$38,106,327	$5,078,895	$32,977,975	$49,458
Mount Laurel (T)	$15,418,468,979	$47,411,773	$2,929,281	$35,492,442	$8,990,050
New Hanover (T)	$2,868,939,587	$1,389,607	$885,854	$0	$503,753
North Hanover (T)	$2,404,670,347	$1,179,050	$1,066,769	$112,282	$0
Palmyra (B)	$2,133,107,140	$31,551,933	$6,384,318	$16,962,679	$8,204,937
Pemberton (B)	$736,141,491	$38,682	$38,682	$0	$0
Pemberton (T)	$6,973,242,839	$25,568,191	$12,069,874	$9,189,474	$4,308,843
Riverside (T)	$2,459,954,166	$31,235,853	$6,062,187	$21,337,023	$3,836,643
Riverton (B)	$1,096,729,598	$26,804,248	$1,404,324	$22,643,918	$2,756,006
Shamong (T)	$2,504,926,736	$3,641,828	$1,607,936	$274,063	$1,759,829
Southampton (T)	$4,593,018,255	$11,974,585	$8,055,682	$70,850	$3,848,053
Springfield (T)	$2,140,517,320	$3,920,458	$580,771	$2,781,494	$558,192
Tabernacle (T)	$2,200,440,237	$341,229	$275,795	$0	$65,434
Washington (T)	$604,084,949	$41,178,112	$10,479,180	$16,898,948	$13,799,984
Westampton (T)	$4,620,292,645	$2,529,389	$1,811,269	$193,039	$525,080
Willingboro (T)	$8,789,434,159	$24,504,420	$14,787,428	$9,580,291	$136,701
Woodland (T)	$1,333,495,831	$8,189,383	$197,129	$0	$7,992,254
Wrightstown (B)	$748,872,423	$0	$0	$0	$0
Burlington County (Total)	**$167,984,093,755**	**$1,919,489,133**	**$440,357,445**	**$1,168,500,554**	**$310,631,134**

Source: Hazus v6.0

Table 4.3.6-14. Estimated General Building Stock Exposure to the Sea Level Rise 1-foot Hazard Area

Jurisdiction	Total Number of Buildings	Total RCV	Estimated Building Stock in Sea Level Rise Hazard Area — Building Count: Number	Percent of Total	RCV: Value	Percent of Total
Bass River (T)	719	$881,423,037	11	1.5%	$24,002,658	2.7%
Beverly (C)	939	$1,218,790,334	0	0.0%	$0	0.0%
Bordentown (C)	1,041	$2,794,074,193	1	0.1%	$404,984	<0.1%
Bordentown (T)	3,389	$5,866,485,431	8	0.2%	$147,092,038	2.5%
Burlington (C)	3,165	$5,813,312,404	4	0.1%	$2,783,834	<0.1%
Burlington (T)	6,525	$8,819,483,894	1	<0.1%	$12,604,725	0.1%
Chesterfield (T)	2,673	$2,243,175,804	2	0.1%	$809,968	<0.1%
Cinnaminson (T)	5,833	$6,206,033,564	16	0.3%	$87,642,491	1.4%
Delanco (T)	1,717	$1,777,428,934	2	0.1%	$687,849	<0.1%
Delran (T)	5,008	$5,342,639,406	0	0.0%	$0	0.0%
Eastampton (T)	1,947	$1,223,958,808	0	0.0%	$0	0.0%
Edgewater Park (T)	2,210	$2,391,677,740	1	<0.1%	$380,754	<0.1%
Evesham (T)	13,368	$11,128,366,531	0	0.0%	$0	0.0%
Fieldsboro (B)	224	$241,524,257	1	0.4%	$280,249	0.1%
Florence (T)	4,084	$6,582,323,116	0	0.0%	$0	0.0%
Hainesport (T)	2,546	$3,283,651,920	4	0.2%	$35,574,242	1.1%
Lumberton (T)	3,724	$4,304,673,748	8	0.2%	$3,142,943	0.1%
Mansfield (T)	3,805	$3,398,330,024	0	0.0%	$0	0.0%
Maple Shade (T)	5,120	$5,835,178,181	2	<0.1%	$785,738	<0.1%
Medford (T)	8,792	$10,042,226,056	0	0.0%	$0	0.0%
Medford Lakes (B)	1,804	$967,238,228	0	0.0%	$0	0.0%
Moorestown (T)	7,173	$12,232,463,125	10	0.1%	$37,900,465	0.3%
Mount Holly (T)	2,987	$3,763,298,318	1	<0.1%	$34,431,980	0.9%
Mount Laurel (T)	13,150	$15,418,468,979	0	0.0%	$0	0.0%
New Hanover (T)	1,068	$2,868,939,587	0	0.0%	$0	0.0%
North Hanover (T)	2,176	$2,404,670,347	0	0.0%	$0	0.0%
Palmyra (B)	2,482	$2,133,107,140	3	0.1%	$648,819	<0.1%
Pemberton (B)	519	$736,141,491	0	0.0%	$0	0.0%
Pemberton (T)	9,729	$6,973,242,840	0	0.0%	$0	0.0%
Riverside (T)	2,532	$2,459,954,166	0	0.0%	$0	0.0%
Riverton (B)	989	$1,096,729,598	2	0.2%	$34,826,634	3.2%
Shamong (T)	2,494	$2,504,926,736	0	0.0%	$0	0.0%
Southampton (T)	5,368	$4,593,018,255	0	0.0%	$0	0.0%
Springfield (T)	1,826	$2,140,517,320	1	0.1%	$237,617	<0.1%
Tabernacle (T)	2,938	$2,200,440,237	0	0.0%	$0	0.0%
Washington (T)	538	$604,084,949	10	1.9%	$4,112,143	0.7%
Westampton (T)	2,795	$4,620,292,645	0	0.0%	$0	0.0%
Willingboro (T)	10,830	$8,789,434,159	2	<0.1%	$761,508	<0.1%
Woodland (T)	782	$1,333,495,830	0	0.0%	$0	0.0%
Wrightstown (B)	296	$748,872,423	0	0.0%	$0	0.0%
Burlington County (Total)	**149,305**	**$167,984,093,756**	**90**	**0.1%**	**$429,111,637**	**0.3%**

Source: Burlington County, 2023; NJOGIS 2023; Microsoft BING 2022; RS Means 2022; NOAA 2022

Table 4.3.6-15. Estimated General Building Stock Exposure to the Sea Level Rise 3-foot Hazard Area

Jurisdiction	Total Number of Buildings	Total RCV	Estimated Building Stock in Sea Level Rise Hazard Area: Building Count		RCV	
			Number	Percent of Total	Value	Percent of Total
Bass River (T)	719	$881,423,037	26	3.6%	$30,119,786	3.4%
Beverly (C)	939	$1,218,790,334	0	0.0%	$0	0.0%
Bordentown (C)	1,041	$2,794,074,193	4	0.4%	$41,924,842	1.5%
Bordentown (T)	3,389	$5,866,485,431	9	0.3%	$147,497,021	2.5%
Burlington (C)	3,165	$5,813,312,404	7	0.2%	$4,528,121	0.1%
Burlington (T)	6,525	$8,819,483,894	2	<0.1%	$15,167,805	0.2%
Chesterfield (T)	2,673	$2,243,175,804	2	0.1%	$809,968	<0.1%
Cinnaminson (T)	5,833	$6,206,033,564	88	1.5%	$234,090,087	3.8%
Delanco (T)	1,717	$1,777,428,934	6	0.3%	$36,584,133	2.1%
Delran (T)	5,008	$5,342,639,406	30	0.6%	$33,053,271	0.6%
Eastampton (T)	1,947	$1,223,958,808	0	0.0%	$0	0.0%
Edgewater Park (T)	2,210	$2,391,677,740	1	<0.1%	$380,754	<0.1%
Evesham (T)	13,368	$11,128,366,531	0	0.0%	$0	0.0%
Fieldsboro (B)	224	$241,524,257	1	0.4%	$280,249	0.1%
Florence (T)	4,084	$6,582,323,116	0	0.0%	$0	0.0%
Hainesport (T)	2,546	$3,283,651,920	6	0.2%	$36,191,236	1.1%
Lumberton (T)	3,724	$4,304,673,748	15	0.4%	$5,720,382	0.1%
Mansfield (T)	3,805	$3,398,330,024	0	0.0%	$0	0.0%
Maple Shade (T)	5,120	$5,835,178,181	3	0.1%	$12,885,638	0.2%
Medford (T)	8,792	$10,042,226,056	0	0.0%	$0	0.0%
Medford Lakes (B)	1,804	$967,238,228	0	0.0%	$0	0.0%
Moorestown (T)	7,173	$12,232,463,125	11	0.2%	$38,281,219	0.3%
Mount Holly (T)	2,987	$3,763,298,318	3	0.1%	$35,651,462	0.9%
Mount Laurel (T)	13,150	$15,418,468,979	1	<0.1%	$207,451	<0.1%
New Hanover (T)	1,068	$2,868,939,587	0	0.0%	$0	0.0%
North Hanover (T)	2,176	$2,404,670,347	0	0.0%	$0	0.0%
Palmyra (B)	2,482	$2,133,107,140	5	0.2%	$793,061	<0.1%
Pemberton (B)	519	$736,141,491	0	0.0%	$0	0.0%
Pemberton (T)	9,729	$6,973,242,840	0	0.0%	$0	0.0%
Riverside (T)	2,532	$2,459,954,166	8	0.3%	$40,654,305	1.7%
Riverton (B)	989	$1,096,729,598	3	0.3%	$48,916,604	4.5%
Shamong (T)	2,494	$2,504,926,736	0	0.0%	$0	0.0%
Southampton (T)	5,368	$4,593,018,255	0	0.0%	$0	0.0%
Springfield (T)	1,826	$2,140,517,320	1	0.1%	$237,617	<0.1%
Tabernacle (T)	2,938	$2,200,440,237	0	0.0%	$0	0.0%
Washington (T)	538	$604,084,949	26	4.8%	$72,114,906	11.9%
Westampton (T)	2,795	$4,620,292,645	6	0.2%	$1,622,162	<0.1%
Willingboro (T)	10,830	$8,789,434,159	8	0.1%	$2,807,776	<0.1%
Woodland (T)	782	$1,333,495,830	0	0.0%	$0	0.0%
Wrightstown (B)	296	$748,872,423	0	0.0%	$0	0.0%
Burlington County (Total)	**149,305**	**$167,984,093,756**	**272**	**0.2%**	**$840,519,856**	**0.5%**

Source: Burlington County, 2023; NJOGIS 2023; Microsoft BING 2022; RS Means 2022; NOAA 2022

National Flood Insurance Program Statistics

In addition to total building stock modeling, individual data available on flood policies, claims, and repetitive loss (RL) properties were analyzed. FEMA Region 2 provided a list of residential properties with National Flood Insurance Program (NFIP) policies, past claims, and multiple claims (RLs). According to the metadata provided, the NFIP Repetitive Loss File contains losses reported from individuals who have flood insurance through the federal government. A property is considered a repetitive loss property when there are two or more losses reported that were paid more than $1,000 for each loss. The two losses must be within 10 years of each other and be at least 10 days apart. Only losses since January 1, 1978, that are closed are considered.

Counts of severe repetitive loss properties were not available for review during this planning process for Burlington County. According to the National Flood Insurance Act, a severe repetitive loss property is defined as a residential property covered under an NFIP flood insurance policy, and satisfying Item 3 below and either Item 1 or Item 2 (42 U.S. Code 4102a, Section 1361A):

1. At least four NFIP claim payments for the property (including building and contents) over $5,000 each have occurred, and the cumulative amount of such claim payments exceeded $20,000.
2. At least two separate claims payments for the property (building payments only) have occurred, and the cumulative amount of the building portion of such claims exceeded the market value of the building.
3. For either of the above, at least two of the referenced claims must have occurred within any 10-year period and must have occurred more than 10 days apart.

Table 4.3.6-16 summarizes NFIP policies, claims, and repetitive loss statistics for Burlington County. Locations of the properties with policies, claims, and repetitive and severe repetitive flooding were geocoded by FEMA with the understanding that differences (and variations in those differences) were possible between listed longitude and latitude coordinates of properties and actual locations of property addresses—namely, that indications of some locations were more accurate than others.

Table 4.3.6-16. NFIP Policies, Claims, and Repetitive Loss Statistics

Jurisdiction	Total Number of Policies	Total Claims	Total Payments	Number of NFIP RL Properties
Bass River (T)	31	46	$1,248,920.15	4
Beverly (C)	4	1	$3,513.71	0
Bordentown (C)	3	8	$32,407.54	2
Bordentown (T)	17	9	$7,285.60	1
Burlington (C)	736	276	$687,096.10	14
Burlington (T)	68	40	$270,825.50	2
Chesterfield (T)	6	3	$2,128.40	0
Cinnaminson (T)	169	168	$1,350,712.09	18
Delanco (T)	76	22	$138,143.76	2
Delran (T)	78	99	$631,897.45	12
Eastampton (T)	17	97	$871,378.78	15
Edgewater Park (T)	6	5	$16,200.85	0
Evesham (T)	106	37	$234,570.92	4
Fieldsboro (B)	0	0	$0.00	0
Florence (T)	12	5	$27,929.03	0
Hainesport (T)	14	5	$11,782.21	0
Lumberton (T)	51	206	$7,179,248.51	42
Mansfield (T)	11	5	$9,489.05	0

Jurisdiction	Total Number of Policies	Total Claims	Total Payments	Number of NFIP RL Properties
Maple Shade (T)	21	8	$260,619.32	1
Medford (T)	51	31	$294,197.27	3
Medford Lakes (B)	164	205	$3,726,738.86	13
Moorestown (T)	93	55	$250,625.01	4
Mount Holly (T)	52	121	$2,093,593.00	16
Mount Laurel (T)	158	82	$516,765.02	5
New Hanover (T)	0	5	$889.34	0
North Hanover (T)	6	1	$13,060.31	0
Palmyra (B)	132	44	$235,083.95	4
Pemberton (B)	1	5	$3,995.73	0
Pemberton (T)	129	117	$1,449,323.99	13
Riverside (T)	40	53	$532,674.79	4
Riverton (B)	25	3	$3,527.46	0
Shamong (T)	13	7	$8,926.85	1
Southampton (T)	50	156	$3,218,832.22	29
Springfield (T)	5	3	$21,515.74	0
Tabernacle (T)	9	1	$6,406.91	0
Washington (T)	28	22	$1,133,647.60	2
Westampton (T)	26	21	$219,627.09	4
Willingboro (T)	133	34	$721,475.65	2
Woodland (T)	1	0	$0.00	0
Wrightstown (B)	1	2	$15,631.58	0
Burlington County (Total)	**2,543**	**2,008**	**$27,450,687**	**217**

Source: NFIP 2023

Notes: Data current as of October 2023. RL = Any insurable building for which two or more claims of more than $1,000 were paid by the NFIP in any rolling 10-year period since 1978.

Impact on Critical Facilities

It is important to determine the critical facilities and infrastructure within the County that may be at risk of flooding and who may be impacted should damage occur. Critical services during and after a flood event may not be available if critical facilities are directly damaged or transportation routes to access these critical facilities are impacted. Roads that are blocked or damaged can isolate residents and can prevent access throughout the planning area to many service providers needing to get to vulnerable populations or to make repairs. Utilities such as overhead power, cable, and phone lines could also be vulnerable due to utility poles damaged by standing water or the surge of water from a dam failure event. Loss of these utilities could create additional isolation issues for the inundation zones (refer to Section 4.3.1 Dam Failure).

Major roadways that may be impacted by the 1-percent annual chance flood event include Interstates Route-130, Route-73, Route-38, the Garden State Parkway, New Jersey Turnpike, Route-206, and other various state and county roads. There are several issues associated with transportation routes flooding, including isolation caused by bridges being washed out or blocked by floods or debris, health problems caused by water and sewer systems that are flooded or backed up, drinking water contamination caused by floodwaters carrying pollutants in water supplies, and localized urban flooding caused by culverts blocked with debris.

Community lifeline exposure to the 1-percent and 0.2-percent annual chance flood hazard event boundary was examined. In addition, Hazus was used to estimate the flood loss potential to community lifelines located in the

FEMA mapped floodplains. Table 4.3.6-16 summarizes the number of community lifelines exposed to the 1-percent and 0.2-percent flood inundation areas by jurisdiction. Of the 283 community lifelines located in the 1-percent annual chance flood event boundary, Safety and Security has the majority of facilities (212). Out of the 340 community lifelines located in the 0.2-percent annual chance flood event boundary, Safety and Security has the majority of facilities (238). Refer to Section 3 (County Profile) for more information about the critical facilities and lifelines in Burlington County.

Table 4.3.6-17. Estimated Number of Lifelines Located in the Flood Hazard Areas

FEMA Lifeline Category	Number of Lifelines	Number of Lifelines Located in the 1-Percent Annual Chance Flood Event Hazard Area	Number of Lifelines Located in the 0.2-Percent Annual Chance Flood Event Hazard Area
Communications	2	0	0
Energy	31	3	4
Food, Hydration, Shelter	189	6	11
Hazardous Materials	207	29	48
Health and Medical	113	5	6
Safety and Security	1,101	212	238
Transportation	53	16	17
Water Systems	119	12	16
Burlington County (Total)	**1,813**	**283**	**340**

Source: Burlington County, 2023; FEMA 2019

Table 4.3.6-18 summarizes the number of community lifelines exposed to the Sea Level Rise 1-foot and 3-Foot Hazard Areas by jurisdiction. Of the 11 community lifelines located in the Sea Level Rise 1-foot Hazard Area, Safety and Security and Transportation have the majority of facilities (4 each). Out of the 18 community lifelines located in the Sea Level Rise 3-foot Hazard Area, Safety and Security, Transportation and Hazardous Materials have the same number of facilities (6 each). Refer to Section 3 (County Profile) for more information about the critical facilities and lifelines in Burlington County.

Table 4.3.6-18. Estimated Number of Lifelines Located in the Sea Level Rise Hazard Areas

FEMA Lifeline Category	Number of Lifelines	Number of Lifelines Located in the Sea Level Rise 1-Foot Hazard Area	Number of Lifelines Located in the Sea Level Rise 3-Foot Hazard Area
Communications	2	0	0
Energy	31	0	0
Food, Hydration, Shelter	189	0	0
Hazardous Materials	207	3	6
Health and Medical	113	0	0
Safety and Security	1,101	4	6
Transportation	53	4	6
Water Systems	119	0	0
Burlington County (Total)	**1,813**	**11**	**18**

Source: Burlington County, 2023; FEMA 2019

Impact on Economy

Flood events can significantly impact the local and regional economy. This includes but is not limited to general building stock damages and associated tax loss, impacts on utilities and infrastructure, business interruption, and impacts on tourism; Table 4.3.6-19 summarizes building-related economic losses due to the 1-percent annual chance flood event. In areas that are directly flooded, renovations of commercial and industrial buildings may be necessary, disrupting associated services. The Impact on General Building Stock subsection above discusses replacement cost value for buildings located in flood zones.

Table 4.3.6-19. Building-Related Economic Loss Estimates from the 1-percent Annual Chance Flood Event

	Building-Related Economic Loss Estimates				
Flood Hazard	**Inventory Loss**	**Relocation Loss**	**Wage Loss**	**Rental Loss**	**Income Loss**
1-Percent Annual Chance Flood Event	$502,150,000	$371,570,000	$832,000,000	$201,200,000	$1,987,000,000

Source: Hazus v6.0

Debris management may also be a large expense after a flood event. HAZUS estimates the amount of structural debris generated during a flood event. The model breaks down debris into three categories: (1) finishes (dry wall, insulation, etc.); (2) structural (wood, brick, etc.); and (3) foundations (concrete slab and block, rebar, etc.). These distinctions are necessary because of the different types of equipment needed to handle debris. Table 4.3.6-20 summarizes the Hazus v6 countywide debris estimates for the 1-percent annual chance flood event. This table only estimates structural debris generated by flooding and does not include non-structural debris or additional potential damage and debris possibly generated by wind that may be associated with a flood event or storm that causes flooding. Overall, Hazus estimates that there will be 28,176 tons of debris generated during the 1-percent annual chance flood event in Burlington County.

Table 4.3.6-20. Estimated Debris Generated from the 1-Percent Annual Chance Flood Event

	Debris Generated from the 1-Percent Annual Chance Flood (tons)			
Jurisdiction	**Total**	**Finish**	**Structure**	**Foundation**
Bass River (T)	1,232	1,024	130	78
Beverly (C)	40	40	0	0
Bordentown (C)	137	87	30	20
Bordentown (T)	494	177	193	124
Burlington (C)	18,102	16,017	1,322	764
Burlington (T)	194	175	11	7
Chesterfield (T)	28	9	11	8
Cinnaminson (T)	1,138	1,099	24	15
Delanco (T)	396	236	104	56
Delran (T)	783	621	103	59
Eastampton (T)	22	17	2	4
Edgewater Park (T)	2	2	0	0
Evesham (T)	74	73	1	0
Fieldsboro (B)	43	18	14	11
Florence (T)	338	103	139	96
Hainesport (T)	227	170	35	21
Lumberton (T)	182	141	24	17
Mansfield (T)	54	26	17	10

Jurisdiction	Debris Generated from the 1-Percent Annual Chance Flood (tons) Total	Finish	Structure	Foundation
Maple Shade (T)	189	186	2	1
Medford (T)	229	227	1	1
Medford Lakes (B)	128	128	0	0
Moorestown (T)	240	239	0	0
Mount Holly (T)	1,288	1,288	0	0
Mount Laurel (T)	151	144	4	3
New Hanover (T)	6	5	0	0
North Hanover (T)	58	35	14	9
Palmyra (B)	238	236	1	1
Pemberton (B)	23	23	0	0
Pemberton (T)	332	318	7	7
Riverside (T)	358	349	5	3
Riverton (B)	112	98	8	5
Shamong (T)	17	13	1	3
Southampton (T)	164	163	0	0
Springfield (T)	33	28	3	2
Tabernacle (T)	3	3	0	0
Washington (T)	162	160	2	1
Westampton (T)	34	34	0	0
Willingboro (T)	904	774	79	51
Woodland (T)	2	2	0	0
Wrightstown (B)	20	12	5	3
Burlington County (Total)	**28,176**	**24,503**	**2,293**	**1,380**

Source: Hazus v6.0

Impact on Environment

As Burlington County and its jurisdictions evolve with changes in population and density, flood events may increase in frequency and/or severity as land use changes, more structures are built, and impervious surfaces expand. Furthermore, flood extents for the 1-percent annual chance flood event will continue to evolve alongside natural occurrences such as climate change and/or severe weather events. These flood events will inevitably impact Burlington County's natural and local environment.

The environmental impacts of a flood can include significant water quality and debris-disposal issues. Flood waters can back up sanitary sewer systems and inundate wastewater treatment plants, causing raw sewage to contaminate residential and commercial buildings and the flooded waterway. The contents of unsecured containers of oil, fertilizers, pesticides, and other chemicals get added to flood waters. Hazardous materials may be released and distributed widely across the floodplain. Water supply and wastewater treatment facilities could be offline for weeks. After the flood waters subside, contaminated and flood-damaged building materials and contents must be properly disposed of. Contaminated sediment must be removed from buildings, yards, and properties. In addition, severe erosion is likely; such erosion can negatively impact local ecosystems.

Cascading Impacts on Other Hazards

Public Health

Cascading impacts may also include exposure to pathogens such as mold. After flood events, excess moisture and standing water contribute to the growth of mold in buildings. Mold may present a health risk to building occupants, especially those with already compromised immune systems such as infants, children, the elderly and pregnant women. The degree of impact will vary and is not strictly measurable. Mold spores can grow in as short a period as 24-48 hours in wet and damaged areas of buildings that have not been properly cleaned. Very small mold spores can easily be inhaled, creating the potential for allergic reactions, asthma episodes, and other respiratory problems. Buildings should be properly cleaned and dried out to safely prevent mold growth (CDC 2020).

Molds and mildews are not the only public health risk associated with flooding. Floodwaters can be contaminated by pollutants such as sewage, human and animal feces, pesticides, fertilizers, oil, asbestos, and rusting building materials. Common public health risks associated with flood events also include (FEMA 2022):

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

Current loss estimation models such as Hazus are not equipped to measure public health impacts. The best level of mitigation for these impacts is to be aware that they can occur, educate the public on prevention, and be prepared to deal with these vulnerabilities in responding to flood events.

Utility Disruption

Floods of any type have the potential to impact water and power utilities which may impact public and private use, as well as cause disruption to critical infrastructure. Refer to the list below to view flooding's harmful effects on the water supply (Andrew 2021):

- Water Supply Contamination: Excess floodwater can contaminate private drinking water sources, such as wells and springs. Floodwater picks up debris, increasing the number of bacteria, sewage, and other industrial waste and chemicals into the water source or leaky pipes. Excess water also makes it more difficult for water treatment plants to treat the water efficiently and effectively. If there is a contamination at any step of the water flow process, this puts consumers at risk of exposure to dangerous toxins that could result in serious harm, such as wound infections, skin rashes, gastrointestinal illnesses, and tetanus; in extreme cases, death may occur.
- Disruption to Clean Drinking and Cooking Water: In the event of only having access to contaminated water, consumers are unable to cook or clean in their home the water is certified as safe. Depending on the severity of the flood and the storm, this could take days, weeks, months and in some cases even years. Without access to clean drinking and cooking water, consumers ultimately become reliant on bottled water. In impoverished communities, this reality is even more detrimental because those affected may not have the economic means to "stock up" on bottled water. Moreover, in a flood, retail locations are often inaccessible and/or low on water supply.

Floodwaters can also cause damage to power utilities. In particular, flooded buildings may have the utilities disrupted if the service panel, generator, meter, etc. are not elevated above the flood protection level. 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.

Further Changes that May Impact Vulnerability

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

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

Projected Development

Section 3 identifies areas targeted for future growth and development across the County. Any areas of growth located in the special flood hazard area could be potentially impacted by flooding. Areas outside of the special flood hazard can also be impacted by urban flooding and less frequent and more severe flooding events. Specific areas of recent and new development are indicated in tabular form and/or on the hazard maps included in Volume II, Section 9 (Jurisdictional Annexes) of this plan.

Projected Changes in Population

Burlington County has experienced an increase in its population since 2010. 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, Burlington County is projected to have a population of 460,400 by 2024, 464,900 by 2029, and 472,700 by 2034 (State of New Jersey 2017). Changes in the density of population can impact the number of persons exposed to flooding. As areas continue to be cleared for new development and run-off persists, the population in the County will remain exposed to this hazard. Refer to Section 3 (County Profile), which includes a discussion on population trends for the County.

Climate Change

As discussed above, most studies project that the County will see an increase in average annual temperatures and precipitation. Increased severe storm and heavy rainfall events are likely to increase the occurrence and severity of flooding in Burlington County. It is anticipated that the County will continue to experience direct and indirect impacts of flooding events annually that may induce secondary hazards such as infrastructure deterioration or failure, utility failures, power outages, water quality and supply concerns, and transportation delays, accidents, and inconveniences.

Change of Vulnerability Since 2019 HMP

Burlington County continues to be vulnerable to the flood hazard. However, there are several differences between the exposure estimates of this plan update and the results reported in the 2019 HMP. Updated population statistics and building stock was used in the current risk assessment. Further, exposure for both the population and critical facilities was analyzed. These updated datasets provide a more accurate exposure analysis to the flood hazard.

4.3.7 Severe Weather

2024 HMP Changes

- New and updated figures from federal and state agencies are incorporated.
- Previous occurrences were updated with events that occurred between 2018 and 2022.

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

Hazard Description

For the purpose of this HMP update and as deemed appropriated by the Burlington County Planning Committee, the severe weather hazard includes high wind, tornadoes, thunderstorms and lightning, hailstorms, and hurricane/tropical storms, which are defined below. The flood profile (Section 4.3.6) discusses storm surges associated with hurricane/tropical storm events.

High Winds

Wind begins with differences in air pressures. It is rough horizontal movement of air caused by uneven heating of the earth's surface. Wind occurs at all scales, from local breezes lasting a few minutes to global winds resulting from solar heating of the earth. High winds are often associated by other severe weather events such as thunderstorms, tornadoes, hurricanes, and tropical storms (NWS 2012). There are various types of high wind events, including those listed below.

- *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.
- A *microburst* is a small, concentrated downburst that produces an outward burst of strong winds at or near the surface. Microbursts are small — less than 4 km 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.
- *Derechos* are widespread, long-lived wind storm that is associated with a band of rapidly moving showers or thunderstorms. A typical derecho consists of numerous microbursts, downbursts, and downburst clusters. If the wind damage swath extends more than 240 miles (about 400 kilometers) and includes wind gusts of at least 58 mph (93 km/h) or greater along most of its length, then the event may be classified as a derecho (NOAA 2023).

Tornadoes

A tornado is a violently rotating column of air that extends from a thunderstorm to the ground with an average forward speed of 30 miles per hour (mph). Tornadoes typically develop from either a severe thunderstorm or hurricane as cool air rapidly overrides a layer of warm air. Tornadoes can occur at any time of the year, with peak seasons at different times for different states (NWS 2010).

Thunderstorms and Lightning

> Thunderstorms can lead to flooding, landslides, strong winds, and lightning. Roads could become impassable from flooding, downed trees or power lines, or a landslide. Downed utility poles can lead to utility losses, such as electricity, phone, and water (from loss of pumping and filtering capabilities).

A thunderstorm is a local storm produced by a cumulonimbus cloud and accompanied by lightning and thunder (NWS 2021). A thunderstorm forms from a combination of moisture, rapidly rising warm air, and a force capable of lifting air, such as a warm and cold front, a sea breeze, or a mountain. Thunderstorms form from the equator to as far north as Alaska. Although thunderstorms generally affect a small area when they occur, they have the potential to become dangerous due to their ability in generating tornadoes, hailstorms, strong winds, flash flooding, and lightning. The NWS considers a thunderstorm *severe* only if it produces damaging wind gusts of 58 mph or higher or large hail one inch (quarter size) in diameter or larger or tornadoes (NWS 2021).

Lighting is a bright flash of electrical energy produced by a thunderstorm. The resulting clap of thunder is the result of a shock wave created by the rapid heating and cooling of the air in the lightning channel. All thunderstorms produce lightning and are very dangerous. Lightning ranks as one of the top weather killers in the United States, killing approximately 50 people and injuring hundreds each year. Lightning can occur anywhere there is a thunderstorm. Lightning can be cloud to air, cloud to cloud, and cloud to ground (NOAA 2014).

Hailstorms

Hail forms inside a thunderstorm where there are strong updrafts of warm air and downdrafts of cold water. A water droplet picked up by the updrafts can be carried well above the freezing level. Water droplets freeze when temperatures reach 32 °F or colder. As the frozen droplet begins to fall, it might thaw as it moves into warmer air toward the bottom of the thunderstorm, or the droplet might be picked up again by another updraft and carried back into the cold air to re-freeze. With each trip above and below the freezing level, the frozen droplet adds another layer of ice. The frozen droplet, with many layers of ice, falls to the ground as hail (NSSL 2021).

Hurricanes and Tropical Storms

Tropical cyclones are an organized system of clouds and thunderstorms originating in tropical or subtropical waters. Tropical cyclones (hurricanes and tropical storms) are fueled by a different heat mechanism than other cyclonic windstorms such as nor'easters and polar lows. The characteristic that separates a tropical storm from another cyclonic system is that at any height in the atmosphere, the center of a tropical storm will be warmer than its surroundings, a phenomenon called "warm core" storm systems (NWS n.d.). Tropical cyclones strengthen when water evaporated from the ocean is released as the saturated air rises, resulting in condensation of water vapor contained in the moist air. Tropical cyclones begin as disturbed areas of weather, often referred to as tropical waves. As the storm organizes, it is designated as a tropical depression (NOAA 2020). Tropical cyclones are classified based on wind speeds:

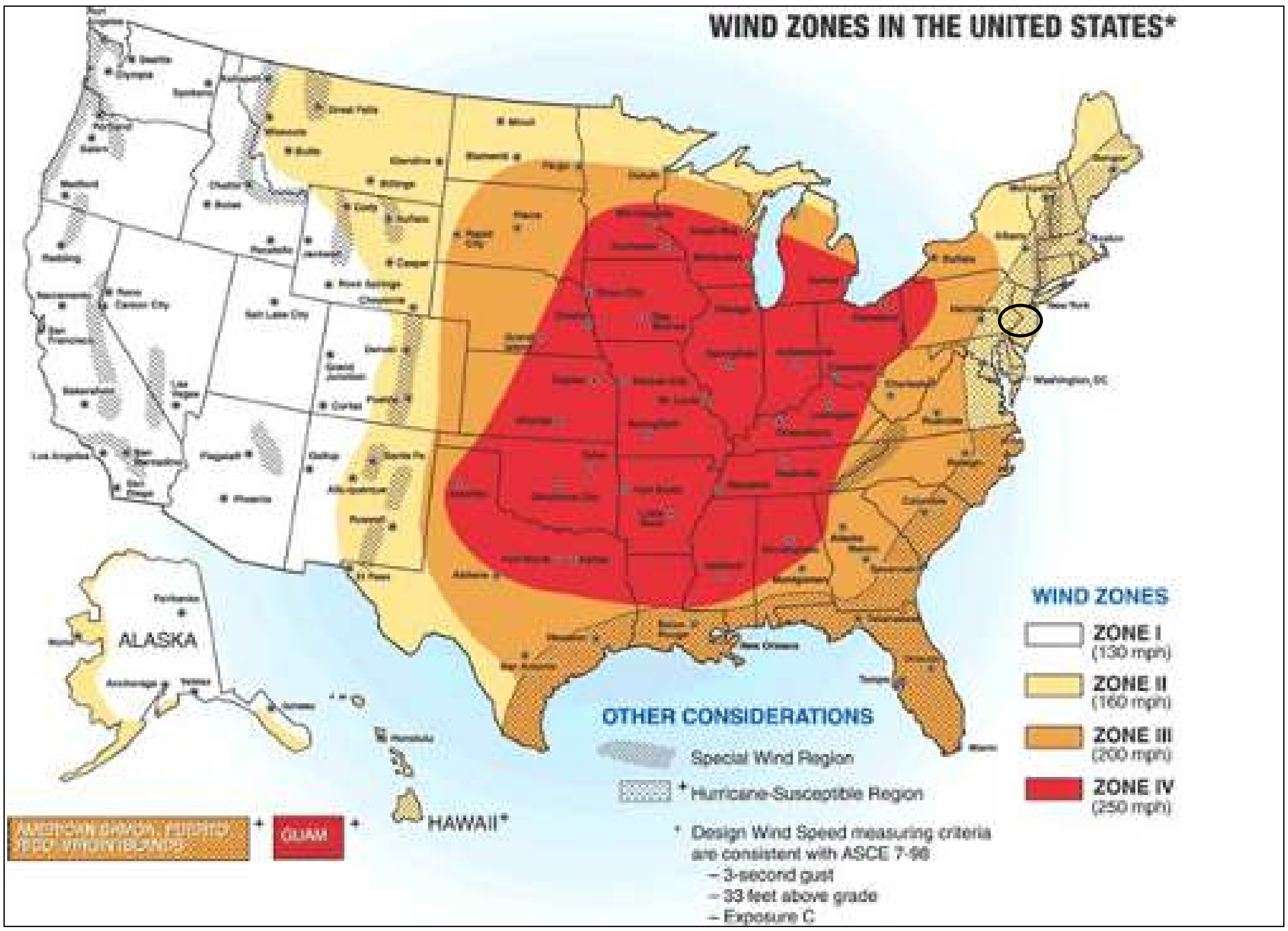
- Tropical depressions have maximum sustained winds of 38 mph or less
- Tropical storms have maximum sustained winds of 39 to 73 mph
- Hurricanes have maximum sustained winds of 74 to 110 mph
- Major hurricanes have maximum sustained winds of 111 mph or greater (NHC n.d.)

Tropical systems can develop in the Atlantic between the Lesser Antilles and the African coast or in the warm tropical waters of the Caribbean Sea and Gulf of Mexico. These storms can move up the Atlantic coast of the United States, impacting the eastern seaboard, or move into the United States through the states along the Gulf Coast, bringing wind and rain as far north as New England before moving eastward offshore) (NOAA 2020).

Location

All of Burlington County is exposed to severe weather events (high winds, tornadoes, thunderstorms, lightning, hail, hurricanes/tropical storms, and extreme temperatures) and the entire County is subject to high winds from severe weather events. According to the FEMA Winds Zones of the United States map, Burlington County is located in Wind Zones II, where wind speeds can reach up to 160 mph. The County is also located in the hurricane susceptible region. Figure 4.3.7-1 illustrates wind zones across the United States, which indicate the impacts of the strength and frequency of wind activity per region. The information on the figure is based on 40 years of tornado data and 100 years of hurricane data collected by FEMA.

Figure 4.3.7-1. Wind Zones in the United States



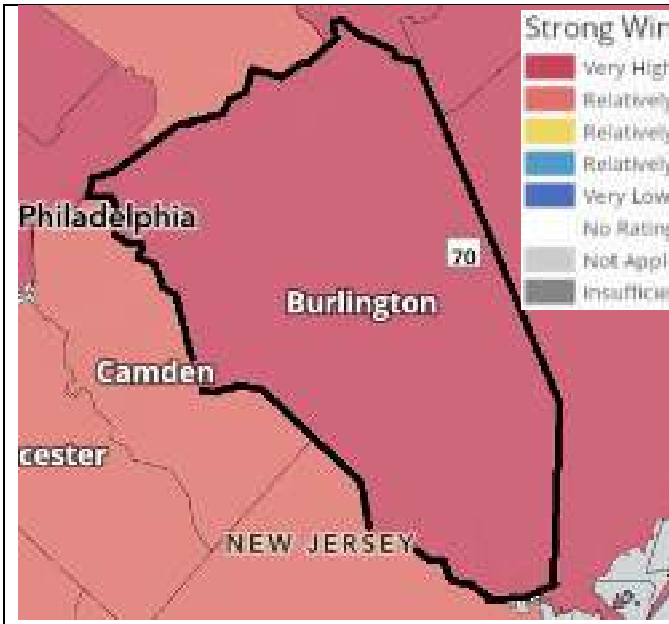
Note: The black oval indicates the approximate location of Burlington County

Source: NIST 2011

High Winds

High winds are most likely to occur in locations susceptible to the kinds of storms that produce them (thunderstorm, tornado, or hurricane) (NOAA n.d.). However, high wind events may occur without such storms and can be just as destructive. Figure 4.3.7-2 and Figure 4.3.7-3 show the strong wind risk index for Burlington County on the county and census tract scales, respectively. This index helps to understand the susceptibility of the County to strong wind. According to the National Risk Index, on the county scale, the County has a very high risk of strong winds; on the census tract scale, the County ranges from a relatively low to a very high risk.

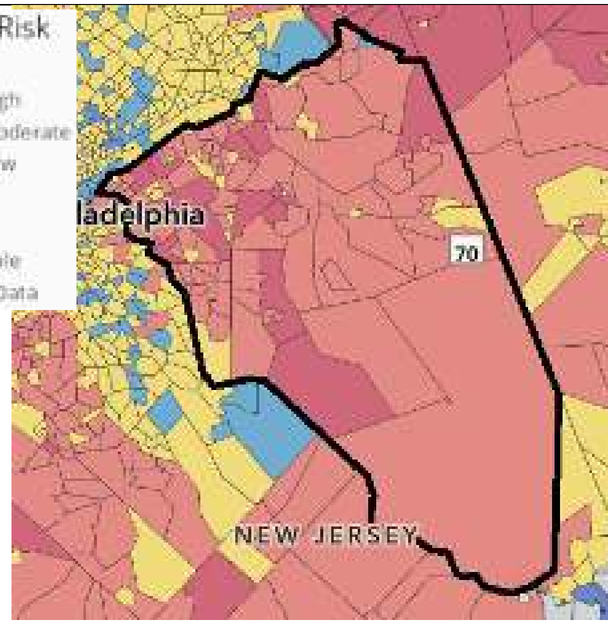
Figure 4.3.7-2. National Risk Index, Strong Wind Risk Index Score Using the County Scale



Note: Burlington is outlined in black

Source: FEMA 2019

Figure 4.3.7-3. National Risk Index, Strong Wind Risk Index Score Using the Census Tract Scale



Note: Burlington is outlined in black

Source: FEMA 2019

Tornadoes

Similar to that of thunderstorms, tornadoes do not have any specific geographic boundary and can occur anywhere in Burlington County. According to NOAA's Storm Events Database, of the total 21 tornadoes which have occurred in Burlington County, 8 tornadoes were recorded since 2019.

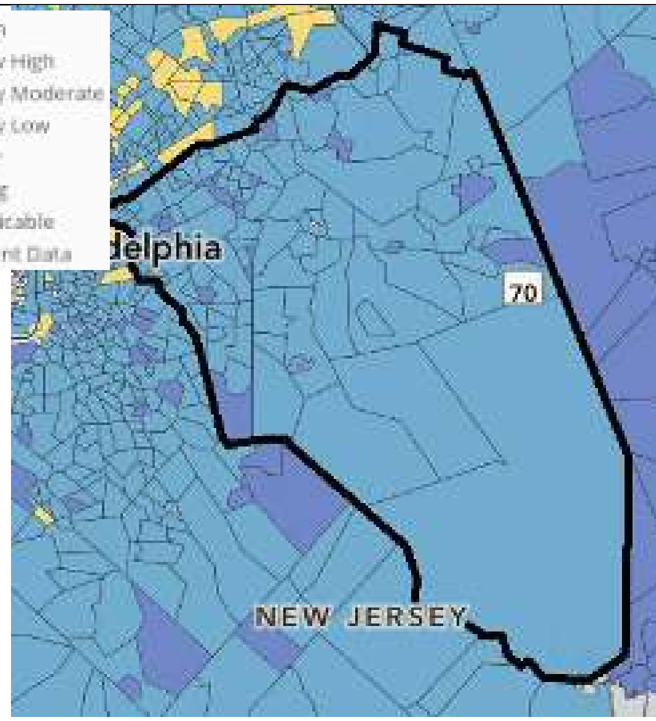
Figure 4.3.7-4 and Figure 4.3.7-5 show the tornado risk index for Burlington County on the county and census tract scales, respectively. This index helps to understand the susceptibility of the County to hurricanes. According to the National Risk Index, on the county scale, the County has a relatively moderate risk of tornadoes; on the census tract scale, the County ranges from a very low to a relatively moderate risk.

Figure 4.3.7-4. National Risk Index, Tornado Risk Index Score Using the County Scale

Note: Burlington is outlined in black

Source: FEMA 2019

Figure 4.3.7-5. National Risk Index, Tornado Risk Index Score Using the Census Tract Scale



Note: Burlington is outlined in black

Source: FEMA 2019

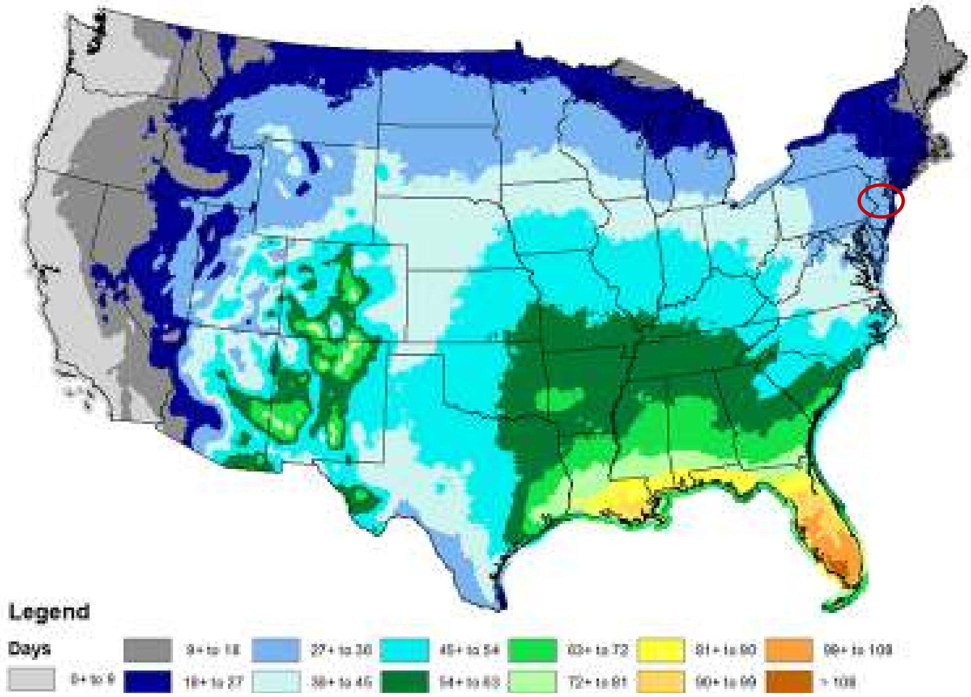
Thunderstorms and Lightning

Thunderstorms tend to take place during the spring and summer, and during the warmest times of the day, which tend to be late afternoon and early evening (NOAA n.d.). Figure 4.3.7-6 displays thunderstorm days per year across the United States. The map shows that Burlington County is likely to have between 27 and 36 thunderstorms each year (NOAA 2023).

Hailstorms

Hailstorms can form anywhere; however, they are more likely to fall in areas that have the most thunderstorms. The longer a hailstone spends in the clouds, the larger it becomes as more droplets continue to freeze. Hail falls when it becomes heavy enough to overcome the strength of the thunderstorm updraft and is pulled to the earth by gravity. Smaller hailstones may be blown away from the updraft by horizontal winds, so larger hail typically falls closer to the updraft than smaller hail (NOAA n.d.). Figure 4.3.7-7 and Figure 4.3.7-8 show the hail risk index for Burlington County on the county and census tract scales, respectively. This index helps to understand the susceptibility of the County to hail. According to the National Risk Index, on the county scale, the County has a very low risk of hail; on the census tract scale, the County ranges from having no rating to a relatively low risk.

Figure 4.3.7-6. Average Number of Thunderstorms in the United States



Note: The red oval indicates the approximate location of Burlington County.

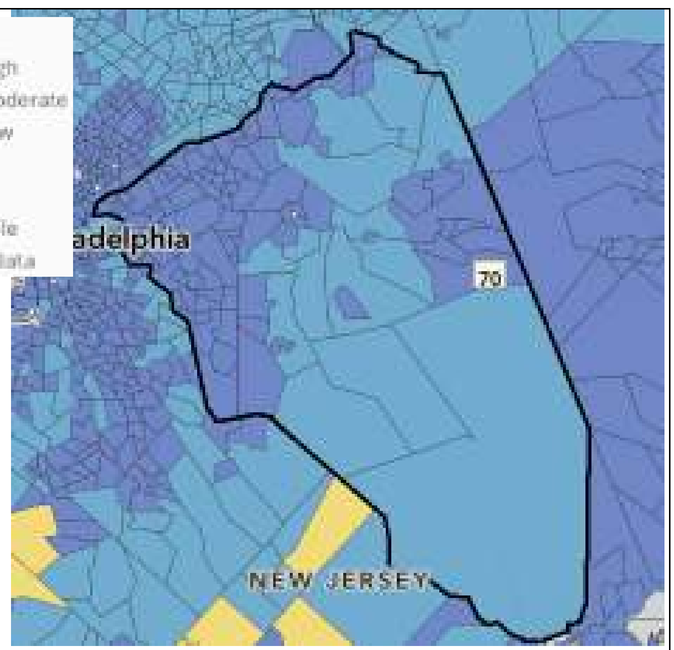
Source: NOAA 2023

Figure 4.3.7-7. National Risk Index, Hail Risk Index Score Using the County Scale

Note: Burlington is outlined in black

Source: FEMA 2019

Figure 4.3.7-8. National Risk Index, Hail Risk Index Score Using the Census Tract Scale



Note: Burlington is outlined in black

Source: FEMA 2019

Hurricanes and Tropical Storms

Hurricanes and tropical storms are most likely to form during hurricane season, which is from June to November each year. Each storm's path is predicted on a case-by-case basis which allows scientists to be able to consider information from the specific storm as well as what is known about the conditions of the atmosphere and the ocean (University Corporation for Atmospheric Research 2022).

Figure 4.3.7-9 and Figure 4.3.7-10 display wind impacts from the 100- and 500-year mean return period (MRP) events. For the 100-year MRP, eastern Burlington County experiences Category 2 hurricane peak wind gusts and the western side of the County experiences Category 1 hurricane peak wind gusts. For the 500-year MRP, the peak wind gusts for the eastern County are associated with a Category 1 hurricane, and the western side of the County experiences wind gusts associated with a Category 2 hurricane.

Figure 4.3.7-11 and Figure 4.3.7-12 show the Hurricane Risk Index for Burlington County on the county and census tract scales, respectively. This index helps to understand the susceptibility of the County to hurricanes. According to the National Risk Index, on the county scale, the County has a relatively moderate risk of hurricanes; on the census tract scale, the County ranges from a relatively low to a relatively moderate risk.

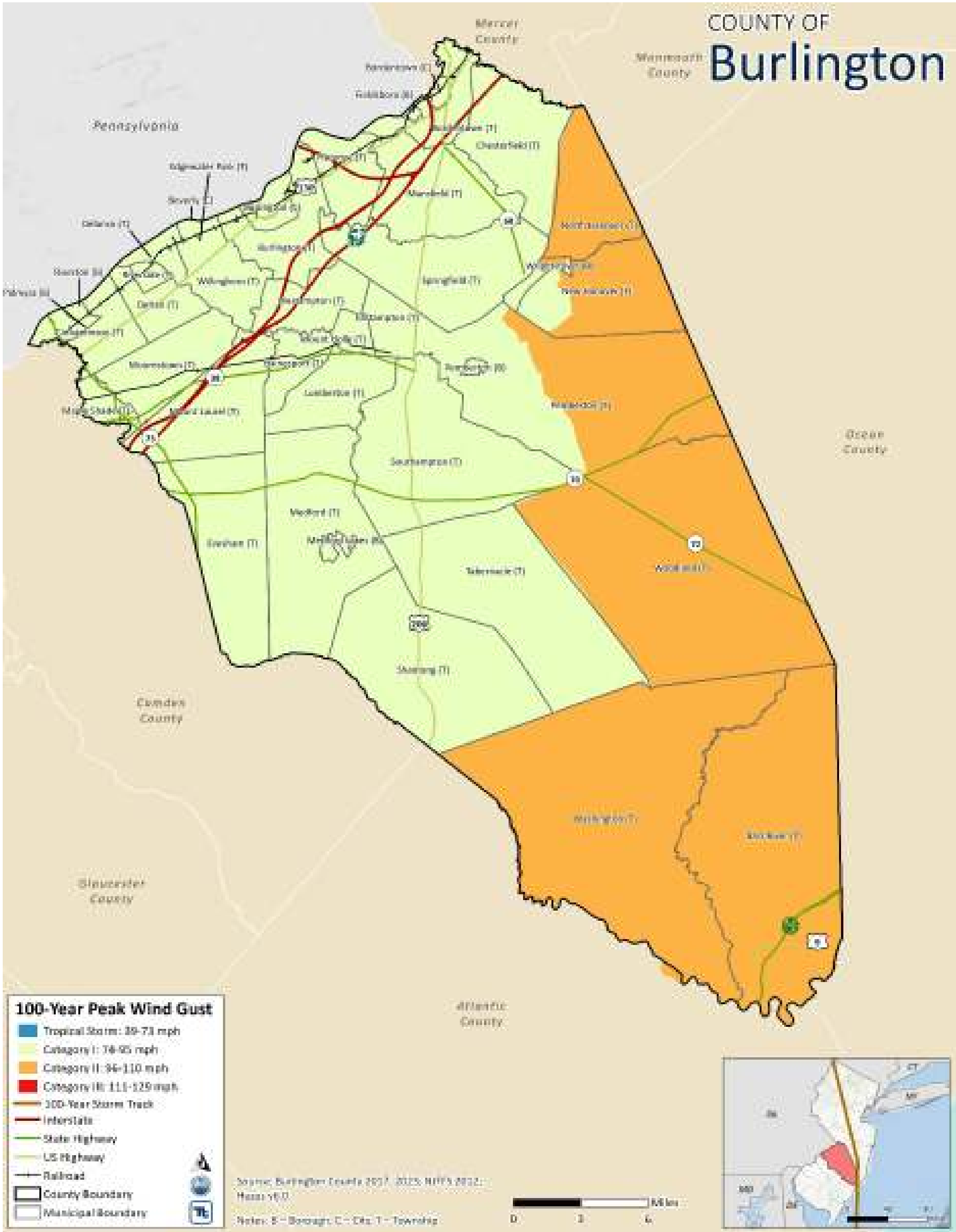
Figure 4.3.7-13 shows the paths of hurricanes and tropical storms that tracked within 60 nautical miles of Burlington County (the approximate distance from the center of rotation of these storms where significant impacts are still felt). Since 1950, the County has been impacted by 18 tropical storms and 5 hurricanes.

Storm Surge

Portions of Burlington County experience coastal flooding from the Delaware River or Mullica River caused by extremely high tides and/or storm surge events (refer to Section 4.3.6 Flood for information on coastal flooding). The reach of storm surge is dependent on the elevation of the land and the height of the storm tide. Inland communities are also vulnerable to storm surge events as rising water levels can also affect river systems, causing storm surges to travel upstream resulting in the flooding of inland areas (NOAA 2023). While all of the County is exposed to hurricane wind and rainfall risk, storm surge risk is limited to areas close to tidal waterways.

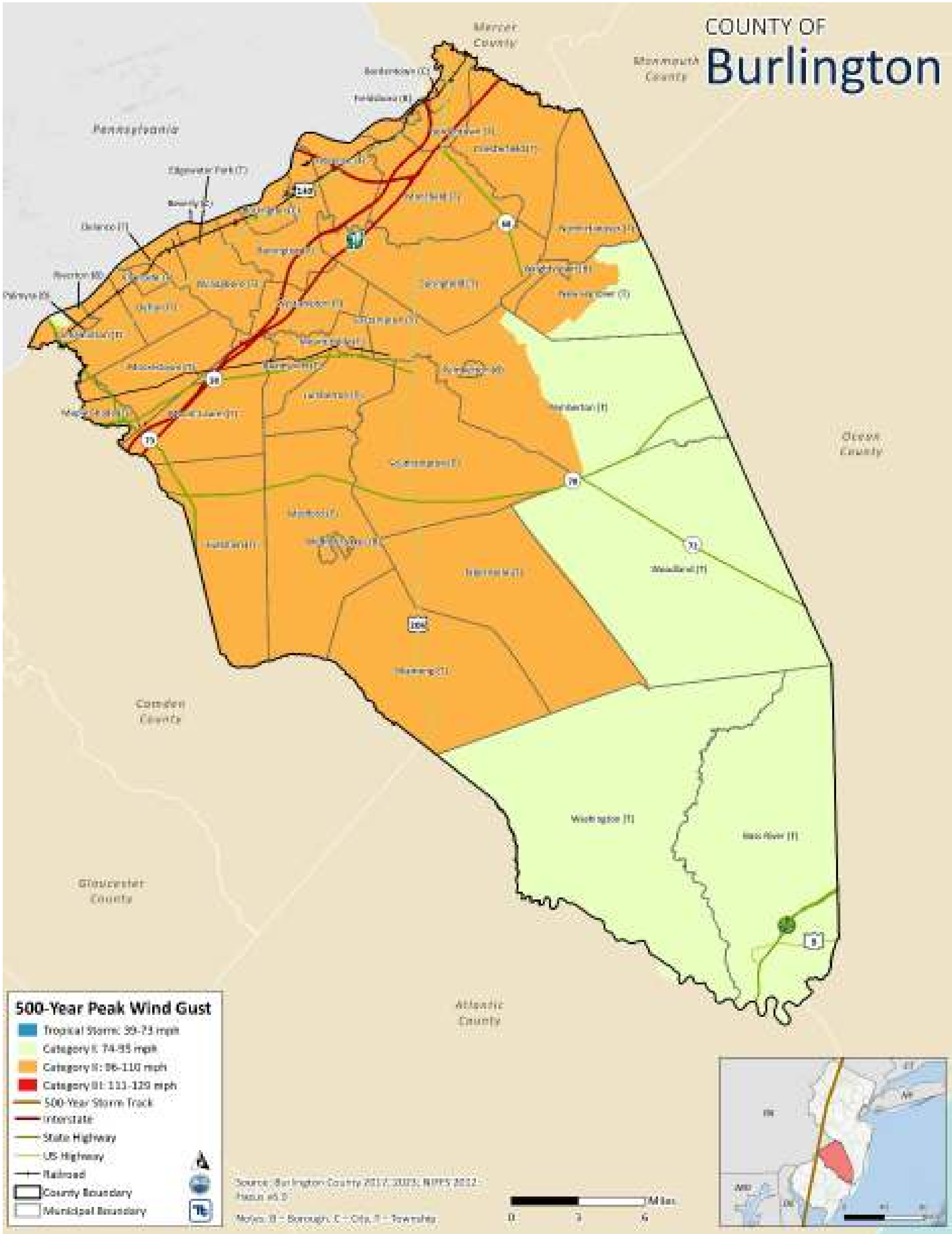
Figure 4.3.7-14 displays the storm surge hazard areas for category 1, 2, and 3 hurricanes in Burlington County based on the SLOSH model. These hazard areas are located along the tidal waterways in the County including the Delaware River, Assiscunk Creek, Rancocas Creek, Pennsauken Creek, and the Mullica River. The largest expanse of these hazard areas are in the coastal wetlands along the Mullica River.

Figure 4.3.7-9. 100-Year MRP Hurricane Event



TETRA TECH

Figure 4.3.7-10. 500-Year MRP Hurricane Event



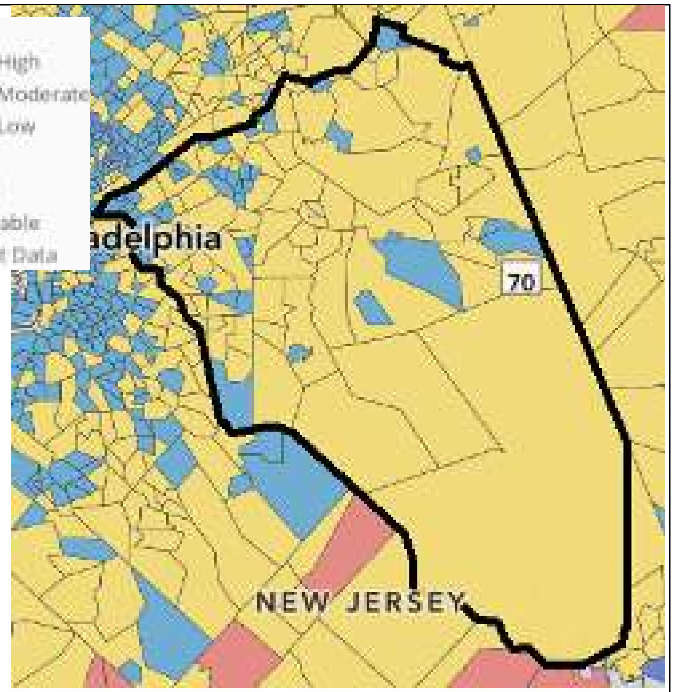
TETRA TECH

Figure 4.3.7-11. National Risk Index, Hurricane Risk Index Score Using the County Scale

Note: Burlington is outlined in black

Source: FEMA 2019

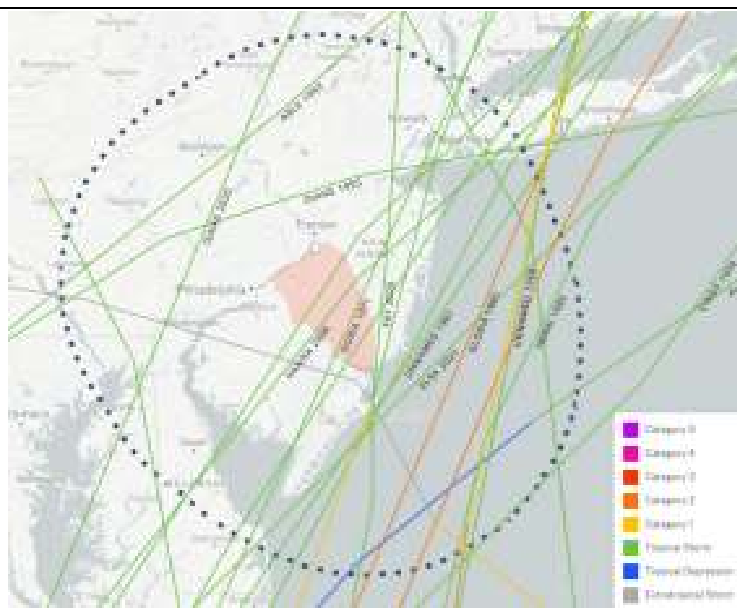
Figure 4.3.7-12. National Risk Index, Hurricane Risk Index Score Using the Census Tract Scale



Note: Burlington is outlined in black

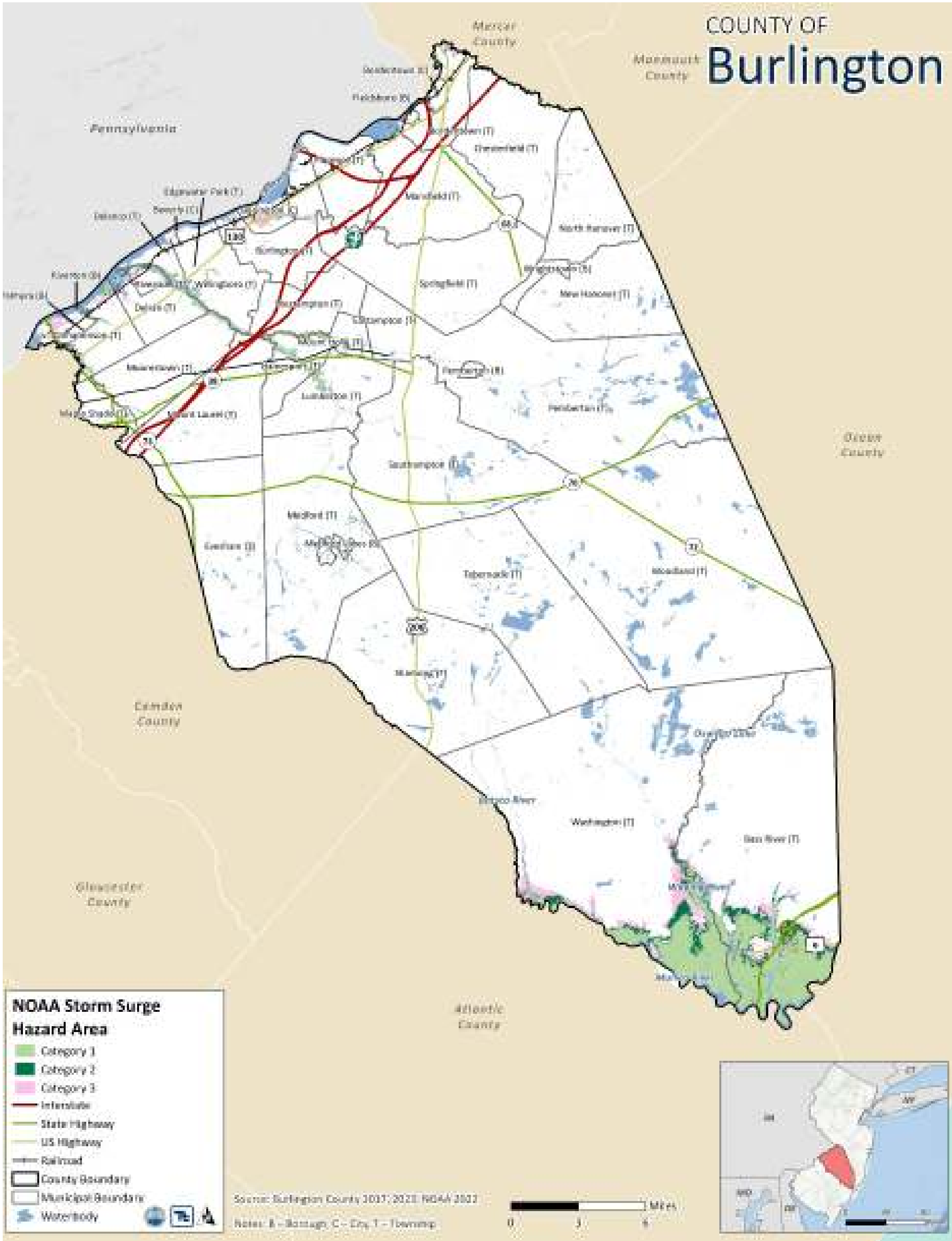
Source: FEMA 2019

Figure 4.3.7-13. Historical Tracks of Tropical Storms and Hurricanes Within 60 Nautical Miles of Burlington County, 1950-2023



Source: NOAA NHC 2023

Figure 4.3.7-14. SLOSH Hazard Areas in Burlington County



TETRA TECH

Extent

High Winds

The NWS categorizes winds based on wind speed as follows (NWS n.d.):

- Strong, dangerous, or damaging: ≥40 miles per hour (mph)
- Very Windy: 30 – 40 mph
- Windy: 20 – 30 mph
- Breezy, brisk, or blustery: 15 – 25 mph
- None, light, or light and variable: <15 mph

The Beaufort wind scale, developed in 1805, is also used today to classify wind conditions, and is provided in Appendix H (Supplementary Data).

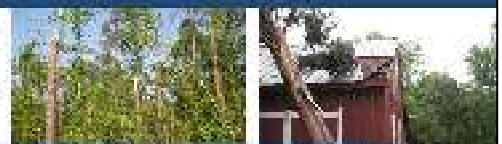
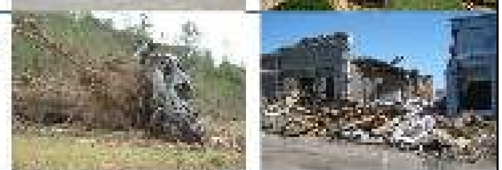
The NWS issues advisories and warnings for winds that are typically site-specific. The NWS issues high wind advisories, watches, and warnings when wind speeds can pose a hazard or are life threatening. The criterion for each of these varies from state to state. According to the NWS, wind warnings and advisories from the Mount Holly National Weather Service Office are defined as follows:

- *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 (NWS 2012).

Tornadoes

The magnitude or severity of a tornado is categorized using the Enhanced Fujita Tornado Intensity Scale (EF Scale), which compares wind speed and actual damage. Figure 4.3.7-15 illustrates the relationship between EF ratings, wind speed, and expected tornado damage.

Figure 4.3.7-15 Explanation of EF-Scale Ratings

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

Source: NWS 2015

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).

Thunderstorms and Lightning

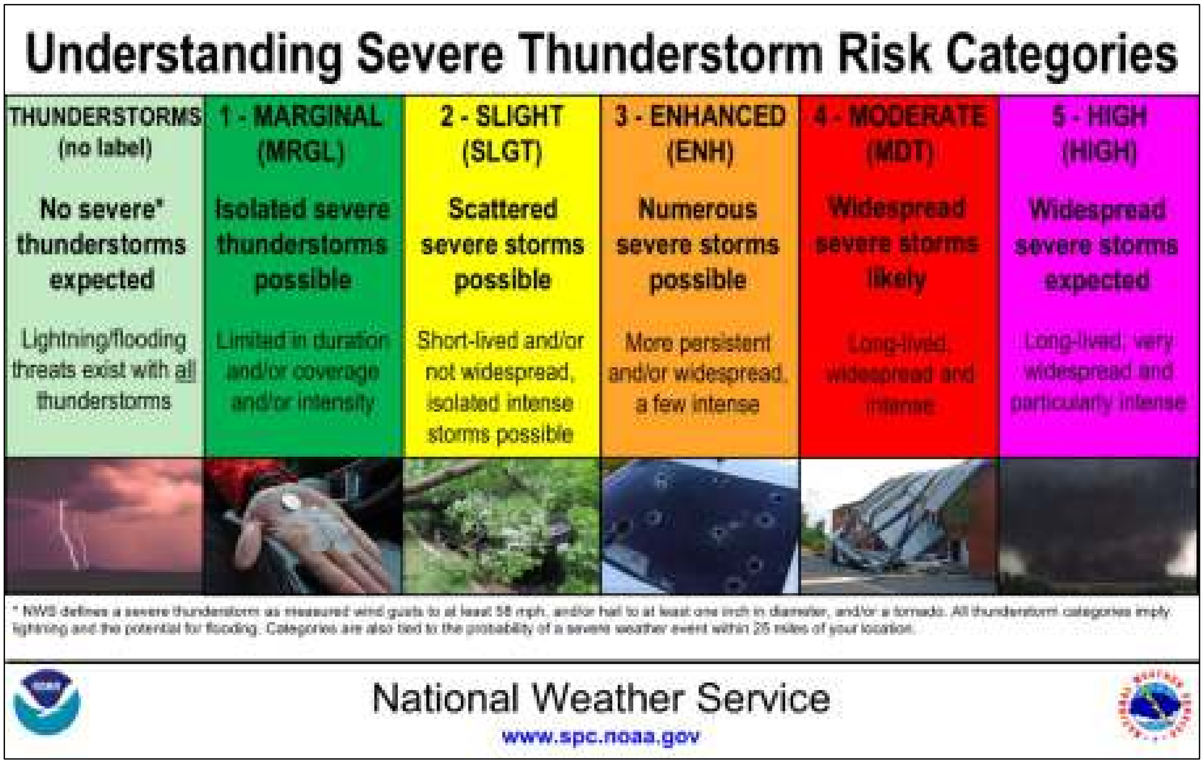
Severe thunderstorm statements, watches, and warnings are issued by the local NWS office and the Storm Prediction Center. The NWS and the Storm Prediction Center will update the watches and warnings and notify the public when they are no longer in effect. NWS issues statements, watches, and warnings for thunderstorms:

- *Special Weather Statement:* Issued for strong storms that are below severe levels but may have impacts. Usually reserved for the threat of wind gust of 40–57 mph or hail of 0.5-inches to 0.99-inches in diameter (NWS 2023).
- *Severe Thunderstorm Watches:* A severe thunderstorm watch is issued when severe thunderstorms are possible in and near watch areas (NWS 2023).

- *Severe Thunderstorm Warning:* A severe thunderstorm is imminent or occurring; it is either detected by weather radar or reported by storm spotters. A severe thunderstorm is one that produces winds 58 mph or stronger and/or hail 1 inch in diameter or larger. A warning means to take shelter (NWS 2023).

The NWS has five risk categories for severe thunderstorm risk: marginal, slight, enhanced, moderate, and high. The probabilistic forecast directly expresses the best estimate of a severe weather event occurring within 25 miles of a point (NWS 2022). Figure 4.3.7-16 details the thunderstorm risk categories.

Figure 4.3.7-16. Thunderstorm Risk



Source: NOAA n.d.

Currently, cloud-to-ground (CG) and intra-cloud (IC) lightning flashes are detected and mapped in real-time by two different networks in the United States: the National Lightning Detection Network and the Earth Networks Total Lightning Network. These systems work by detecting radio waves (sferics) 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, though only the very largest hail stones pose serious risk to people, if exposed. It is often estimated by comparing it to a known object (Figure 4.3.7-17). 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 4.3.7-17. Hail Size Chart

Source: NWS 2023

Hurricanes and Tropical Storms

The extent of a hurricane or tropical storm is commonly categorized in accordance with the Saffir-Simpson Hurricane Wind Scale, which assigns a designation of tropical storm for storms with sustained wind speeds below 74 mph and a hurricane category rating of 1–5 based on a hurricane's increasing sustained wind speed. This scale estimates potential property damage. Hurricanes reaching Category 3 and higher are considered *major hurricanes* because of their potential for significant loss of life and damage. Tropical Storms and Category 1 and 2 storms are still dangerous and require preventative measures (NOAA 2020). Figure 4.3.7-18 presents this scale.

Figure 4.3.7-18 The Saffir-Simpson Scale

Source: NOAA 2020

The NWS issues hurricane and tropical storm watches and warnings. These watches and warnings are issued or will remain in effect after a tropical cyclone becomes post-tropical, when such a storm poses a significant threat to life and property. The NWS allows the National Hurricane Center (NHC) to issue advisories during the post-tropical stage (NOAA NHC 2010). See below for descriptions of each watch and warning (NOAA NHC 2010):

- *Tropical Storm Watch*: An announcement that tropical storm conditions (sustained winds of 39 to 73 mph) are possible within the specified coastal area within 48 hours.
- *Tropical Storm Warning*: An announcement that tropical storm conditions (sustained winds of 39 to 73 mph) are expected somewhere within the specified coastal area within 36 hours.
- *Hurricane Watch*: An announcement that hurricane conditions (sustained winds of 74 mph or higher) are possible within the specified coastal area. Because hurricane preparedness activities become difficult once winds reach tropical storm force, the hurricane watch is issued 48 hours in advance of the anticipated onset of tropical-storm-force winds.
- *Hurricane Warning*: An announcement that hurricane conditions (sustained winds of 74 mph or higher) are expected somewhere within the specified coastal area. Because hurricane preparedness activities become difficult once winds reach tropical storm force, the hurricane warning is issued 36 hours in advance of the anticipated onset of tropical-storm-force winds (NOAA NHC 2010).

Storm Surge

The SLOSH model is a storm surge forecast model that forecasts surge events using information astronomical tides, storm track, intensity, and size of the storm. In addition to coastal flood watches and warnings, storm surge watches and warnings can also be issued for coastal areas in conjunction with tropical cyclone activity.

A storm surge watch is issued when there is the possibility of life-threatening inundation from rising water moving inland from the shoreline somewhere within the specified area, generally within 48 hours. The watch may be issued earlier when other conditions, such as the onset of tropical storm-force winds, are expected to limit the time available to take protective actions for surge (e.g., evacuations). The watch may also be issued for locations not expected to receive life-threatening inundation, but which could potentially be isolated by inundation in adjacent areas (NHC n.d.).

A storm surge warning is issued when there is danger of life-threating inundation from rising water moving inland from the shoreline anywhere within the specified area, generally within 36 hours. The warning may be issued earlier when other conditions, such as the onset of tropical storm-force winds, are expected to limit the time available to take protective actions for surge (e.g., evacuations). The warning may also be issued for locations not expected to receive life-threatening inundation, but which could potentially be isolated by inundation in adjacent areas (NHC n.d.).

Previous Occurrences and Losses

FEMA Major Disasters and Emergency Declarations

Between May 1953 and June 2023, the State of New Jersey was included in 32 FEMA declared severe weather-related disasters (DR) or emergencies (EM) classified as one or a combination of the following hazards: coastal storm, high tides, heavy rain, hurricane, tropical storm, nor'easter, straight-line winds, and mudslide. Generally, these disasters cover a wide region of the State; therefore, they may have impacted many counties. Of those declarations, Burlington County has been included in 15 declarations. Since the 2020 HMP, Burlington County has been included in two additional the FEMA disaster declarations. Table 4.3.7-1 lists FEMA declarations from May 1953 to May 2023 for this HMP update. Detailed information about the declared disasters since 1953 is provided in Section 3 (County Profile).

Table 4.3.7-1. FEMA Declarations for Severe Weather Events in Burlington County

FEMA Declaration Number	Date of Declaration	Date of Event	Event Type	Event Title
EM-3148-NJ	September 17, 1999	September 16-18, 1999	Hurricane	Hurricane Floyd Emergency Declarations
DR-1530-NJ	July 16, 2004	July 12-23, 2004	Severe Storm	Severe Storms and Flooding
EM-3257-NJ	September 19, 2005	August 29 – October 1, 2005	Hurricane	Hurricane Katrina Evacuations
DR-1694-NJ	April 26, 2007	April 14-20, 2007	Severe Storm	Heavy Rains, Severe Storms, Hail, and Tornadoes
DR-1897-NJ	April 2, 2010	March 12 – April 15, 2010	Severe Storm	Heavy Rains and Flooding
EM-3332-NJ	August 27, 2011	August 26 – September 5, 2011	Hurricane	Hurricane Irene
DR-4021-NJ	August 31, 2011	August 26 – September 5, 2011	Hurricane	Hurricane Irene
EM-3354-NJ	October 28, 2012	October 26 – November 8, 2012	Hurricane	Hurricane Sandy
DR-4086-NJ	October 30, 2012	October 26 – November 8, 2012	Hurricane	Hurricane Sandy
DR-4231-NJ	July 22, 2015	June 23, 2015	Severe Storm	Severe Storm
DR-4264-NJ	March 14, 2016	January 22-24, 2016	Severe Storm	Severe Winter Storm and Snowstorm
DR-4368-NJ	June 8, 2018	March 6-7, 2018	Severe Storm	Severe Winter Storm and Snowstorm
DR-4574-NJ	December 11, 2020	August 4, 2020	Tropical Storm	New Jersey Tropical Storm Isaias
EM-3573-NJ	September 3, 2021	September 1-3, 2021	Hurricane	New Jersey Remnants of Hurricane Ida

FEMA Declaration Number	Date of Declaration	Date of Event	Event Type	Event Title
DR-4614-NJ	September 5, 2021	September 1-3, 2021	Hurricane	New Jersey Remnants of Hurricane Ida

Source: FEMA 2023

U.S. Department of Agriculture Disaster Declarations

The Secretary of Agriculture from the U.S. Department of Agriculture (USDA) is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in counties that are contiguous to a designated county. As shown in Table 4.3.7-2, between August 2018 and May 2023, Burlington County was included in one severe weather-related agricultural disaster declarations.

Table 4.3.7-2. USDA Declarations for Severe Weather Events in Burlington County, August 2018 and May 2023

Date of Event	Event Type	USDA Declaration Number	Description
April 1 – June 21, 2019	Heavy Rain	S4519	Excessive Rain, Flash Flooding, and Flooding

Source: USDA 2023

Previous Events

For the 2024 HMP update, known severe weather events that impacted Burlington County between August 2018 and May 2023 are listed in Table 4.3.7-3. For events prior to 2018, refer to the 2018 Burlington County HMP.

Table 4.3.7-3. Severe Weather Incidents in Burlington County, 2018 to 2023

Date of Event	Event Type	Declaration Number	Burlington County Designated?	Description
February 25, 2019	High Wind	N/A	N/A	High winds gusting 50-60 miles per hour resulted in scattered power outages and trees down. Some minor structural damage also occurred. Trees and power lines reported down on NJ-47.
April 15, 2019	Thunderstorm Wind	N/A	N/A	A severe weather outbreak caused widespread straight line wind damage. Several thunderstorm related damage reports were received. The National Weather Service estimated wind gusts to be around 60 miles per hour.
April 26, 2019	Thunderstorm Wind	N/A	N/A	Severe storms caused widespread wind damage. Tree and powerline damage was observed in Maple Shade, Willingboro, and Mansfield. A downed tree blocked multiple lanes of State Highway 38.
June 2, 2019	Hail, Thunderstorm Wind	N/A	N/A	Severe thunderstorms impacted the region. Hail was reported to be between 0.75 and 1 inch in diameter. Trees were reported down in Pemberton Township.
June 29, 2019	Hail, Thunderstorm Wind	N/A	N/A	Widespread severe thunderstorms developed, resulting in numerous reports of damaging wind, as well as some hail. Hail was reported to be 0.75 inch in diameter. Trees, large limbs, and powerlines were downed in Mount Holly and Pemberton Township; one tree fell onto a residence. In Mount Holly. A downed tree fell on NJ-68 and closed all lanes in Springfield Township
July 6, 2019	Tornado, Thunderstorm Wind	N/A	N/A	Scattered strong to severe thunderstorms developed in the area. An EF-0 tornado occurred in Mount Laurel Township. The tornado caused minor damage to a warehouse and overturned one car before quickly dissipating. No injuries or fatalities occurred during

Date of Event	Event Type	Declaration Number	Burlington County Designated?	Description
				this event. Trees were reported down in Mount Laurel, unassociated with the EF-0 tornado.
July 11, 2019	Tornado, Thunderstorm Wind	N/A	N/A	A brief tornado occurred in Mount Laurel Township. The EF-1 tornado caused major tree damage, including uprooting; a few houses and apartments in the Township incurred minor damage. A tree was downed in the right lane of NJ-68; another tree was blown down onto a road near Ramblewood Country Club.
July 17, 2019	Thunderstorm Wind	N/A	N/A	The remnants of Hurricane Barry moved into Burlington County, producing severe weather. Trees and tree limbs were reported down in Willingboro and Springfield.
July 21, 2019	Thunderstorm Wind	N/A	N/A	A severe storm produced areas of wind damage. Wires were downed on Odd Fellows Road.
July 22, 2019	Thunderstorm Wind	N/A	N/A	Severe weather developed producing widespread damaging winds with considerable damage over a large area. Wind gusts were recorded at 60 miles per hour. Several trees, large tree branches and powerlines were downed, including a tree drowned on NJ-38, closing all lanes. Another tree was downed on I-295, closing the ramp to Exit 57. Building damage was reported in Beverly. A tree fell on a house in Moorestown with an occupant inside.
July 31, 2019	Thunderstorm Wind	N/A	N/A	Scattered thunderstorms developed; some storms became strong to severe with the threat of damaging winds. Wires were reported down in Cinnaminson and Beverly.
August 7, 2019	Hail, Thunderstorm Wind	N/A	N/A	Numerous severe storms impacted Burlington County, producing damaging winds and hail. Hail was reported to be 0.75 inch in diameter. Several tree limbs and powerlines were reported down.
August 19, 2019	Thunderstorm Wind	N/A	N/A	Scattered thunderstorms developed; some storms became strong to severe with the threat of damaging winds. Trees and powerlines were downed in Moorestown, Westampton, and Mansfield; a tree collapsed onto a house in Moorestown.
July 11, 2020	Tropical Storm	N/A	N/A	Tropical Storm Fay made landfall just north of Atlantic City before tracking north, bring heavy rain and wind.
February 7, 2020	High Wind, Thunderstorm Wind	N/A	N/A	Winds remained strong following a severe weather outbreak; winds were strongest in coastal areas. Winds began to diminish late in the day as the weather system moved further away. Tree and power line damage was reported; a fallen tree closed all lanes on NJ-68 and another closed Exit 52 off I-295 Southbound. Wind gusts of 60 miles per hour were measured.
March 3, 2020	Thunderstorm Wind	N/A	N/A	Widespread showers and some embedded thunder developed, producing damaging wind gusts. Trees and wires were downed in Burlington Township. There was no property or crop damage reported from this event in Burlington County.

Date of Event	Event Type	Declaration Number	Burlington County Designated?	Description
April 9, 2020	Thunderstorm Wind	N/A	N/A	Scattered thunderstorms developed; some storms became strong to severe with the threat of damaging winds. Several trees and powerlines were downed. A downed tree blocked the right lane of the westbound New Jersey Turnpike. A tree was downed on I-295 north of Exit 43, causing lane restrictions. There was no property or crop damage reported from this event in Burlington County.
April 13, 2020	High Wind	N/A	N/A	Severe thunderstorms produced several damaging wind reports. Wind damage was reported near Tabernacle. Observations suggest it is highly likely additional tree damage occurred in the heavily wooded and sparsely populated portions of the County. The McGuire Air Force Base measured a 60 mile per hour wind gust. Multiple reports of tree and utility damage were received.
April 21, 2020	Thunderstorm Wind	N/A	N/A	Scattered thunderstorms developed; some storms became strong to severe with the threat of damaging winds. Multiple reports of tree and utility damage were received.
April 30, 2020	High Wind	N/A	N/A	Strong wind gusts produced tree and utility damage. A large tree down was reported in Maple Shade. Fencing was blown down in Delran. Some power outages also occurred in the area, likely due to utility damage from high winds.
June 3-4, 2020	Thunderstorm Wind	N/A	N/A	A derecho developed then moved rapidly. The storm produced damaging winds more than 60 miles per hour; as the thunderstorm continued eastward, wind damage reports became more numerous and widespread. Wind gust reports between 60 and 70 MPH were common. In addition to these destructive wind gusts, frequent to continuous cloud to ground lightning and heavy downpours were also reported throughout the area. Because this derecho moved off the coast rapidly, another round of severe thunderstorms occurred over some of the same areas. Reported wind gusts associated with these thunderstorms generally ranged between 45 and 65 miles per hour. Multiple large trees down and at least one power pole snapped in Cinnaminson. A downed tree was reported on the New Jersey Turnpike north of State Highway 73 near Moorestown; another tree was downed on I-295 in Mount Laurel; US-130 had downed powerlines and poles on the roadway. A wind gust of 64 miles per hour was recorded in Delanco and Willingboro; a 73 mile per hour wind gust was recorded in Delran; and a 72 mile per hour gust was recorded in Moorestown. Numerous trees were downed in Willingboro, Beverly, Delran, Riverside, Westampton, Burlington City, and Moorestown. A tree fell on a car, also landing on a section of a home, near Moorestown; the house had no significant damage.
July 6, 2020	Thunderstorm Wind	N/A	N/A	Severe thunderstorms developed, producing strong winds. Multiple reports of tree and utility damage were received. Downed wires closed NJ-73 in both directions between Brick Rd and Maple Ave. Multiple trees and wires were downed on NJ-73 in Marlton. A tree fell on wires on Creek Rd at NJ-38 in Hainesport.
July 30, 2020	Thunderstorm Wind	N/A	N/A	Scattered thunderstorms, some of which became strong to severe, produced several reports of damaging winds. Wires were downed in Riverside, Burlington City, Mansfield, and Bordentown.

Date of Event	Event Type	Declaration Number	Burlington County Designated?	Description
August 3, 2020	Thunderstorm Wind	N/A	N/A	Multiple clusters of thunderstorms produced scattered and significant wind damage. Trees and wires downed were reported. Siding was blown off a building in Mount Laurel.
August 4, 2020	Tropical Storm	DR-4574-NJ	Yes	Tropical Storm Isaias brought high winds, heavy rain, and coastal flooding to Burlington County. Multiple observations of 40 to 50 miles per hour sustained winds were recorded. Numerous trees and power lines were downed. There was a reported 53 mile per hour wind gust in Tabernacle. Downed trees and power lines were reported and sustained tropical storm force winds almost certainly occurred.
August 12, 2020	Thunderstorm Wind	N/A	N/A	Severe thunderstorms developed, producing strong winds. Multiple reports of tree and utility damage were received.
August 28, 2020	Thunderstorm Wind	N/A	N/A	Significant storms produced widespread wind damage. Multiple reports of tree and utility damage were received. Downed trees caused a power outage at US-206 and Mansfield Road.
November 15, 2020	Thunderstorm Wind	N/A	N/A	There was no property or crop damage reported from this event in Burlington County.
December 24, 2020	High Wind	N/A	N/A	A high wind event occurred in Burlington County. The McGuire Air Force Base measured a 58 mile per hour wind gust. Observations from the more densely observed northwestern part of the County, and coastal observations from surrounding Counties, suggest wind gusts of around 60 miles per hour likely occurred.
March 28, 2021	Thunderstorm Wind	N/A	N/A	A strong weather system produced wind damage. Several severe wind gusts were measured, with numerous reports of tree, utility, and some structural damage. Trees and wires were reported down in Springfield Township. The National Weather service estimated wind gusts reached 60 miles per hour.
April 21, 2021	Hail	N/A	N/A	Severe storms led to scattered instances of hail and wind damage in Burlington County. Hail was reported to be 0.88 inch in diameter.
April 29, 2021	Thunderstorm Wind	N/A	N/A	Thunderstorms developed and resulted in reports of damaging wind. Multiple trees and powerlines were downed in Evesham, Moorestown, and Mount Holly.
May 26, 2021	Thunderstorm Wind	N/A	N/A	A widespread severe weather event resulted in damaging winds. Numerous instances of downed trees and power lines and some property damage were reported. Thunderstorms during the evening hours were also prolific lightning producers. Multiple trees and powerlines were downed in Mount Holly, Hainesport, Medford, Willingboro, Palmyra, and Riverton.
June 4, 2021	Hail, Thunderstorm Wind	N/A	N/A	Several severe storms posed a threat for damaging winds and hail. Trees and wires downed were reported in Palmyra, Florence, North Hanover, Wrightstown, Springville, Pemberton, Medford, and Medford Lakes. Hail was reported to be 0.75 inch in diameter.
June 9, 2021	Lightning, Thunderstorm Wind	N/A	N/A	Severe thunderstorms developed bringing a threat for damaging winds, hail, and torrential rain. A couple of downed trees and limbs were reported in the Edgewater Park. A man in his 70s was struck and killed by lightning at Burlington Country Club. This was the first documented case of a fatal lightning strike in the United States in 2021.

Date of Event	Event Type	Declaration Number	Burlington County Designated?	Description
June 14, 2021	Thunderstorm Wind	N/A	N/A	Strong and severe storms posed a risk of damaging winds along with some hail. Multiple trees and powerlines were downed in Bass River, Moorestown, Florence, and Bordentown.
July 1, 2021	Thunderstorm Wind	N/A	N/A	Severe storms capable of producing straight line wind damage caused reports of downed trees and power outages due to winds. Wires were reported down in Pemberton and Bordentown.
July 6, 2021	Thunderstorm Wind	N/A	N/A	Storms produced damaging winds and some hail. Wires were downed in Moorestown.
July 8-9, 2021	Tropical Storm	N/A	N/A	Tropical Storm Elsa paralleled the New Jersey coastline, bringing heavy thunderstorms to Burlington County.
July 12, 2021	Thunderstorm Wind	N/A	N/A	Scattered to widespread thunderstorms developed; some of the storms became severe, with several instances of damaging wind across the region. Trees and wires downed were reported in Moorestown, Maple Shade, Springfield, Willingboro, Florence, Beverly, Fieldsboro, Mansfield, Palmyra, and Riverton.
July 17, 2021	Tornado, Thunderstorm Wind	N/A	N/A	Severe storms with damaging wind impacted Burlington County. A weak EF-1 tornado was confirmed in the County. Areas of heavy rain and flash flooding also occurred due to the widespread and slow-moving storm. A narrow, discontinuous, path of tree damage began just east of the Route 206 and Columbus-Jobstown Road intersection; tornado dissipated before the Ocean County line.
July 21, 2021	Thunderstorm Wind	N/A	N/A	Widespread thunderstorms developed; storms mainly took the form of clusters. Several storms became severe, posing a threat for both damaging winds and large hail. Large tree limbs were downed and blocked Bridgeboro Rd near the Westfield Rd intersection in Moorestown. Wires were downed in Delanco near the border with Riverside Twp and the Rancocas Creek.
July 29, 2021	Tornado, Hail, Thunderstorm Wind	N/A	N/A	A tornado touched down on in a heavily forested area in the eastern portion of Woodland Twp. After touching down, the tornado moved in an east-northeasterly direction and quickly crossed the Ocean County border. Trees and wires were reported down, and shingles were blown off roofs. Hail was reported to be between 1 to 1.5 inches in diameter.
August 26, 2021	Thunderstorm Wind	N/A	N/A	Storms produced locally damaging winds. Tree limbs and wires were downed on Moravvian Ave and Pancoast Blvd in Delran Twp, and near Beverly Rancocas Rd in Willingboro Twp.
September 1, 2021	Tornado, Thunderstorm Wind	EM-3573-NJ, DR-4614-NJ	Yes	The remnants of Hurricane Ida resulted in widespread thunderstorms. An EF-1 tornado formed in Burlington Township, near the Township line with Edgewater Park. Extensive tree damage was reported, including large branches snapped and trees uprooted. Damage to houses and vehicles was also reported, including a tree which had fallen onto an unoccupied vehicle. Power outages occurred due to damage to powerlines. The tornado continued into Bucks County, Pennsylvania.
November 13, 2021	Hail	N/A	N/A	Severe thunderstorms produced hail in Burlington County; hail was reported to be 0.88 inch in diameter.

Date of Event	Event Type	Declaration Number	Burlington County Designated?	Description
February 18, 2022	Thunderstorm Wind	N/A	N/A	Locally damaging wind gusts occurred ahead of a weather system; isolated thunderstorms later developed. This system strengthened and produced several instances of damaging wind near the I-95 corridor. There was a power outage in Willingboro due to fallen tree limbs; tree limbs were also reported down in Mount Laurel and Bordentown.
March 7, 2022	Thunderstorm Wind	N/A	N/A	Widespread wind gusts of 50 to 65 miles per hour moved through Burlington County. This resulted in scattered to numerous reports of downed trees and power outages. A tree was downed on US-130 northbound south of Jacksonville Road. Several poles and wires were downed on Route 541 near Irick Road and Western Drive. Power outages occurred at nearby hotels in Westampton.
April 14, 2022	Thunderstorm Wind	N/A	N/A	Scattered showers and thunderstorms developed, causing the storms to mainly stay below severe limits, some locally strong to damaging wind gusts were reported. Wires and a tree were reported down in Pemberton.
April 16, 2022	Hail	N/A	N/A	Scattered thunderstorms developed and produced hail. Hail was reported to be between 0.75 and 1 inch in diameter.
May 20, 2022	Hail	N/A	N/A	Severe storms produced damaging winds, hail, and one brief tornado in New Jersey. In Burlington County, hail was reported to be between 0.75 and 2.5 inches in diameter.
May 27, 2022	Thunderstorm Wind	N/A	N/A	Scattered to widespread storm development produced instances of damaging wind. A large tree was split on Harper Drive in Moorestown.
June 2, 2022	Thunderstorm Wind	N/A	N/A	Widespread thunderstorms developed; some of the storms became severe as they moved through the region, producing damaging winds and small hail. Trees were downed and uprooted, powerlines were downed, and tree limbs fell in Beverly, Delanco, Edgewater Park, Mount Laurel, Pemberton, Medford, and Woodland.
June 9, 2022	Thunderstorm Wind	N/A	N/A	Multiple clusters of showers and thunderstorms produced localized wind damage. A downed tree blocked a ramp on Route 38 in Mount Laurel.
July 21, 2022	Thunderstorm Wind	N/A	N/A	An isolated thunderstorm produced some minor wind damage near Marlton. Evesham Twp Police Department reported wires down on North Elmwood Road near Route 70.

Source: NOAA NCEI 2023; FEMA 2023; USDA 2023

Probability of Future Occurrence

For the 2024 HMP update, the most up-to-date data was collected to calculate the probability of future occurrence of severe weather events for the County. Information from NOAA-NCEI storm events database, FEMA, and the NOAA NHC was used to identify the number of severe weather events that occurred between 1950 and May 2023. Table 4.3.7-4 presents the probability of future events for severe weather in Burlington County.

Table 4.3.7-4. Probability of Future Occurrences of Severe Weather Events

Hazard Type	Number of Occurrences Between 1950 and 2023	% Chance of Occurring in Any Given Year
Funnel Cloud	12	16.43%

Hazard Type	Number of Occurrences Between 1950 and 2023	% Chance of Occurring in Any Given Year
Hail	76	100%
Heavy Rain	67	91.78%
High Wind	41	56.16%
Hurricane	5	0.68%
Lightning	40	54.79%
Strong Wind	128	100%
Thunderstorm Wind	254	100%
Tornado	21	28.77%
Tropical Storm	18	24.66%
Total	**662**	**100%**

Source: NOAA 2023; NOAA NHC 2023

Note: Disaster occurrences include federally declared disasters since the 1950 Federal Disaster Relief Act, and selected events since 1968. 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 underestimated.

In Section 4.4, the identified hazards of concern for the County were ranked. The probability of occurrence, or likelihood of the event, is one parameter used for hazard rankings. Based on historical records and input from the Planning Team, the probability of occurrence for severe weather in the County is considered "frequent."

Climate Change Impacts

Providing projections of future climate change for a specific region is challenging. Shorter term projections are more closely tied to existing trends making longer term projections even more challenging. The further out a prediction reaches the more subject to changing dynamics it becomes.

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 (1.9 °C) increase in the State's average temperature, which is faster than the rest of the Northeast region (2 °F [1.1 °C]) and the world (1.5 °F [0.8 °C]). This warming trend is expected to continue. By 2050, temperatures in New Jersey are expected to increase by 4.1 to 5.7 °F (2.3 °C to 3.2 °C). 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 (5.6 °C) 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 (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, New Jersey 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. New Jersey will experience more intense rain events, less snow, and more rainfalls. Also, small decreases in the amount of precipitation may occur in the summer, 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).

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. Over the last 50 years, in 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). In the past decade, warmer ocean temperatures have resulted in many tropical systems taking place outside of the typical hurricane season. It remains to be seen if other factors such as steering currents, atmospheric sheer, and the presence of Saharan dust will be impacted in ways which increase or decrease the risk of hurricanes in Burlington County.

Vulnerability Assessment

To assess Burlington County's risk to the severe weather hazard, a spatial analysis was conducted using SLOSH Categories 1, 2, and 3 hazard areas were assessed to estimate exposure to the Storm Surge hazard area. The SLOSH boundaries (sourced from NOAA) were overlaid on the centroids of updated assets (population, building stock, and critical facilities); as well as on the centroids of anticipated new development. Centroids that intersected the SLOSH boundaries were totaled to estimate the building RCV and vulnerable populations to the SLOSH Category 1, 2 and 3 hazard areas. These results are summarized below.

A Hazus probabilistic analysis was performed to analyze the wind hazard losses for Burlington County for the 100- and 500-year MRP events. The probabilistic Hazus hurricane model activates a database of thousands of potential storms that have tracks and intensities reflecting the full spectrum of Atlantic hurricanes observed since 1886 and identifies those with tracks associated with Burlington County. Hazus contains data on historic hurricane events and wind speeds. It also includes surface roughness and vegetation (tree coverage) maps for the area. Surface roughness and vegetation data support the modeling of wind force across various types of land surfaces. Default demographic and updated building and critical facility inventories in Hazus were used for the analysis. Although damage is estimated at the census tract level, results were presented at the municipal level. Because there are multiple census tracts that contain more than one jurisdiction, a density analysis was used to extract the percentage of building structures that fall within each tract and jurisdiction. The percentage was multiplied against the results calculated for each tract and summed for each jurisdiction.

Impact on Life, Health, and Safety

The impact of a severe weather on life, health, and safety is dependent upon several factors including the severity of the event and whether adequate warning time was provided to residents. The entire population of Burlington County (461,860) is exposed to this hazard.

Lightning can be responsible for deaths, injuries, and property damage. Lightning-based deaths and injuries typically involve heart damage, inflated lungs, or brain damage, as well as loss of consciousness, amnesia, paralysis, and burns, depending on the severity of the strike. Additionally, most people struck by lightning survive, although they may have severe burns and internal damage. People located outdoors (i.e., recreational activities and farming) are considered most vulnerable to hailstorms, thunderstorms, and tornadoes because there is little to no warning, and shelter might not be available. Downed trees, damaged buildings, and debris carried by high winds from hurricanes, tropical storms, or tornadoes can lead to injury or loss of life.

Table 4.3.7-5 identifies the estimated population located in each Sea, Lake, and Overland Surges (SLOSH) Category Hazard Area. The Township of Bass River has the highest number of people (66) in the SLOSH Category 1 Hazard Area, while the Township of Washington has the highest percentage (5.1 percent) of its population in the SLOSH Category 1 Hazard Area. The Township of Cinnaminson has the highest number of people (434) in the SLOSH

Category 2 Hazard Area, while the Township of Bass River has the highest percentage (23.1 percent) of their population in the SLOSH Category 2 Hazard Area. The City of Burlington has the highest number of people (2,343) in the SLOSH Category 3 Hazard Area, while the Township of Bass River has the highest percentage (51.6 percent) of their population in the SLOSH Category 3 Hazard Area.

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 16 displaced households and 10 persons seeking short-term sheltering caused by the 500-year MRP event. Further, Hazus estimates that there will be 537 households displaced and 292 persons seeking short-term sheltering caused by the 500-year MRP event (Table 4.3.7-6).

Socially Vulnerable Populations

Research has shown that some populations, while they may not have more hazard exposure, may experience exacerbated impacts and prolonged recovery if/when impacted. This is due to many factors, including their physical and financial ability to react or respond during a hazard. Of the population exposed, the most vulnerable include the economically disadvantaged and the population over age 65. Economically disadvantaged populations may be more vulnerable because they are likely to evaluate their risk and make decisions to evacuate based on net economic impacts on their families. The population over age 65 is also more vulnerable because they are more likely to seek or need medical attention that may not be available due to isolation during a flood event, and they may have more difficulty evacuating. According to the 2021 5-year ACS estimates, there are 27,947 total persons living below the poverty level, 78,093 persons over the age of 65 years, 23,350 persons under the age of 5 years, 9,103 non-English speakers, and 51,899 persons with a disability in Burlington County, as shown in Table 4.3.7-7.

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 (Hazwoper OSHA 2020).

Table 4.3.7-5. Estimated Population Located in SLOSH Category Hazard Areas

Jurisdiction	Total Population (Decennial Population 2020)	Estimated Population in the SLOSH Hazard Area					
		SLOSH Category 1		SLOSH Category 2		SLOSH Category 3	
		Number	Percent of Total	Number	Percent of Total	Number	Percent of Total
Bass River (T)	1,355	66	4.8%	314	23.1%	700	51.6%
Beverly (C)	2,499	0	0.0%	0	0.0%	6	0.2%
Bordentown (C)	3,993	0	0.0%	4	0.1%	4	0.1%
Bordentown (T)	11,791	0	0.0%	0	0.0%	4	<0.1%
Burlington (C)	9,743	0	0.0%	0	0.0%	2,343	24.1%
Burlington (T)	23,983	0	0.0%	0	0.0%	12	<0.1%
Chesterfield (T)	9,422	0	0.0%	0	0.0%	0	0.0%
Cinnaminson (T)	17,064	53	0.3%	434	2.5%	1,025	6.0%
Delanco (T)	4,824	0	0.0%	12	0.2%	194	4.0%
Delran (T)	17,882	4	<0.1%	159	0.9%	541	3.0%

Jurisdiction	Total Population (Decennial Population 2020)	Estimated Population in the SLOSH Hazard Area					
		SLOSH Category 1		SLOSH Category 2		SLOSH Category 3	
		Number	Percent of Total	Number	Percent of Total	Number	Percent of Total
Eastampton (T)	6,191	0	0.0%	0	0.0%	0	0.0%
Edgewater Park (T)	8,930	0	0.0%	0	0.0%	4	<0.1%
Evesham (T)	46,826	0	0.0%	0	0.0%	0	0.0%
Fieldsboro (B)	526	0	0.0%	0	0.0%	0	0.0%
Florence (T)	12,812	0	0.0%	0	0.0%	0	0.0%
Hainesport (T)	6,035	5	0.1%	8	0.1%	11	0.2%
Lumberton (T)	12,803	8	0.1%	28	0.2%	44	0.3%
Mansfield (T)	8,897	0	0.0%	0	0.0%	0	0.0%
Maple Shade (T)	19,980	0	0.0%	4	<0.1%	13	0.1%
Medford (T)	24,497	0	0.0%	0	0.0%	0	0.0%
Medford Lakes (B)	4,264	0	0.0%	0	0.0%	0	0.0%
Moorestown (T)	21,355	10	<0.1%	26	0.1%	30	0.1%
Mount Holly (T)	9,981	0	0.0%	0	0.0%	7	0.1%
Mount Laurel (T)	44,633	0	0.0%	0	0.0%	4	<0.1%
New Hanover (T)	6,367	0	0.0%	0	0.0%	0	0.0%
North Hanover (T)	7,963	0	0.0%	0	0.0%	0	0.0%
Palmyra (B)	7,438	16	0.2%	16	0.2%	1,898	25.5%
Pemberton (B)	1,371	0	0.0%	0	0.0%	0	0.0%
Pemberton (T)	26,903	0	0.0%	0	0.0%	0	0.0%
Riverside (T)	8,003	0	0.0%	3	<0.1%	450	5.6%
Riverton (B)	2,764	3	0.1%	6	0.2%	209	7.6%
Shamong (T)	6,460	0	0.0%	0	0.0%	0	0.0%
Southampton (T)	10,317	0	0.0%	0	0.0%	0	0.0%
Springfield (T)	3,245	0	0.0%	0	0.0%	0	0.0%
Tabernacle (T)	6,776	0	0.0%	0	0.0%	0	0.0%
Washington (T)	693	36	5.1%	103	14.9%	240	34.6%
Westampton (T)	9,121	0	0.0%	0	0.0%	22	0.2%
Willingboro (T)	31,889	3	<0.1%	6	<0.1%	42	0.1%
Woodland (T)	1,544	0	0.0%	0	0.0%	0	0.0%
Wrightstown (B)	720	0	0.0%	0	0.0%	0	0.0%
Burlington County (Total)	**461,860**	**203**	**<0.1%**	**1,123**	**0.2%**	**7,802**	**1.7%**

Source: Burlington County, 2023; NJOGIS 2023; Microsoft BING 2022; U.S. Census Bureau 2020; NOAA 2022

Table 4.3.7-6. Estimated Displaced Households and Persons Seeking Shelter Caused by the 100-Year 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
Bass River (T)	0	0	0	0
Beverly (C)	0	0	2	1
Bordentown (C)	1	0	8	3
Bordentown (T)	4	2	17	9
Burlington (C)	0	0	13	8
Burlington (T)	0	0	30	20
Chesterfield (T)	1	0	4	2
Cinnaminson (T)	0	0	12	6

Jurisdiction	100-Year MRP Hurricane		500-Year MRP Hurricane	
	Displaced Households	Persons Seeking Short-Term Sheltering	Displaced Households	Persons Seeking Short-Term Sheltering
Delanco (T)	0	0	6	3
Delran (T)	0	0	12	8
Eastampton (T)	0	0	10	6
Edgewater Park (T)	0	0	9	6
Evesham (T)	0	0	69	30
Fieldsboro (B)	0	0	1	0
Florence (T)	1	0	29	14
Hainesport (T)	0	0	11	5
Lumberton (T)	0	0	27	18
Mansfield (T)	0	0	8	4
Maple Shade (T)	0	0	16	8
Medford (T)	0	0	46	19
Medford Lakes (B)	0	0	7	2
Moorestown (T)	0	0	17	9
Mount Holly (T)	0	0	25	21
Mount Laurel (T)	0	0	63	28
New Hanover (T)	0	0	0	0
North Hanover (T)	1	0	1	0
Palmyra (B)	0	0	4	2
Pemberton (B)	0	0	0	0
Pemberton (T)	8	8	9	9
Riverside (T)	0	0	10	10
Riverton (B)	0	0	2	0
Shamong (T)	0	0	6	2
Southampton (T)	0	0	10	4
Springfield (T)	0	0	2	1
Tabernacle (T)	0	0	4	2
Washington (T)	0	0	0	0
Westampton (T)	0	0	13	7
Willingboro (T)	0	0	34	25
Woodland (T)	0	0	0	0
Wrightstown (B)	0	0	0	0
Burlington County (Total)	**16**	**10**	**537**	**292**

Source: Hazus v6.0

Notes: Values are rounded down

Table 4.3.7-7. Burlington County Socially Vulnerable Populations by Municipality

Jurisdiction[a]	Decennial Population 2020		American Community Survey 5-Year Population Estimates (2021)									
			Population Over 65		Population Under 5		Non-English Speaking Population		Population with Disability		Population Below Poverty Level	
	Jurisdiction Total	% of County Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total
Bass River (T)	1,355	0.3%	248	18.3%	67	4.9%	0	0.0%	175	12.9%	95	7.0%
Beverly (C)	2,499	0.5%	292	11.7%	183	7.3%	0	0.0%	249	10.0%	300	12.0%
Bordentown (C)	3,993	0.9%	772	19.3%	216	5.4%	16	0.4%	422	10.6%	227	5.7%
Bordentown (T)	11,791	2.6%	1,601	13.6%	472	4.0%	289	2.4%	1,092	9.3%	194	1.6%
Burlington (C)	9,743	2.1%	1,301	13.4%	661	6.8%	208	2.1%	1,251	12.8%	1,422	14.6%
Burlington (T)	23,983	5.2%	3,526	14.7%	1,497	6.2%	385	1.6%	2,366	9.9%	2,185	9.1%
Chesterfield (T)	9,422	2.0%	760	8.1%	578	6.1%	153	1.6%	423	4.5%	165	1.8%
Cinnaminson (T)	17,064	3.7%	3,103	18.2%	929	5.4%	208	1.2%	1,661	9.7%	584	3.4%
Delanco (T)	4,824	1.0%	1,297	26.9%	191	4.0%	42	0.9%	676	14.0%	322	6.7%
Delran (T)	17,882	3.9%	2,570	14.4%	1,047	5.9%	723	4.0%	1,548	8.7%	902	5.0%
Eastampton (T)	6,191	1.3%	557	9.0%	264	4.3%	0	0.0%	478	7.7%	488	7.9%
Edgewater Park (T)	8,930	1.9%	1,571	17.6%	700	7.8%	367	4.1%	1,465	16.4%	1,645	18.4%
Evesham (T)	46,826	10.1%	8,574	18.3%	2,237	4.8%	749	1.6%	4,504	9.6%	1,476	3.2%
Fieldsboro (B)	526	0.1%	82	15.6%	64	12.2%	0	0.0%	62	11.8%	36	6.8%
Florence (T)	12,812	2.8%	2,122	16.6%	645	5.0%	260	2.0%	1,460	11.4%	827	6.5%
Hainesport (T)	6,035	1.3%	1,327	22.0%	58	1.0%	0	0.0%	744	12.3%	250	4.1%
Lumberton (T)	12,803	2.8%	2,048	16.0%	661	5.2%	107	0.8%	1,490	11.6%	805	6.3%
Mansfield (T)	8,897	1.9%	2,506	28.2%	394	4.4%	330	3.7%	1,465	16.5%	181	2.0%
Maple Shade (T)	19,980	4.3%	2,897	14.5%	1,159	5.8%	694	3.5%	2,433	12.2%	1,971	9.9%
Medford (T)	24,497	5.3%	5,151	21.0%	1,085	4.4%	31	0.1%	2,775	11.3%	724	3.0%
Medford Lakes (B)	4,264	0.9%	879	20.6%	211	4.9%	0	0.0%	407	9.5%	26	0.6%
Moorestown (T)	21,355	4.6%	3,480	16.3%	837	3.9%	603	2.8%	1,654	7.7%	807	3.8%
Mount Holly (T)	9,981	2.2%	1,199	12.0%	454	4.5%	133	1.3%	1,624	16.3%	958	9.6%
Mount Laurel (T)	44,633	9.7%	8,299	18.6%	2,011	4.5%	889	2.0%	4,203	9.4%	1,689	3.8%
New Hanover (T)	6,367	1.4%	311	4.9%	214	3.4%	29	0.4%	192	3.0%	116	1.8%
North Hanover (T)	7,963	1.7%	532	6.7%	975	12.2%	125	1.6%	631	7.9%	481	6.0%
Palmyra (B)	7,438	1.6%	1,077	14.5%	190	2.6%	44	0.6%	961	12.9%	616	8.3%
Pemberton (B)	1,371	0.3%	282	20.6%	56	4.1%	47	3.4%	308	22.5%	140	10.2%

Jurisdiction[a]	Decennial Population 2020		American Community Survey 5-Year Population Estimates (2021)									
			Population Over 65		Population Under 5		Non-English Speaking Population		Population with Disability		Population Below Poverty Level	
	Jurisdiction Total	% of County Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total
Pemberton (T)	26,903	5.8%	4,306	16.0%	1,429	5.3%	1,092	4.1%	4,006	14.9%	2,518	9.4%
Riverside (T)	8,003	1.7%	1,039	13.0%	354	4.4%	754	9.4%	972	12.1%	1,257	15.7%
Riverton (B)	2,764	0.6%	554	20.0%	80	2.9%	5	0.2%	187	6.8%	72	2.6%
Shamong (T)	6,460	1.4%	1,313	20.3%	324	5.0%	0	0.0%	671	10.4%	136	2.1%
Southampton (T)	10,317	2.2%	3,153	30.6%	293	2.8%	125	1.2%	1,551	15.0%	589	5.7%
Springfield (T)	3,245	0.7%	479	14.8%	129	4.0%	65	2.0%	311	9.6%	160	4.9%
Tabernacle (T)	6,776	1.5%	1,524	22.5%	380	5.6%	0	0.0%	747	11.0%	233	3.4%
Washington (T)	693	0.2%	138	19.9%	8	1.2%	8	1.1%	87	12.6%	21	3.0%
Westampton (T)	9,121	2.0%	1,139	12.5%	263	2.9%	81	0.9%	802	8.8%	268	2.9%
Willingboro (T)	31,889	6.9%	5,707	17.9%	1,916	6.0%	538	1.7%	5,100	16.0%	2,685	8.4%
Woodland (T)	1,544	0.3%	319	20.7%	49	3.2%	0	0.0%	627	40.6%	363	23.5%
Wrightstown (B)	720	0.2%	58	8.1%	69	9.6%	5	0.7%	119	16.5%	13	1.8%
Burlington County Total	**461,860**	**100.0%**	**78,093**	**16.9%**	**23,350**	**5.1%**	**9,103**	**2.0%**	**51,899**	**11.2%**	**27,947**	**6.1%**

Source: U.S. Census Bureau 2020, 2021

Note: Persons per household = 2.6

a. (B) = borough; (C) = city; (T) = township

Impact on General Building Stock

All buildings are exposed to severe weather hazards such as hailstorms and lightning strikes. Refer to Section 3 (County Profile), which summarizes the building inventory in Burlington County. While hailstorms are not frequently known to cause major injuries or damage in New Jersey, an extreme event can carry hail stones traveling at speeds greater than 100 miles per hour (NWS 2019). This could cause structural damage for the general building stock in the County. Severe 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 damage per year (NFPA 2013).

Buildings located within the SLOSH hazard areas are exposed and considered vulnerable to the severe storm hazard, in particular hurricanes and storm surge. Buildings constructed of wood or vinyl siding are generally more likely to be impacted by the severe storm hazard than buildings constructed of brick or concrete. The estimated building stock inventory located in the hazard area for each SLOSH category is summarized by municipality in Table 4.3.7-8 through Table 4.3.7-10. Approximately 0.1 percent ($179 million) of the County's building replacement cost value is located in the SLOSH category 1 hazard area; 0.5 percent ($782 million) in the SLOSH category 2 hazard area; and 2.7 percent (4.5 billion) in the SLOSH category 3 hazard area. The Township of Bass River has the greatest number and proportion of buildings located in the category 1 hazard area (35 structures – 4.9 percent of its total). The Township of Cinnaminson has the greatest number of buildings located in the category 2 hazard area (162 structures – 2.8 percent of its total), and the Township of Bass River has the greatest proportion of its buildings located in the category 2 hazard area (i.e., 21.8 percent). The City of Burlington has the greatest number of buildings located in the category 3 hazard area (820 structures – 25.9 percent of its total), and the Township of Bass River has the greatest proportion of its buildings located in the category 3 hazard area (i.e., 51.3 percent).

Potential building damage was evaluated by Hazus across the damage categories defined as follows for a light wood-framed building (definitions for other building types are included in the Hazus technical manual documentation):

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

Table 4.3.7-8. Estimated General Building Stock Exposure in the SLOSH Category 1 Hazard Area

Jurisdiction	Total Number of Buildings	Total RCV	Estimated Building Stock in the SLOSH Hazard Area: Building Count – Number	Building Count – Percent of Total	RCV – Value	RCV – Percent of Total
Bass River (T)	719	$881,423,037	35	4.9%	$34,751,992	3.9%
Beverly (C)	939	$1,218,790,334	0	0.0%	$0	0.0%
Bordentown (C)	1,041	$2,794,074,193	0	0.0%	$0	0.0%
Bordentown (T)	3,389	$5,866,485,431	0	0.0%	$0	0.0%
Burlington (C)	3,165	$5,813,312,404	0	0.0%	$0	0.0%
Burlington (T)	6,525	$8,819,483,894	0	0.0%	$0	0.0%
Chesterfield (T)	2,673	$2,243,175,804	0	0.0%	$0	0.0%
Cinnaminson (T)	5,833	$6,206,033,564	20	0.3%	$76,376,024	1.2%
Delanco (T)	1,717	$1,777,428,934	0	0.0%	$0	0.0%
Delran (T)	5,008	$5,342,639,406	1	<0.1%	$380,754	<0.1%
Eastampton (T)	1,947	$1,223,958,808	0	0.0%	$0	0.0%
Edgewater Park (T)	2,210	$2,391,677,740	0	0.0%	$0	0.0%
Evesham (T)	13,368	$11,128,366,531	0	0.0%	$0	0.0%
Fieldsboro (B)	224	$241,524,257	0	0.0%	$0	0.0%
Florence (T)	4,084	$6,582,323,116	0	0.0%	$0	0.0%
Hainesport (T)	2,546	$3,283,651,920	2	0.1%	$761,508	<0.1%
Lumberton (T)	3,724	$4,304,673,748	2	0.1%	$775,408	<0.1%
Mansfield (T)	3,805	$3,398,330,024	0	0.0%	$0	0.0%
Maple Shade (T)	5,120	$5,835,178,181	0	0.0%	$0	0.0%
Medford (T)	8,792	$10,042,226,056	0	0.0%	$0	0.0%
Medford Lakes (B)	1,804	$967,238,228	0	0.0%	$0	0.0%
Moorestown (T)	7,173	$12,232,463,125	3	<0.1%	$1,170,061	<0.1%
Mount Holly (T)	2,987	$3,763,298,318	0	0.0%	$0	0.0%
Mount Laurel (T)	13,150	$15,418,468,979	0	0.0%	$0	0.0%
New Hanover (T)	1,068	$2,868,939,587	0	0.0%	$0	0.0%
North Hanover (T)	2,176	$2,404,670,347	0	0.0%	$0	0.0%
Palmyra (B)	2,482	$2,133,107,140	5	0.2%	$793,061	<0.1%
Pemberton (B)	519	$736,141,491	0	0.0%	$0	0.0%
Pemberton (T)	9,729	$6,973,242,840	0	0.0%	$0	0.0%
Riverside (T)	2,532	$2,459,954,166	0	0.0%	$0	0.0%
Riverton (B)	989	$1,096,729,598	1	0.1%	$394,654	<0.1%
Shamong (T)	2,494	$2,504,926,736	0	0.0%	$0	0.0%
Southampton (T)	5,368	$4,593,018,255	0	0.0%	$0	0.0%
Springfield (T)	1,826	$2,140,517,320	0	0.0%	$0	0.0%
Tabernacle (T)	2,938	$2,200,440,237	0	0.0%	$0	0.0%
Washington (T)	538	$604,084,949	24	4.5%	$63,908,648	10.6%
Westampton (T)	2,795	$4,620,292,645	0	0.0%	$0	0.0%
Willingboro (T)	10,830	$8,789,434,159	1	<0.1%	$380,754	<0.1%
Woodland (T)	782	$1,333,495,830	0	0.0%	$0	0.0%
Wrightstown (B)	296	$748,872,423	0	0.0%	$0	0.0%
Burlington County (Total)	**149,305**	**$167,984,093,756**	**94**	**0.1%**	**$179,692,863**	**0.1%**

Source: Burlington County 2023; NJOGIS 2023; Microsoft BING 2022; RS Means 2022; NOAA 2022

TETRA TECH

Table 4.3.7-9. Estimated General Building Stock Exposure in the SLOSH Category 2 Hazard Area

Jurisdiction	Total Number of Buildings	Total RCV	Estimated Building Stock in the SLOSH Hazard Area: Building Count – Number	Building Count – Percent of Total	RCV – Value	RCV – Percent of Total
Bass River (T)	719	$881,423,037	157	21.8%	$106,218,453	12.1%
Beverly (C)	939	$1,218,790,334	0	0.0%	$0	0.0%
Bordentown (C)	1,041	$2,794,074,193	1	0.1%	$404,984	<0.1%
Bordentown (T)	3,389	$5,866,485,431	2	0.1%	$72,368,590	1.2%
Burlington (C)	3,165	$5,813,312,404	0	0.0%	$0	0.0%
Burlington (T)	6,525	$8,819,483,894	1	<0.1%	$2,563,080	<0.1%
Chesterfield (T)	2,673	$2,243,175,804	0	0.0%	$0	0.0%
Cinnaminson (T)	5,833	$6,206,033,564	162	2.8%	$315,703,457	5.1%
Delanco (T)	1,717	$1,777,428,934	7	0.4%	$37,135,580	2.1%
Delran (T)	5,008	$5,342,639,406	48	1.0%	$43,266,418	0.8%
Eastampton (T)	1,947	$1,223,958,808	0	0.0%	$0	0.0%
Edgewater Park (T)	2,210	$2,391,677,740	0	0.0%	$0	0.0%
Evesham (T)	13,368	$11,128,366,531	0	0.0%	$0	0.0%
Fieldsboro (B)	224	$241,524,257	0	0.0%	$0	0.0%
Florence (T)	4,084	$6,582,323,116	0	0.0%	$0	0.0%
Hainesport (T)	2,546	$3,283,651,920	3	0.1%	$1,142,262	<0.1%
Lumberton (T)	3,724	$4,304,673,748	7	0.2%	$2,851,508	0.1%
Mansfield (T)	3,805	$3,398,330,024	0	0.0%	$0	0.0%
Maple Shade (T)	5,120	$5,835,178,181	2	<0.1%	$12,403,623	0.2%
Medford (T)	8,792	$10,042,226,056	0	0.0%	$0	0.0%
Medford Lakes (B)	1,804	$967,238,228	0	0.0%	$0	0.0%
Moorestown (T)	7,173	$12,232,463,125	9	0.1%	$37,505,811	0.3%
Mount Holly (T)	2,987	$3,763,298,318	0	0.0%	$0	0.0%
Mount Laurel (T)	13,150	$15,418,468,979	0	0.0%	$0	0.0%
New Hanover (T)	1,068	$2,868,939,587	0	0.0%	$0	0.0%
North Hanover (T)	2,176	$2,404,670,347	0	0.0%	$0	0.0%
Palmyra (B)	2,482	$2,133,107,140	7	0.3%	$37,119,298	1.7%
Pemberton (B)	519	$736,141,491	0	0.0%	$0	0.0%
Pemberton (T)	9,729	$6,973,242,840	0	0.0%	$0	0.0%
Riverside (T)	2,532	$2,459,954,166	5	0.2%	$2,539,063	0.1%
Riverton (B)	989	$1,096,729,598	3	0.3%	$14,865,378	1.4%
Shamong (T)	2,494	$2,504,926,736	0	0.0%	$0	0.0%
Southampton (T)	5,368	$4,593,018,255	0	0.0%	$0	0.0%
Springfield (T)	1,826	$2,140,517,320	0	0.0%	$0	0.0%
Tabernacle (T)	2,938	$2,200,440,237	0	0.0%	$0	0.0%
Washington (T)	538	$604,084,949	66	12.3%	$95,446,942	15.8%
Westampton (T)	2,795	$4,620,292,645	0	0.0%	$0	0.0%
Willingboro (T)	10,830	$8,789,434,159	2	<0.1%	$761,508	<0.1%
Woodland (T)	782	$1,333,495,830	0	0.0%	$0	0.0%
Wrightstown (B)	296	$748,872,423	0	0.0%	$0	0.0%
Burlington County (Total)	**149,305**	**$167,984,093,756**	**482**	**0.3%**	**$782,295,954**	**0.5%**

Source: Burlington County 2023; NJOGIS 2023; Microsoft BING 2022; RS Means 2022; NOAA 2022

Table 4.3.7-10. Estimated General Building Stock Exposure in the SLOSH Category 3 Hazard Area

Jurisdiction	Total Number of Buildings	Total RCV	Estimated Building Stock in the SLOSH Hazard Area			
			Building Count		RCV	
			Number	Percent of Total	Value	Percent of Total
Bass River (T)	719	$881,423,037	369	51.3%	$483,792,685	54.9%
Beverly (C)	939	$1,218,790,334	4	0.4%	$4,387,580	0.4%
Bordentown (C)	1,041	$2,794,074,193	1	0.1%	$404,984	<0.1%
Bordentown (T)	3,389	$5,866,485,431	4	0.1%	$109,479,364	1.9%
Burlington (C)	3,165	$5,813,312,404	820	25.9%	$1,852,928,498	31.9%
Burlington (T)	6,525	$8,819,483,894	6	0.1%	$46,758,225	0.5%
Chesterfield (T)	2,673	$2,243,175,804	0	0.0%	$0	0.0%
Cinnaminson (T)	5,833	$6,206,033,564	363	6.2%	$533,783,503	8.6%
Delanco (T)	1,717	$1,777,428,934	72	4.2%	$84,646,362	4.8%
Delran (T)	5,008	$5,342,639,406	170	3.4%	$114,966,762	2.2%
Eastampton (T)	1,947	$1,223,958,808	0	0.0%	$0	0.0%
Edgewater Park (T)	2,210	$2,391,677,740	1	<0.1%	$380,754	<0.1%
Evesham (T)	13,368	$11,128,366,531	0	0.0%	$0	0.0%
Fieldsboro (B)	224	$241,524,257	0	0.0%	$0	0.0%
Florence (T)	4,084	$6,582,323,116	0	0.0%	$0	0.0%
Hainesport (T)	2,546	$3,283,651,920	5	0.2%	$3,941,582	0.1%
Lumberton (T)	3,724	$4,304,673,748	11	0.3%	$4,429,737	0.1%
Mansfield (T)	3,805	$3,398,330,024	0	0.0%	$0	0.0%
Maple Shade (T)	5,120	$5,835,178,181	6	0.1%	$16,157,630	0.3%
Medford (T)	8,792	$10,042,226,056	0	0.0%	$0	0.0%
Medford Lakes (B)	1,804	$967,238,228	0	0.0%	$0	0.0%
Moorestown (T)	7,173	$12,232,463,125	11	0.2%	$38,047,567	0.3%
Mount Holly (T)	2,987	$3,763,298,318	2	0.1%	$917,380	<0.1%
Mount Laurel (T)	13,150	$15,418,468,979	1	<0.1%	$207,451	0.0%
New Hanover (T)	1,068	$2,868,939,587	0	0.0%	$0	0.0%
North Hanover (T)	2,176	$2,404,670,347	0	0.0%	$0	0.0%
Palmyra (B)	2,482	$2,133,107,140	657	26.5%	$763,188,595	35.8%
Pemberton (B)	519	$736,141,491	0	0.0%	$0	0.0%
Pemberton (T)	9,729	$6,973,242,840	0	0.0%	$0	0.0%
Riverside (T)	2,532	$2,459,954,166	165	6.5%	$164,770,361	6.7%
Riverton (B)	989	$1,096,729,598	77	7.8%	$75,954,436	6.9%
Shamong (T)	2,494	$2,504,926,736	0	0.0%	$0	0.0%
Southampton (T)	5,368	$4,593,018,255	0	0.0%	$0	0.0%
Springfield (T)	1,826	$2,140,517,320	0	0.0%	$0	0.0%
Tabernacle (T)	2,938	$2,200,440,237	0	0.0%	$0	0.0%
Washington (T)	538	$604,084,949	175	32.5%	$224,268,135	37.1%
Westampton (T)	2,795	$4,620,292,645	6	0.2%	$1,641,952	<0.1%
Willingboro (T)	10,830	$8,789,434,159	15	0.1%	$39,622,325	0.5%
Woodland (T)	782	$1,333,495,830	0	0.0%	$0	0.0%
Wrightstown (B)	296	$748,872,423	0	0.0%	$0	0.0%
Burlington County (Total)	**149,305**	**$167,984,093,756**	**2,941**	**2.0%**	**$4,564,675,867**	**2.7%**

Source: Burlington County 2023; NJOGIS 2023; Microsoft BING 2022; RS Means 2022; NOAA 2022

The results of potential damage states for buildings in Burlington County categorized by general occupancy classes (i.e., residential, commercial, industrial, etc.) from Hazus are summarized in Table 4.3.7-11 for the 100-year MRP event. Hazus estimates that there will be $249,636,513 in damage to structures caused by the 100-year MRP event, with the estimated residential damage being the most expensive at $215,195,962, or 86.2 percent of the total damage. Table 4.3.7-12 summarizes the damage to structures for the 500 MRP event, which estimates that there will be $1,003,552,104 in damage to structures caused by the 500-year MRP event, with the estimated residential damage being the most expensive at $770,181,556, or 76.7 percent of the total damage.

Building damage as a result of the 100-year and 500-year MRP hurricanes was estimated using Hazus. Table 4.3.7-13 summarizes estimated total building and content losses caused by the 100-year and 500-year MRP events by building occupancy class. Up to 7 buildings will be completely destroyed by the 100-year MRP event and up to 4 will be severely damaged. The majority of the losses are estimated to the residential occupancy class. Up to 215 buildings will be completely destroyed by the 500-year MRP event and up to 247 will be severely damaged. The majority of the losses are estimated to the residential occupancy class.

Impact on Critical Facilities

Critical facilities are at risk of being impacted by high winds associated with structural damage, or falling tree limbs/flying debris, which can result in the loss of power. Power loss can greatly impact households, business operations, public utilities, and emergency personnel. Emergency personnel such as police, fire, and EMS will not be able to effectively respond in a power loss event to maintain the safety of its citizens unless backup power and fuel sources are available. Loss of power can impact other public utilities, including potable water, wastewater treatment, and communications. In addition to public water services, property owners with private wells might not have access to potable water until power is restored.

All critical facilities in the County are exposed to the severe weather hazard with similar risks as discussed for the general building stock. It is essential that critical facilities remain operational during natural hazard events. Backup power is recommended for critical facilities and infrastructure. Where backup power is needed for critical facilities that provide essential services, municipalities identified mitigation actions in Section 9 (Jurisdictional Annexes).

In Burlington County, there are 90 critical facilities and lifelines, combined, located in the SLOSH hazard area, categories 1 through 3. There are 6 critical facilities and lifelines located in SLOSH category 1, 11 critical facilities and lifelines in category 2, and 73 critical facilities and lifelines located in category 3. For all SLOSH hazard areas, the safety and security lifeline has the most facilities. Table 4.3.7-14 summarizes the number of critical lifelines in the SLOSH hazard area, sorted by categories.

The Hazus hurricane model was used to estimate a range of probabilities of each damage state category to the County's critical facilities and lifelines for hurricane events. Table 4.3.7-15 and Table 4.3.7-16 summarize the damage state probabilities for critical facilities during the 100-year and 500-year MRP events, respectively. The minimum and maximum estimated probability of sustaining damage is presented for each facility type.

Table 4.3.7-11. Estimated Building Losses Caused by the 100-Year MRP Hurricane by Occupancy

Jurisdiction	Estimated Building Losses Caused by the 100-Year MRP Hurricane			
	Total	Residential Structures Only	Commercial Structures Only	All Other Occupancies Structures Only
Bass River (T)	$2,512,908	$1,947,647	$332,821	$232,440
Beverly (C)	$1,052,625	$917,918	$95,012	$39,695
Bordentown (C)	$4,231,132	$2,977,133	$969,119	$284,880
Bordentown (T)	$10,020,244	$7,574,448	$2,121,469	$324,326
Burlington (C)	$5,292,468	$3,968,726	$855,912	$467,830
Burlington (T)	$9,060,960	$7,577,057	$709,087	$774,816
Chesterfield (T)	$7,088,842	$5,842,625	$349,163	$897,053
Cinnaminson (T)	$4,964,194	$4,533,768	$269,174	$161,252
Delanco (T)	$1,794,695	$1,639,896	$69,370	$85,429
Delran (T)	$4,837,399	$4,507,737	$198,378	$131,284
Eastampton (T)	$3,022,176	$2,874,837	$71,733	$75,606
Edgewater Park (T)	$3,524,001	$3,335,419	$132,008	$56,574
Evesham (T)	$13,080,991	$12,180,074	$558,563	$342,354
Fieldsboro (B)	$645,359	$437,310	$165,568	$42,481
Florence (T)	$10,377,767	$8,221,462	$1,012,998	$1,143,306
Hainesport (T)	$3,207,868	$2,689,369	$367,533	$150,966
Lumberton (T)	$6,620,786	$5,601,363	$558,232	$461,191
Mansfield (T)	$8,738,187	$7,741,953	$523,136	$473,098
Maple Shade (T)	$3,117,758	$2,710,810	$333,680	$73,267
Medford (T)	$16,933,731	$15,738,033	$800,458	$395,240
Medford Lakes (B)	$3,067,865	$3,017,536	$20,107	$30,222
Moorestown (T)	$10,008,170	$9,082,245	$532,483	$393,441
Mount Holly (T)	$4,656,852	$3,510,910	$775,181	$370,761
Mount Laurel (T)	$13,265,758	$11,651,412	$1,195,061	$419,285
New Hanover (T)	$3,421,241	$676,483	$436,647	$2,308,112
North Hanover (T)	$6,418,301	$4,385,591	$870,990	$1,161,720
Palmyra (B)	$1,550,128	$1,426,470	$81,742	$41,917
Pemberton (B)	$1,364,839	$947,042	$316,659	$101,139
Pemberton (T)	$28,011,259	$25,570,709	$1,230,274	$1,210,275
Riverside (T)	$1,687,926	$1,414,777	$209,786	$63,362
Riverton (B)	$1,163,020	$1,094,249	$37,380	$31,391
Shamong (T)	$6,240,221	$5,952,551	$95,007	$192,663
Southampton (T)	$12,065,759	$11,109,797	$517,511	$438,451
Springfield (T)	$3,948,982	$2,868,346	$387,080	$693,555
Tabernacle (T)	$6,039,104	$5,707,492	$133,771	$197,840
Washington (T)	$1,877,412	$1,455,804	$248,197	$173,410
Westampton (T)	$4,413,524	$3,585,533	$344,287	$483,704
Willingboro (T)	$16,692,726	$16,027,036	$253,083	$412,607
Woodland (T)	$2,728,742	$2,115,986	$360,723	$252,034
Wrightstown (B)	$890,594	$578,406	$117,111	$195,076
Burlington County (Total)	**$249,636,513**	**$215,195,962**	**$18,656,497**	**$15,784,055**

Source: Hazus v6.0; Burlington County, 2023; NJOGIS 2023; Microsoft BING 2022; RS Means 2022

Table 4.3.7-12. Estimated Building Losses Caused by the 500-Year MRP Hurricane by Occupancy

Jurisdiction	Estimated Building Losses Caused by the 500-Year MRP Hurricane			
	Total	Residential Structures Only	Commercial Structures Only	All Other Occupancies Structures Only
Bass River (T)	$1,275,407	$1,068,508	$128,162	$78,737
Beverly (C)	$4,449,603	$3,312,818	$843,526	$293,260
Bordentown (C)	$12,519,987	$7,494,901	$3,953,118	$1,071,968
Bordentown (T)	$28,427,396	$18,572,767	$8,589,552	$1,265,077
Burlington (C)	$28,559,341	$15,827,371	$8,828,313	$3,903,656
Burlington (T)	$46,672,868	$31,867,482	$6,815,475	$7,989,911
Chesterfield (T)	$13,506,023	$10,542,493	$1,001,371	$1,962,159
Cinnaminson (T)	$25,114,973	$20,578,546	$2,819,737	$1,716,689
Delanco (T)	$7,942,846	$6,582,626	$625,999	$734,222
Delran (T)	$22,605,280	$19,213,489	$2,037,146	$1,354,645
Eastampton (T)	$13,391,389	$12,115,052	$630,872	$645,465
Edgewater Park (T)	$13,148,764	$11,389,798	$1,263,649	$495,318
Evesham (T)	$86,971,584	$73,067,106	$9,153,755	$4,750,723
Fieldsboro (B)	$2,283,037	$1,272,884	$789,857	$220,296
Florence (T)	$49,580,215	$33,181,426	$7,171,524	$9,227,265
Hainesport (T)	$23,584,402	$15,429,422	$6,098,166	$2,056,814
Lumberton (T)	$43,180,028	$30,868,612	$7,223,231	$5,088,185
Mansfield (T)	$27,907,097	$23,083,707	$2,883,741	$1,939,649
Maple Shade (T)	$19,862,813	$14,814,928	$4,196,152	$851,732
Medford (T)	$100,711,754	$80,541,312	$14,514,486	$5,655,957
Medford Lakes (B)	$13,397,772	$12,910,102	$225,585	$262,085
Moorestown (T)	$50,412,221	$39,597,876	$6,499,282	$4,315,064
Mount Holly (T)	$28,532,341	$17,552,968	$8,237,648	$2,741,725
Mount Laurel (T)	$78,915,783	$58,378,121	$15,676,391	$4,861,270
New Hanover (T)	$3,737,525	$529,563	$369,224	$2,838,738
North Hanover (T)	$6,782,863	$4,594,771	$967,823	$1,220,269
Palmyra (B)	$7,612,126	$6,413,109	$798,510	$400,507
Pemberton (B)	$3,474,438	$2,187,375	$986,479	$300,584
Pemberton (T)	$30,619,169	$26,776,757	$1,869,507	$1,972,905
Riverside (T)	$8,195,045	$5,916,519	$1,793,999	$484,527
Riverton (B)	$5,452,984	$4,739,436	$388,691	$324,856
Shamong (T)	$22,571,743	$20,192,504	$881,973	$1,497,267
Southampton (T)	$38,481,444	$31,021,949	$4,772,174	$2,687,321
Springfield (T)	$14,814,938	$9,208,827	$2,613,571	$2,992,541
Tabernacle (T)	$15,627,146	$13,993,091	$719,518	$914,536
Washington (T)	$961,232	$805,975	$95,967	$59,290
Westampton (T)	$29,458,013	$18,263,962	$5,265,008	$5,929,043
Willingboro (T)	$70,358,604	$64,472,876	$2,664,160	$3,221,568
Woodland (T)	$1,397,501	$1,171,810	$139,494	$86,198
Wrightstown (B)	$1,054,411	$628,719	$140,135	$285,558
Burlington County (Total)	**$1,003,552,104**	**$770,181,556**	**$144,672,970**	**$88,697,578**

Source: Hazus v6.0; Burlington County, 2023; NJOGIS 2023; Microsoft BING 2022; RS Means 2022

Table 4.3.7-13. Estimated Building Damage (Structure and Contents) from a Hurricane Event

Occupancy Class	Total Number of Buildings in Occupancy	Severity of Expected Damage	100-Year MRP Hurricane		500-Year MRP Hurricane	
			Building Count	Percent of Occupancy Class Total	Building Count	Percent of Occupancy Class Total
Residential Exposure (Single and Multi-Family Dwellings)	135,116	NONE	129,431	95.8%	106,585	78.9%
		MINOR	5,395	4.0%	24,659	18.3%
		MODERATE	280	0.2%	3,440	2.5%
		SEVERE	3	<0.1%	218	0.2%
		DESTRUCTION	7	<0.1%	215	0.2%
Commercial Buildings	6,297	NONE	6,093	96.8%	5,212	82.8%
		MINOR	191	3.0%	816	13.0%
		MODERATE	13	0.2%	249	4.0%
		SEVERE	0	0.0%	20	0.3%
		DESTRUCTION	0	0.0%	0	0.0%
Industrial Buildings	1,170	NONE	1,137	97.2%	969	82.8%
		MINOR	31	2.7%	150	12.8%
		MODERATE	2	0.1%	47	4.0%
		SEVERE	0	0.0%	3	0.3%
		DESTRUCTION	0	0.0%	0	0.0%
Government, Religion, Agricultural, and Education Buildings	6,722	NONE	6,313	93.9%	5,507	81.9%
		MINOR	379	5.6%	1,083	16.1%
		MODERATE	29	0.4%	125	1.9%
		SEVERE	1	<0.1%	6	0.1%
		DESTRUCTION	0	0.0%	0	0.0%

Source: Hazus v6.0

Table 4.3.7-14. Estimated Number of Lifelines in the SLOSH Hazard Areas

FEMA Lifeline Category	Total Number of Lifelines	Number of Lifelines Located in the SLOSH Category 1 Hazard Area		
		SLOSH Category 1	SLOSH Category 2	SLOSH Category 3
Communications	2	0	0	0
Energy	31	0	1	2
Food, Hydration, Shelter	189	0	0	1
Hazardous Materials	207	1	3	19
Health and Medical	113	0	0	0
Safety and Security	1,101	4	6	34
Transportation	53	1	1	8
Water Systems	119	0	0	9
Burlington County (Total)	**1,813**	**6**	**11**	**73**

Source: Burlington County 2023; NOAA 2022

Table 4.3.7-15. Estimated Damage to Burlington County Critical Facilities for the 100-Year MRP Hurricane Event

	Loss of Days	Percent-Probability of Sustaining Damage			
		Minor	Moderate	Severe	Complete
Medical Facilities	0	0.6% - 6.4%	<0.1% - 1.9%	0.0%	0.0%
Police Stations	0	1.2% - 8.7%	<0.1% - 1.5%	0% - <0.1%	0.0%
Fire Stations	0	0.5% - 4.5%	<0.1% - 0.8%	0% - <0.1%	0.0%
Schools	0	0.9% - 7.8%	<0.1% - 4.4%	0% - <0.1%	0.0%
Emergency Operation Centers	0	1.3% - 8.7%	<0.1% - 1.5%	0% - <0.1%	0.0%

Source: Hazus v6.0

Table 4.3.7-16. Estimated Damage to Burlington County Critical Facilities for the 500-Year MRP Hurricane Event

	Loss of Days	Percent-Probability of Sustaining Damage			
		Minor	Moderate	Severe	Complete
Medical Facilities	0	1.3% - 13.7%	<0.1% - 11.6%	0.0% - 0.2%	0.0%
Police Stations	0	2.6% - 18.4%	<0.1% - 8.9%	0.0% - 1.1%	0.0%
Fire Stations	0	1.1% - 9.8%	<0.1% - 4.9%	0.0% - 0.4%	0.0% - <0.1%
Schools	0 - 3	2.1% - 12.2%	0.2% - 22.4%	0.0% - 0.7%	0.0%
Emergency Operation Centers	0	2.6% - 19.1%	<0.1% - 9.3%	0.0% - 1.0%	0.0%

Source: Hazus v6.0

For the 100-year MRP event, Hazus estimates that police stations and emergency operation centers have the greatest chance of sustaining minor damage, at a range of 1.2 to 8.7 percent. Schools have the greatest chance of moderate damage, ranging from 0.1 to 4.4 percent. Severe damage to all critical facilities is negligible, ranging from 0.0 to 0.1 percent. For a 500-year MRP event, Hazus estimates that emergency operation centers have the greatest chance of sustaining minor damage: 2.6 to 19.1 percent. Schools have the greatest chance of moderate damage, ranging from 0.2 to 22.4 percent. Severe damage to all critical facilities is negligible, with the greatest chance of damage occurring to police stations, which range from 0.0 to 1.1 percent.

Impact on Economy

Severe weather events can have short- and long-lasting impacts on the economy. When a business is closed during storm recovery, there is lost economic activity in the form of day-to-day business and wages to employees. Overall, economic impacts include the loss of business function (e.g., tourism, recreation), damage to inventory, relocation costs, wage loss and rental loss due to the repair/replacement of buildings. Impacts to transportation lifelines affect both short-term (e.g., evacuation activities) and long-term (e.g., day-to-day commuting and goods transport) transportation needs. Utility infrastructure (power lines, gas lines, electrical systems) could suffer damage and impacts can result in the loss of power, which can impact business operations and can impact heating or cooling provision to the population.

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

Hazus estimates building-related economic losses, including income losses (wage, rental, relocation, and capital-related losses) and capital stock losses (structural, non-structural, content, and inventory losses). Economic losses caused by the 100-year and 500-year hurricane MRP events were estimated by Hazus and are summarized in Table 4.3.7-17. Hazus estimates a difference in losses between the 100-year and 500-year MRP events. Income losses for the 100-year MRP event are $1,886,640, 21.36 percent of the 500-year MRP event's $8,832,580 inventory losses. Similarly, wage losses for the 100-year MRP event are $6,071,880, 19.9 percent of the 500-year MRP event's $30,429,330 wage losses.

Table 4.3.7-17. Economic Losses for the 100-Year and 500 MRP Hurricane Event

Total Business Interruption Loss (in Thousands of Dollars)					
MRP	**Income Loss**	**Relocation Loss**	**Building Losses**	**Wages Losses**	**Rental Losses**
100-Year	$1,886,640	$11,305,760	$249,636,510	$6,071,880	$3,698,870
500-Year	$8,832,580	$95,050,830	$1,003,552,100	$30,429,330	$32,020,160

Source: Hazus v6.0

Hazus also estimates the volume of debris that may be generated as a result of a hurricane event to enable the study region to prepare and rapidly and efficiently manage debris removal and disposal. Debris estimates are divided into two categories: (1) reinforced concrete and steel that require special equipment to break it up before it can be transported, and (2) brick, wood, and other debris that can be loaded directly onto trucks with bulldozers (FEMA 2022).

For the 100-year MRP event, Hazus estimates that 790,406 tons of debris will be generated. For the 500-year MRP event, Hazus estimates a total of 1,516,769 tons of debris will be generated county-wide. Table 4.3.7-18 and Table 4.3.7-19 summarize the estimated debris generated as a result of these events by municipality, respectively.

Impact on Environment

The impact of severe weather events on the environment varies, but researchers are finding that the long-term impacts of more severe weather can be destructive to the natural and local environment. National organizations such as USGS and NOAA have been studying and monitoring the impacts of extreme weather phenomena as it impacts long term climate change, streamflow, river levels, reservoir elevations, rainfall, floods, landslides, erosion, etc. For example, severe weather that creates longer periods of rainfall can erode natural banks along waterways and degrade soil stability for terrestrial species. Tornadoes can tear apart habitats causing fragmentation across ecosystems. (US EPA 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 (U.S. 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 Burlington County. Refer to Section 4.3.2 (Disease Outbreak) for more information about these stressors.

Cascading Impacts on Other Hazards

Severe weather events and severe wind events can escalate the impacts of flooding and utility failure. Severe winds can be destructive to the functionality of utilities by breaching power lines and disconnecting the utility systems. Severe weather may carry extreme rainfall that could exacerbate flooding. Tropical storms and hurricanes can result in storm surge events that result in significant coastal flooding. More information about flooding can be found in Section 4.3.6 of this HMP.

Table 4.3.7-18. Estimated Debris Generated by the 100-Year MRP Hurricane Event

Jurisdiction	Estimated Debris Created During the 100-Year MRP Hurricane Wind Event Brick and Wood (Tons)	Concrete and Steel (Tons)	Tree (Tons)	Eligible Tree Volume (Cubic Yards)
Bass River (T)	229	0	53,306	31,984
Beverly (C)	108	0	99	919
Bordentown (C)	512	0	250	1,993
Bordentown (T)	1,089	0	1,976	10,477
Burlington (C)	547	0	753	4,765
Burlington (T)	867	0	2,713	13,606
Chesterfield (T)	883	0	6,977	9,688
Cinnaminson (T)	382	0	581	4,749
Delanco (T)	168	0	319	1,566
Delran (T)	379	0	652	3,947
Eastampton (T)	297	0	1,121	3,899
Edgewater Park (T)	262	0	565	4,350
Evesham (T)	956	0	5,234	21,822
Fieldsboro (B)	73	0	283	1,131
Florence (T)	1,204	0	2,471	9,802
Hainesport (T)	321	0	868	4,168
Lumberton (T)	682	0	2,584	9,786
Mansfield (T)	989	0	5,533	11,033
Maple Shade (T)	275	0	300	2,750
Medford (T)	965	0	12,477	38,693
Medford Lakes (B)	148	0	414	3,704
Moorestown (T)	735	0	1,550	9,670
Mount Holly (T)	593	0	555	4,841
Mount Laurel (T)	1,097	0	2,101	13,974
New Hanover (T)	377	0	10,657	14,166
North Hanover (T)	787	0	5,002	10,759
Palmyra (B)	125	0	233	1,754
Pemberton (B)	155	0	213	1,202
Pemberton (T)	2,279	0	30,113	61,334
Riverside (T)	185	0	279	2,220
Riverton (B)	78	0	123	1,161
Shamong (T)	388	0	17,321	22,531
Southampton (T)	908	0	16,635	26,447
Springfield (T)	552	0	7,376	8,872
Tabernacle (T)	379	0	20,731	24,874
Washington (T)	171	0	39,753	23,860
Westampton (T)	444	0	1,770	5,595
Willingboro (T)	1,169	0	1,379	12,219
Woodland (T)	248	0	57,776	34,678
Wrightstown (B)	110	0	814	1,562
Burlington County (Total)	**22,115**	**0**	**313,857**	**476,549**

Source: Hazus v6.0

Table 4.3.7-19. Estimated Debris Generated by the 500-Year MRP Hurricane Event

Jurisdiction	Estimated Debris Created During the 500-Year MRP Hurricane Wind Event			
	Brick and Wood (Tons)	Concrete and Steel (Tons)	Tree (Tons)	Eligible Tree Volume (Cubic Yards)
Bass River (T)	99	0	40,764	24,458
Beverly (C)	567	0	392	3,646
Bordentown (C)	1,488	0	498	3,985
Bordentown (T)	3,188	10	3,888	20,397
Burlington (C)	3,330	7	2,298	14,907
Burlington (T)	5,494	8	8,503	42,752
Chesterfield (T)	1,731	1	9,843	13,870
Cinnaminson (T)	2,779	0	3,676	27,286
Delanco (T)	997	0	1,597	7,829
Delran (T)	2,650	0	3,514	21,594
Eastampton (T)	1,635	8	2,802	9,743
Edgewater Park (T)	1,464	0	1,873	14,097
Evesham (T)	9,925	30	22,557	100,583
Fieldsboro (B)	257	1	606	2,423
Florence (T)	5,975	20	6,912	27,900
Hainesport (T)	2,789	10	3,690	17,711
Lumberton (T)	5,113	18	9,954	36,968
Mansfield (T)	3,524	18	12,214	25,355
Maple Shade (T)	2,420	0	2,107	19,169
Medford (T)	9,702	8	38,281	120,794
Medford Lakes (B)	1,196	0	1,158	10,372
Moorestown (T)	5,451	0	6,847	41,536
Mount Holly (T)	3,603	7	1,990	17,182
Mount Laurel (T)	9,554	8	10,579	70,844
New Hanover (T)	388	0	9,972	13,669
North Hanover (T)	834	0	5,009	10,767
Palmyra (B)	866	0	1,152	8,275
Pemberton (B)	425	0	333	1,888
Pemberton (T)	2,591	0	32,874	63,390
Riverside (T)	1,060	0	875	6,937
Riverton (B)	555	0	499	4,665
Shamong (T)	2,073	0	34,619	45,053
Southampton (T)	3,862	6	30,006	48,291
Springfield (T)	1,988	6	16,563	19,898
Tabernacle (T)	1,391	0	33,529	40,297
Washington (T)	74	0	30,411	18,261
Westampton (T)	3,404	12	6,553	20,793
Willingboro (T)	7,798	17	4,779	42,022
Woodland (T)	108	0	44,200	26,540
Wrightstown (B)	126	0	869	1,644
Burlington County (Total)	**112,472**	**195**	**448,782**	**1,067,792**

Source: Hazus v6.0

Further Changes that May Impact Vulnerability

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

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

Projected Development

The ability of new development to withstand severe weather lies in sound land use practices, building design considerations (e.g., Leadership in Energy and Environmental Design [LEED]), and consistent enforcement of codes and regulations for new construction. New development will change the landscape where buildings, roads, and other infrastructure potentially replace open land and vegetation. Surfaces that were once permeable and moist are now impermeable and dry, potentially making them more susceptible to fires caused by lightning.

The Pinelands Commission has identified Pinelands Management Area Boundaries, including regional growth areas and rural development areas that may also provide insight to where development and growth may occur in the County. In addition, each community was requested to provide recent and anticipated new development and infrastructure projects. Specific areas of recent and new development are indicated in tabular form and/or on the hazard maps included in the jurisdictional annexes in Volume II of this plan.

Projected Changes in Population

Burlington County has experienced an increase in its population since 2010. According to the U.S. Census Bureau, the County's population increased by approximately 3 percent between 2010 and 2020 (U.S. Census Bureau 2020). 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, Burlington County is projected to have a population of 460,400 by 2024, 464,900 by 2029, and 472,700 by 2034 (State of New Jersey 2017). Changes in the density of population can impact the number of persons exposed to flooding and erosion. As areas continue to be cleared for new development and run-off persists, the population in the County will remain exposed to this hazard. Refer to Section 3 (County Profile), which includes a discussion on population trends for the County.

Climate Change

As discussed above, most studies project that the County will see an increase in average annual temperatures and precipitation. As the climate warms, the intensity of severe weather may change, with the potential to create more frequent events with lightning and/or hail. 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.

Change of Vulnerability Since 2019 HMP

Overall, the County's vulnerability has not changed, and the entire County will continue to be exposed and vulnerable to severe weather events. As existing development and infrastructure continue to age, they can be at increased risk of failed utility and transportation systems if they are not properly maintained and do not adapt to the changing environment.

4.3.8 Severe Winter Weather

2024 HMP Changes

- New and updated figures from federal and state agencies are incorporated.
- Previous occurrences were updated with events that occurred between 2018 and 2022.

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

Hazard Description

A winter storm is a weather event in which the main types of precipitation are snow, sleet, or freezing rain. They can be a combination of heavy snow, blowing snow, and dangerous wind chills. According to the National Severe Storms Laboratory, the three basic components needed to make a winter storm include the following:

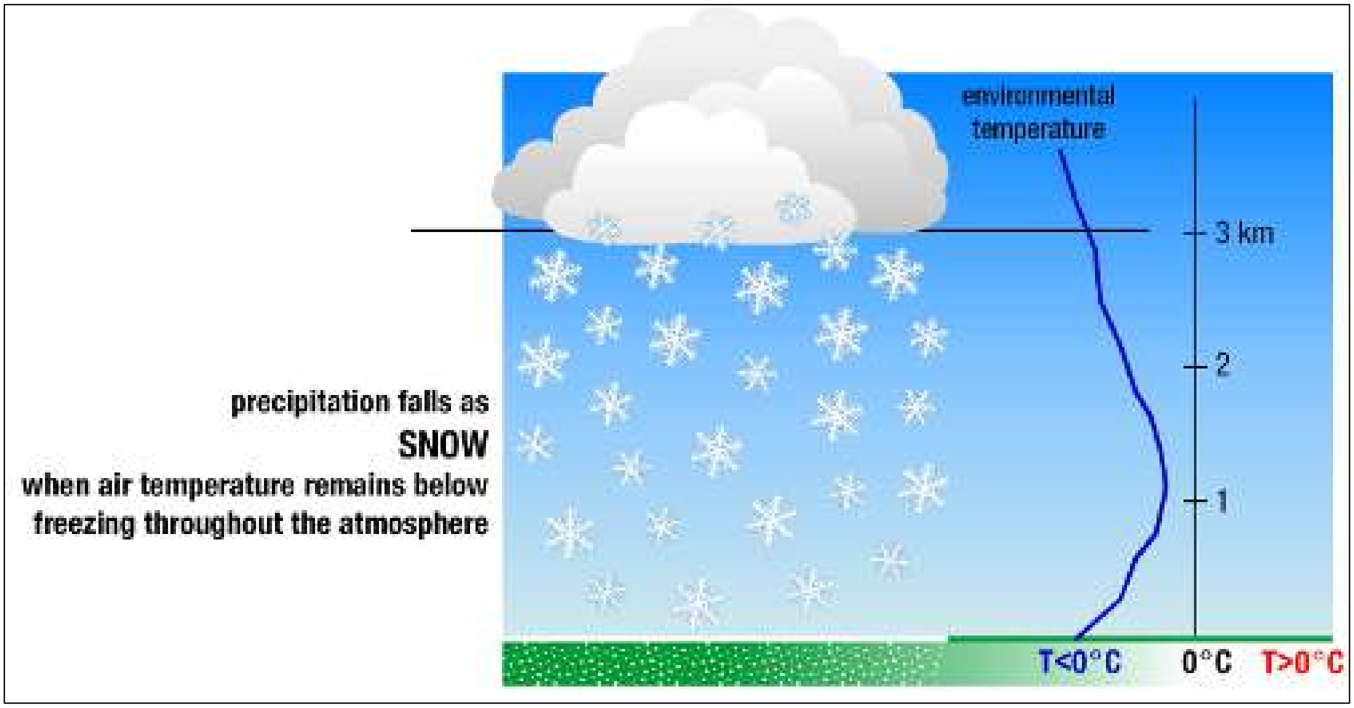
- Below freezing temperatures (cold air) in the clouds and near the ground to make snow and ice.
- Lift, something to raise the moist air to form clouds and cause precipitation, such as warm air colliding with cold air and being forced to rise over the cold dome or air flowing up a mountainside (orographic lifting).
- Moisture to form clouds and precipitation, such as air blowing across a large lake or the ocean (NOAA 2021).

Some winter storms can immobilize an entire region, while others might only affect a single community. Winter storms typically are accompanied by low temperatures, high winds, freezing rain or sleet, and heavy snowfall. The aftermath of a winter storm can have an impact on a community or region for days, weeks, or even months; potentially causing cold temperatures, flooding, storm surge, closed and blocked roadways, downed utility lines, and power outages. Burlington County's winter storms include, but are not limited to heavy snow, blizzards, sleet, ice storms, and nor'easters.

Heavy Snow

According to the National Snow and Ice Data Center (NSIDC), 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 or a snow pellet, which then falls to the earth. Snow falls in different forms: snowflakes, snow pellets, or sleet. Snowflakes are clusters of ice crystals that form from a cloud. Figure 4.3.8-1 depicts snow creation.

Figure 4.3.8-1. Snow Creation



Source: NOAA 2023

Blizzard

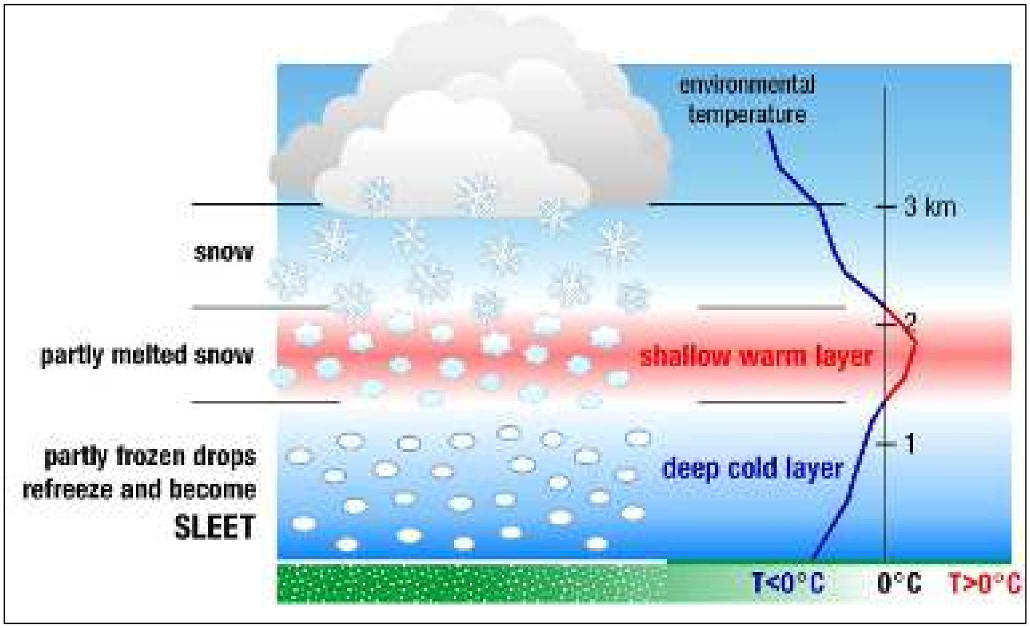
A blizzard is a winter snowstorm with sustained or frequent wind gusts of 35 miles per hour (mph) or more, accompanied by falling or blowing snow reducing visibility to or below 0.25 mile, as the predominant conditions over a 3-hour period (NWS n.d.). Extremely cold temperatures often are associated 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. For more information on the extreme temperature hazard, refer to Section 4.3.5.

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).

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 2013). 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 2013). Figure 4.3.8-2 depicts sleet creation.

Figure 4.3.8-2. Sleet Creation

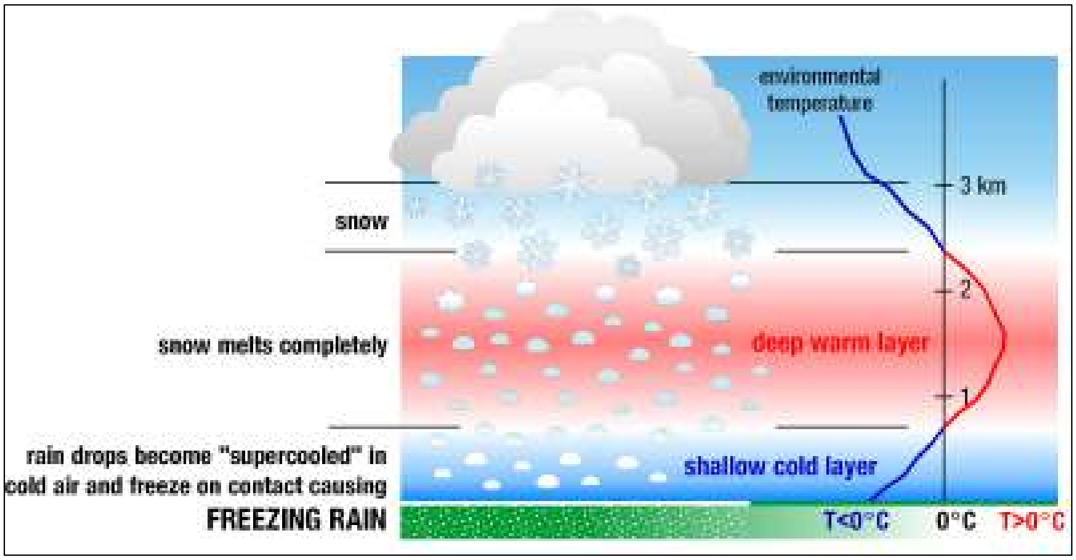


Source: NOAA 2023

Ice Storm

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 4.3.8-3 depicts freezing rain creation.

Figure 4.3.8-3. Freezing Rain Creation



Source: NOAA 2023

TETRA TECH

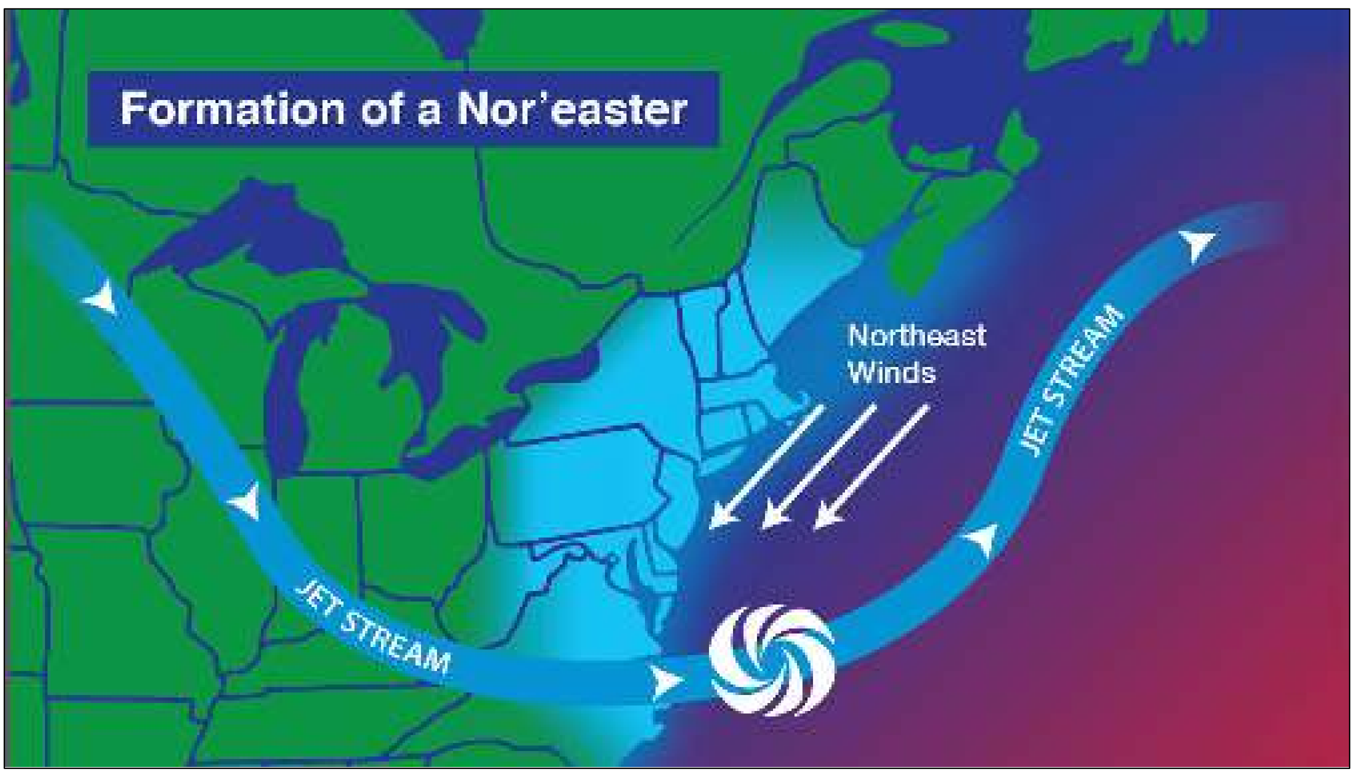
Nor'easter

A Nor'easter is an extratropical cyclone storm that typically brings wind, snow, rain, and flooding to the region. It forms along the east coast of North America and is named after the direction of the strongest winds, which generally blow over the northeast region. Nor'easters form within 100 miles of the coast between New Jersey and Georgia as shown in Figure 4.3.8-4. The polar jet stream blows cold air southward to Canada and eastward towards the warm Atlantic Ocean. When the cold air meets with the warm water, a low-pressure system forms. This low-pressure system results in the formation of clouds in which a nor'easter storm starts to develop (NOAA 2023).

Nor'easters are typically more severe during the winter months. They can produce extremely heavy snow and blizzards, in addition to rain and flooding. These hazards cause coastal erosion and severe damages to structures. Wind gusts are also common during a nor'easter and sometimes can rival that of a tropical cyclone (NOAA 2023). Nor'easters can stall off the mid-Atlantic coast resulting in prolonged episodes of precipitation, coastal flooding, and high winds.

Nor'easters and tropical cyclones can be mistaken as the same type of storm. They are similar in that they are both types of cyclone storm events with spiraling winds around a central pressure zone. However, while tropical cyclones gain their strength from warm, moist air from tropical waters, nor'easters are cold-core systems that do not rely on warm sea surface temperatures (NOAA 2023). Nor'easters can occur any time of the year but are generally common around the months of September and April.

Figure 4.3.8-4. Formation of a Nor'easter



Source: NOAA 2023

Location

Heavy Snow and Blizzards

Heaviest snowfall from winter storms is typically within a 150-mile-wide swath to the northwest of what are generally southwest to northeast moving storms. The trajectory of the snowstorm will determine the location of heaviest snowfalls. In Burlington County the average yearly snowfall is between 20” and 25”. There is, however, significant variation from year to year. February is the month when maximum accumulations on the ground are usually reached. The southeastern third of Burlington County receives slightly less snowfall most likely due to the coastal influences moderating temperatures slightly. Snow may fall from about October 15 to April 30 in the highlands and from about November 15 to April 15 in southern counties, including Burlington (Rutgers University 2021).

Ice Storms and Sleet

All regions across New Jersey are subject to ice storms. In addition to temperature, their occurrence depends on the regional distribution of the pressure systems, as well as local weather conditions. The occurrence and intensity of ice storms often coincides with general distribution of snow. In Burlington County, a cold rain may be falling near the Atlantic County border in the southeastern part of the County, transforming into freezing rain in the central region, and snow over the northwestern portion 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, especially given the confined geographical region the storms often reach and affect. Based on data from 1948–2000, Burlington County can anticipate 2-4 days with freezing rain per year. Based on data from 1932–2001, the County can anticipate 9-15 total hours of freezing rain per year (MRCC 2021).

Nor’easter

The entire County is vulnerable to the damaging impacts of nor’easters. While coastal communities within the County are more susceptible to damage, particularly from coastal flooding and strong winds, some inland communities are susceptible to heavy precipitation and blizzard conditions (National Geographic 2022).

Extent

The magnitude or severity of a severe winter storm depends on several factors, including snowfall rates, regional climatological susceptibility to snowstorms, snowfall amounts, wind speeds, temperatures, visibility, storm duration, topography, time of occurrence during the day and week (e.g., weekday versus weekend), and time of season.

The extent of a severe winter storm can be classified both by meteorological measurements and by evaluating societal impacts. The National Oceanic and Atmospheric Administration’s (NOAA’s) National Climatic Data Center (NCDC) is currently producing the Regional Snowfall Index (RSI) for significant snowstorms that impact the eastern two-thirds of the United States. The RSI ranks snowstorm impacts on a scale from 1 to 5 and is based on the spatial extent of the storm, the amount of snowfall, and the interaction of the extent and snowfall totals with population. The NCDC has analyzed and assigned RSI values to over 500 storms since 1900 (NOAA n.d.). Table 4.3.8-1. presents the five RSI ranking categories.

Table 4.3.8-1. RSI Ranking Categories

Category	Description	RSI Value
1	Notable	1–3
2	Significant	3–6

Category	Description	RSI Value
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).

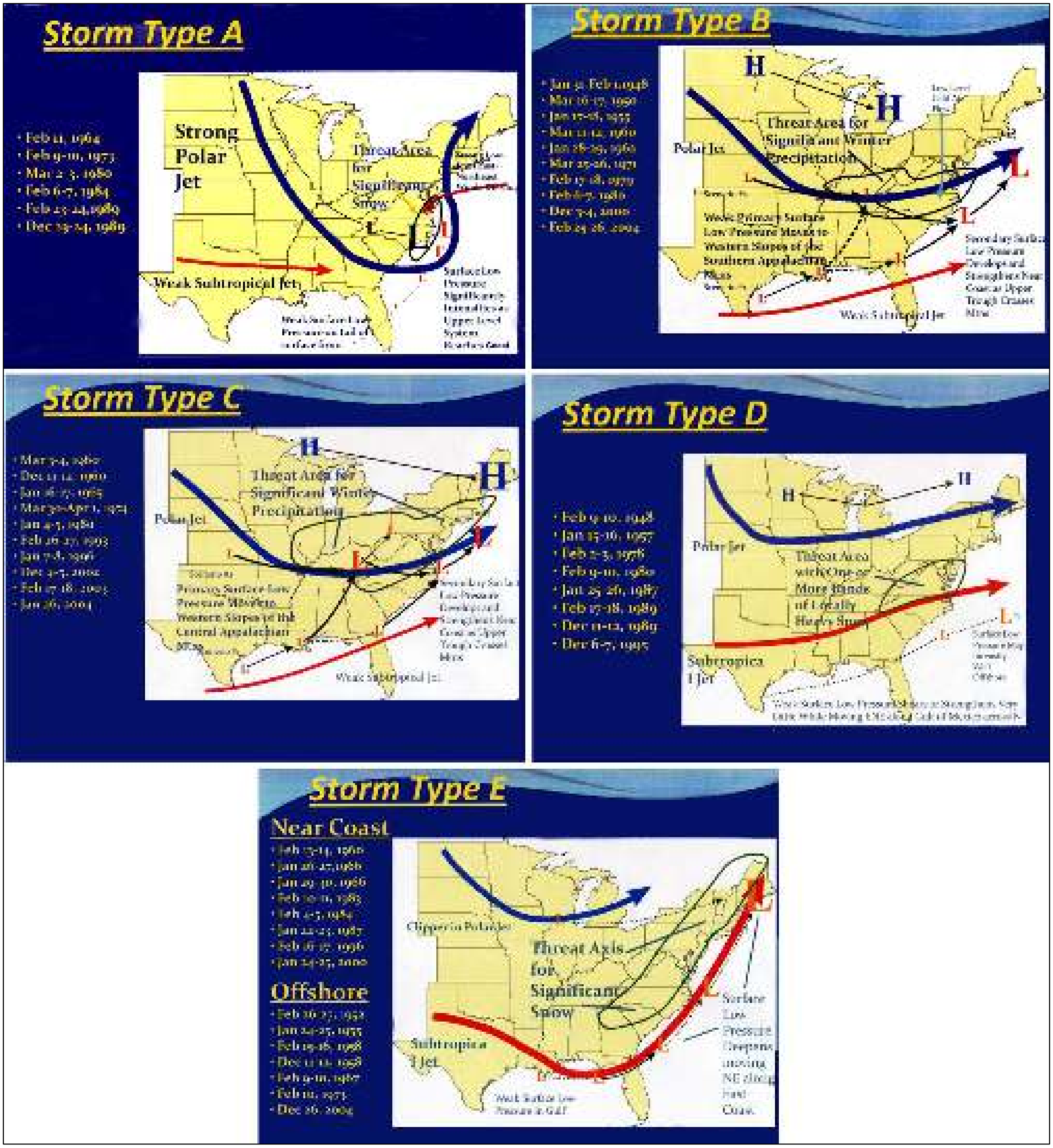
The NWS uses winter weather watches, warnings, and advisories to ensure that people know what to expect in the coming hours and days. Winter weather advisories inform people that winter weather conditions are expected to cause significant inconveniences that may be hazardous. A winter storm watch means 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

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 4.3.8-5 below for visuals on the formation of each Miller Category.

Figure 4.3.8-5. Nor'easter Miller Classifications



Source: Siebers n.d.

Previous Occurrences and Losses

FEMA Major Disasters and Emergency Declarations

Between May 1953 and June 2023, FEMA included the State of New Jersey in eight winter-storm related major disaster (DR) or emergency (EM) declarations. These events were classified as one or a combination of the following incidents: severe winter storm, snowstorm, snow, severe winter coastal storm, blizzard, and ice conditions. Generally, these disasters cover a wide region of the State; therefore, they may have impacted many counties. Burlington County was included in seven of these declarations. Since the 2020 HMP, the County has not been included in any FEMA disaster declarations. Table 4.3.8-2 lists FEMA declarations from May 1953 to May 2023 for this HMP Update. Detailed information about the declared disasters since 1953 is provided in Section 3 (County Profile).

Table 4.3.8-2. FEMA Declarations for Severe Winter Weather Events in Burlington County

FEMA Declaration Number	Date of Declaration	Date of Event	Event Type	Event Title
DR-528-NJ	February 8, 1977	February 8, 1977	Severe Ice Storm	Ice Conditions
EM-3106-NJ	March 17, 1993	March 13-17, 1993	Snowstorm	Severe Blizzard
DR-1088-NJ	January 13, 1996	January 7-12, 1996	Snowstorm	Blizzard of '96 (Severe Snow Storm)
EM-3181-NJ	March 20, 2003	February 16-17, 2003	Snowstorm	Snow
DR-1873-NJ	February 5, 2010	December 19-20, 2009	Snowstorm	Snowstorm
DR-1889-NJ	March 23, 2010	February 5-6, 2010	Snowstorm	Severe Winter Storm and Snowstorm
DR-1954-NJ	February 4, 2011	December 26-27, 2010	Snowstorm	Severe Winter Storm and Snowstorm

Source: FEMA 2023

U.S. Department of Agriculture Disaster Declarations

The Secretary of Agriculture from the U.S. Department of Agriculture (USDA) is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in counties that are contiguous to a designated county. Between August 2018 and June 2023, Burlington County was not included in any severe winter weather-related agricultural disaster declarations (USDA n.d.).

Previous Events

For the 2024 HMP update, known severe winter weather events that impacted Burlington County between August 2018 and May 2023 are discussed below in Table 4.3.8-3. For events prior to 2018, refer to the 2019 Burlington County HMP.

Probability of Future Occurrence

For the 2024 HMP update, the most up-to-date data was collected to calculate the probability of future occurrence of severe winter weather events for the County. Information from NOAA-NCEI storm events database was used to identify the number of severe winter weather events that occurred between January 1950 and March 2023. Table 4.3.8-4 presents the probability of future events for severe winter weather in Burlington County.

Table 4.3.8-3. Severe Winter Weather Events in Burlington County, 2018 to 2023

Date of Event	Event Type	Declaration Number	Burlington County Designated?	Description
November 15, 2018	Winter Weather	N/A	N/A	Early season Winter Storm. Additional trace amounts of snow were reported in Cape May County. Totals ranged from 4.2 in Florence to 1.4 in Hainesport. There were no property or crop damages reported from this event in the County.
December 5, 2018	Winter Weather	N/A	N/A	A localized snowfall event occurred across southern NJ and extreme southeast PA in response to a Norlun Trough. Up to 2 fell across the county. There were no property or crop damages reported from this event in the County.
January 12-13, 2019	Winter Weather	N/A	N/A	A weekend winter storm led to a reported 4 inches of snow. There were no property or crop damages reported from this event in the County.
February 10-12, 2019	Winter Weather	N/A	N/A	Light snow fell, impacting the area with light snow changing to a wintry mix and then to rain. Snowfall totals of 2.1 inches was recorded in Mount Laurel; 2.0 inches in Tabernacle; and 3.1 inches near Evesham. It was reported that there was 0.03 inches of ice at the South Jersey Regional Airport. There were no property or crop damages reported from this event in the County.
February 20, 2019	Winter Weather	N/A	N/A	A mix of wintry precipitation, some heavy, impacted Burlington County. Several inches of snow and areas of freezing rain were observed. A report was received of 3.5 inches of snow in Marlton. Some light icing was also observed, including 0.01 inches at the NWS office in Mount Holly. Reports from nearby areas suggest around 2 to 2.5 inches of snow likely fell. There were no property or crop damages reported from this event in the County.
March 1, 2019	Winter Weather	N/A	N/A	A fast-moving weather system brought a short duration but intense burst of snow. A widespread 2 to 4 inches of snow were observed, most of it within a 3-hour window. The NWS office in Mount Holly measured 2.4 inches of snow. There were no property or crop damages reported from this event in the County.
January 18, 2020	Winter Weather	N/A	N/A	Precipitation fell as a mix of snow, sleet, and freezing rain for a considerable time over parts of Burlington County. Precipitation eventually changed over to mainly rain. A light mix of snow and freezing rain occurred. In Florence, there was a reported 1.1 inches of snow and 0.10 inches of ice accumulation. There were no property or crop damages reported from this event in the County.
December 16, 2020	Winter Storm	N/A	N/A	Heavy snow and sleet fell over the area, with some areas also changing to rain. Snowfall amounts were generally in the 4-to-6-inch range, including a storm total of 6.2 inches at the NWS office near Westampton. There were no property or crop damages reported from this event in the County.
January 31 – February 2, 2021	Winter Storm, Winter Weather	DR-4597-NJ	No	A major winter storm affected Burlington County. Widespread snow accumulation occurred, though the heaviest snow did not fall until the final day of the storm. Reports from the area were sparse, but observations from surrounding areas suggest 3 to 5 inches of snow fell. There were no property or crop damages reported from this event in the County.

Date of Event	Event Type	Declaration Number	Burlington County Designated?	Description
February 7, 2021	Winter Storm, Winter Weather	N/A	N/A	A short duration period of snow occurred in Burlington County. The storm produced several inches of snow, with local variations in the snow totals. Snow fell across the area, though heavier banding largely avoided Burlington County. Several reports of 4 to 5 inches of snow were received, including a report of 5.1 inches of snow in Moorestown. Rain changed to snow across the area, though heavier banding avoided this region. Observations from surrounding areas suggest a general 2 to 3 inches of snow likely fell. There were no property or crop damages reported from this event in the County.
February 10, 2021	Winter Weather	N/A	N/A	Snow accumulated in a widespread area, with reports of 3 to 5 inches of snow, and some amounts locally a little higher. Observations from surrounding areas suggest around 3 inches of snow likely fell in Burlington County. A maximum report of 3.7 inches of snow was received from Florence. There were no property or crop damages reported from this event in the County.
February 13, 2021	Winter Weather	N/A	N/A	Freezing rain with some light ice accumulation occurred in Burlington County. The South Jersey Regional Airport reported 0.06 inches of ice accumulation. Icing was observed at the NWS office in Mount Holly. Observations from surrounding areas suggest around a tenth of an inch of freezing rain likely occurred. There were no property or crop damages reported from this event in the County.
February 18-19, 2021	Winter Storm, Winter Weather	N/A	N/A	A wintry precipitation occurred with many areas seeing snow, some locally heavy, with a change to sleet and rain towards coastal areas. A heavy snow band clipped northwestern portions of Burlington County. Snowfall reports include 6.4 inches in Delanco and 6.3 inches in Bordentown. The South Jersey Regional Airport measured 0.15 inches of ice accumulation. Observations from surrounding areas suggest 2 to 3 inches of snow and sleet and up to a tenth of an inch of glaze ice likely occurred. There were no property or crop damages reported from this event in the County.
January 3, 2022	Winter Storm, Winter Weather	N/A	N/A	A widespread snow event was quick moving and had departed by the late afternoon and early evening of the 3rd. No direct snowfall measurements were received from southeast Burlington County, but numerous surrounding reports suggest a general 6 to 10 inches of snow fell. A general 2 to 3 inches of snow fell in most of the County, though little to no snow had fallen closer to the Delaware River. An NWS employee near Leisuretown reported 2.8 inches of snow. There were no property or crop damages reported from this event in the County.
January 5, 2022	Winter Weather	N/A	N/A	Freezing rain and a widespread light icing event transpired across the eastern mid-Atlantic. While ice accumulations were no more than several hundredths of an inch, this event caused significant travel impacts during the busy morning commute hours. Numerous reports of light ice accumulation were received. There were no property or crop damages reported from this event in the County.

Date of Event	Event Type	Declaration Number	Burlington County Designated?	Description
January 7, 2022	Winter Storm	N/A	N/A	A quick moving storm brought a widespread swath of 3 to 6 inches of snow to most of the eastern mid-Atlantic. Some portions of eastern New Jersey saw some slightly higher amounts of 6 to 7 inches, but in general it was a uniform snowfall for most areas. Numerous surrounding reports suggest a widespread 5 to 6 inches of snow fell. A maximum report of 6.0 inches was received from Shamong. There were no property or crop damages reported from this event in the County.
January 16, 2022	Winter Storm	N/A	N/A	What began as snow, transitioned to mixed precipitation then to rain. Frozen precipitation held on for longer, where some higher snowfall amounts occurred. Numerous snowfall reports of 1 inch or less were received, and the South Jersey Regional Airport reported 0.03 inches of ice accretion. Light ice accumulations were also observed at the nearby Mount Holly. There were no property or crop damages reported from this event in the County.
January 28, 2022	Winter Storm	N/A	N/A	A nor'easter spread snow across Burlington County. The storm also brought strong winds, with gusts of 40 to 50 miles per hour with a few over 60 miles per hour were observed. A widespread 6 to 10 inches of snow fell. A report of 10.0 inches of snow was received from Evesham Twp. A report of 9.6 inches of snow was received from Tabernacle. It is likely that higher totals of 12 to 18 inches occurred in less populated areas further southeast. There were no property or crop damages reported from this event in the County.
February 7, 2022	Winter Weather	N/A	N/A	Light freezing rain and drizzle occurred in Burlington County, with areas of light ice accumulation. Observations from surrounding areas suggest trace amounts of icing occurred. There were no property or crop damages reported from this event in the County.
February 13, 2022	Winter Weather	N/A	N/A	Widespread 2 to 6 inches of snow fell over much of New Jersey, with accumulations mainly occurring on cold and/or grassy surfaces. Impacts were minimal overall. There were reports in Burlington Twp of just 2.8 inches of snow. There were no property or crop damages reported from this event in the County.
February 24, 2022	Winter Weather	N/A	N/A	A wintry mix fell across the region, including as several hours of sleet and freezing rain. In some cases, the ice accumulation was enough to cause tree and power line damage. There were no property or crop damages reported from this event in the County.
December 23, 2022	Winter Weather	N/A	N/A	Temperatures plummeted resulting in icy areas on untreated surfaces. Lingering light precipitation resulted in a flash freeze of untreated surfaces and icy roads as temperatures plummeted well below freezing. There were no property or crop damages reported from this event in the County.

Source: NOAA 2023; FEMA 2023

Table 4.3.8-4. Probability of Future Occurrences of Severe Winter Weather Events

Hazard Type	Number of Occurrences Between 1950 and 2023	% Chance of Occurring in Any Given Year
Blizzard	4	5.47%
Extreme Cold/Wind Chill	2	2.73%
Heavy Snow	39	53.42%
Ice Storm	1	1.36%
Sleet	5	6.84%
Winter Storm	39	53.42%
Winter Weather	142	100%
Total	**232**	**100%**

Source: NOAA NCEI 2023

Note: Disaster occurrences include federally declared disasters since the 1950 Federal Disaster Relief Act, and selected events since 1968. Due to limitations in data, not all severe winter weather events occurring between 1954 and 1996 are accounted for in the tally of occurrences. As a result, the number of hazard occurrences is underestimated.

In Section 4.4, the identified hazards of concern for the County were ranked. The probability of occurrence, or likelihood of the event, is one parameter used for hazard rankings. Based on historical records and input from the Planning Team, the probability of occurrence for severe winter weather in the County is considered "frequent."

Climate Change Impacts

Providing projections of future climate change for a specific region is challenging. Shorter term projections are more closely tied to existing trends making longer term projections even more challenging. The further out a prediction reaches the more subject to changing dynamics it becomes.

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 (1.9 °C) increase in the State's average temperature, which is faster than the rest of the Northeast region (2 °F [1.1 °C]) and the world (1.5 °F [0.8 °C]). This warming trend is expected to continue. By 2050, temperatures in New Jersey are expected to increase by 4.1 to 5.7 °F (2.3 °C to 3.2 °C). 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 (5.6 °C) 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).

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, New Jersey 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. New Jersey will experience more intense rain events, less snow, and more rainfalls (NJDEP 2020).

Both northern and southern New Jersey have become wetter over the past century. Northern New Jersey's 1971-2000 precipitation average was over five inches (12 percent) greater than the average from 1895-1970. Southern New Jersey became two inches (5 percent) wetter late in the 20th century. Average annual precipitation is projected to increase in the region by 5 percent by the 2020s and up to 10 percent by the 2050s. Most of the additional precipitation is expected to come during the winter months (NJDEP 2020).

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 the intensity of winter storms may increase. 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 the Northeast.

Vulnerability Assessment

For the severe winter weather hazard, all of Burlington County has been identified as the hazard area. Therefore, all assets in the County (population, structures, critical facilities, and lifelines), as described in the County Profile (Section 3), are vulnerable to a winter storm event.

A specific area that is vulnerable to the severe winter storm hazard is the floodplain. Severe winter storms can cause flooding through blockage of streams or through snow melt. Vulnerabilities to flooding are presented in the flood hazard profile (Section 4.3.6).

Nor'easters can cause significant coastal flooding due to storm surge, similar to hurricanes and tropical storms. Vulnerabilities to storm surge are presented in the severe weather profile (Section 4.3.7).

Blizzards and nor'easters can cause high winds. Vulnerabilities to wind are presented in the severe weather profile (Section 4.3.7).

The following subsections discuss the County's vulnerability, in qualitative nature, to the severe winter weather hazard.

Impact on Life, Health, and Safety

The entire population of Burlington County (461,860 people) is exposed to severe winter weather events. According to the NOAA National Severe Storms Laboratory; every year, winter weather indirectly and deceptively kills hundreds of people in the U.S., primarily from automobile accidents, overexertion, and exposure. Winter storms are often accompanied by strong winds creating blizzard conditions with blinding wind-driven snow, drifting snow and extreme cold temperatures and dangerous wind chill. They are considered deceptive killers because most deaths and other impacts or losses are indirectly related to the storm. People can die in traffic accidents on icy roads, heart attacks while shoveling snow, or of hypothermia from prolonged exposure to cold (NOAA 2023).

Socially Vulnerable Populations

The homeless and elderly are considered most susceptible to this hazard. The elderly are considered susceptible to this hazard due to their increased risk of injuries and death from falls and overexertion and/or hypothermia from attempts to clear snow and ice. According to the 2021 5-year ACS estimates, there are 27,947 total persons living below the poverty level, 78,093 persons over the age of 65 years, 23,350 persons under the age of 5 years, 9,103 non-English speakers, and 51,899 persons with a disability in Burlington County. In addition, severe winter storm events can reduce the ability of these populations to access emergency services.

Additionally, the homeless and residents below the poverty level may not have access to housing or their housing could be less able to withstand cold temperatures (e.g., homes with poor insulation and heating supply). Residents with low incomes might not have access to housing or their housing can be less able to withstand cold temperatures (e.g., homes with poor insulation and heating supply). For more information on the extreme temperature hazard, refer to Section 4.3.5.

As shown in Table 4.3.8-5, Evesham Township has the highest population over 65 (8,574) and highest population under the age of 5 (2,237). Pemberton Township has the largest population of non-English speaking persons (1,092). Willingboro Township has the greatest population of individuals living in poverty (2,685) and the largest disabled population (5,100). Wrightstown Township has the lowest population over 65 (58). Washington Township has the lowest population of individuals under the age of 5 (8). Bass River Township, Beverly City, Eastampton Township, Fieldsboro Borough, Medford Lakes Borough, Shamong Township, and Woodland Township all have no (0) non-English speaking persons living within the jurisdiction. Fieldsboro Borough has fewest number of disabled persons in their jurisdiction (62). Wrightstown Borough has the lowest population living in poverty (21).

Table 4.3.8-5. Burlington County Socially Vulnerable Populations by Municipality

Jurisdiction[a]	Decennial Population 2020		American Community Survey 5-Year Population Estimates (2021)									
			Population Over 65		Population Under 5		Non-English Speaking Population		Population with Disability		Population Below Poverty Level	
	Jurisdiction Total	% of County Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total
Bass River (T)	1,355	0.3%	248	18.3%	67	4.9%	0	0.0%	175	12.9%	95	7.0%
Beverly (C)	2,499	0.5%	292	11.7%	183	7.3%	0	0.0%	249	10.0%	300	12.0%
Bordentown (C)	3,993	0.9%	772	19.3%	216	5.4%	16	0.4%	422	10.6%	227	5.7%
Bordentown (T)	11,791	2.6%	1,601	13.6%	472	4.0%	289	2.4%	1,092	9.3%	194	1.6%
Burlington (C)	9,743	2.1%	1,301	13.4%	661	6.8%	208	2.1%	1,251	12.8%	1,422	14.6%
Burlington (T)	23,983	5.2%	3,526	14.7%	1,497	6.2%	385	1.6%	2,366	9.9%	2,185	9.1%
Chesterfield (T)	9,422	2.0%	760	8.1%	578	6.1%	153	1.6%	423	4.5%	165	1.8%
Cinnaminson (T)	17,064	3.7%	3,103	18.2%	929	5.4%	208	1.2%	1,661	9.7%	584	3.4%
Delanco (T)	4,824	1.0%	1,297	26.9%	191	4.0%	42	0.9%	676	14.0%	322	6.7%
Delran (T)	17,882	3.9%	2,570	14.4%	1,047	5.9%	723	4.0%	1,548	8.7%	902	5.0%
Eastampton (T)	6,191	1.3%	557	9.0%	264	4.3%	0	0.0%	478	7.7%	488	7.9%
Edgewater Park (T)	8,930	1.9%	1,571	17.6%	700	7.8%	367	4.1%	1,465	16.4%	1,645	18.4%
Evesham (T)	46,826	10.1%	8,574	18.3%	2,237	4.8%	749	1.6%	4,504	9.6%	1,476	3.2%
Fieldsboro (B)	526	0.1%	82	15.6%	64	12.2%	0	0.0%	62	11.8%	36	6.8%
Florence (T)	12,812	2.8%	2,122	16.6%	645	5.0%	260	2.0%	1,460	11.4%	827	6.5%
Hainesport (T)	6,035	1.3%	1,327	22.0%	58	1.0%	0	0.0%	744	12.3%	250	4.1%
Lumberton (T)	12,803	2.8%	2,048	16.0%	661	5.2%	107	0.8%	1,490	11.6%	805	6.3%
Mansfield (T)	8,897	1.9%	2,506	28.2%	394	4.4%	330	3.7%	1,465	16.5%	181	2.0%
Maple Shade (T)	19,980	4.3%	2,897	14.5%	1,159	5.8%	694	3.5%	2,433	12.2%	1,971	9.9%
Medford (T)	24,497	5.3%	5,151	21.0%	1,085	4.4%	31	0.1%	2,775	11.3%	724	3.0%
Medford Lakes (B)	4,264	0.9%	879	20.6%	211	4.9%	0	0.0%	407	9.5%	26	0.6%
Moorestown (T)	21,355	4.6%	3,480	16.3%	837	3.9%	603	2.8%	1,654	7.7%	807	3.8%
Mount Holly (T)	9,981	2.2%	1,199	12.0%	454	4.5%	133	1.3%	1,624	16.3%	958	9.6%
Mount Laurel (T)	44,633	9.7%	8,299	18.6%	2,011	4.5%	889	2.0%	4,203	9.4%	1,689	3.8%
New Hanover (T)	6,367	1.4%	311	4.9%	214	3.4%	29	0.4%	192	3.0%	116	1.8%
North Hanover (T)	7,963	1.7%	532	6.7%	975	12.2%	125	1.6%	631	7.9%	481	6.0%
Palmyra (B)	7,438	1.6%	1,077	14.5%	190	2.6%	44	0.6%	961	12.9%	616	8.3%
Pemberton (B)	1,371	0.3%	282	20.6%	56	4.1%	47	3.4%	308	22.5%	140	10.2%

Jurisdiction[a]	Decennial Population 2020		American Community Survey 5-Year Population Estimates (2021)									
			Population Over 65		Population Under 5		Non-English Speaking Population		Population with Disability		Population Below Poverty Level	
	Jurisdiction Total	% of County Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total
Pemberton (T)	26,903	5.8%	4,306	16.0%	1,429	5.3%	1,092	4.1%	4,006	14.9%	2,518	9.4%
Riverside (T)	8,003	1.7%	1,039	13.0%	354	4.4%	754	9.4%	972	12.1%	1,257	15.7%
Riverton (B)	2,764	0.6%	554	20.0%	80	2.9%	5	0.2%	187	6.8%	72	2.6%
Shamong (T)	6,460	1.4%	1,313	20.3%	324	5.0%	0	0.0%	671	10.4%	136	2.1%
Southampton (T)	10,317	2.2%	3,153	30.6%	293	2.8%	125	1.2%	1,551	15.0%	589	5.7%
Springfield (T)	3,245	0.7%	479	14.8%	129	4.0%	65	2.0%	311	9.6%	160	4.9%
Tabernacle (T)	6,776	1.5%	1,524	22.5%	380	5.6%	0	0.0%	747	11.0%	233	3.4%
Washington (T)	693	0.2%	138	19.9%	8	1.2%	8	1.1%	87	12.6%	21	3.0%
Westampton (T)	9,121	2.0%	1,139	12.5%	263	2.9%	81	0.9%	802	8.8%	268	2.9%
Willingboro (T)	31,889	6.9%	5,707	17.9%	1,916	6.0%	538	1.7%	5,100	16.0%	2,685	8.4%
Woodland (T)	1,544	0.3%	319	20.7%	49	3.2%	0	0.0%	627	40.6%	363	23.5%
Wrightstown (B)	720	0.2%	58	8.1%	69	9.6%	5	0.7%	119	16.5%	13	1.8%
Burlington County Total	**461,860**	**100.0%**	**78,093**	**16.9%**	**23,350**	**5.1%**	**9,103**	**2.0%**	**51,899**	**11.2%**	**27,947**	**6.1%**

Source: U.S. Census Bureau 2020, 2021

Note: Persons per household = 2.6

Impact on General Building Stock

The entire general building stock inventory is exposed and vulnerable to the severe winter storm hazard. In general, structural impacts include damage to roofs and building frames, rather than building content. Current modeling tools are not available to estimate specific losses for this hazard. As an alternate approach, this plan considers percentage damages that could result from severe winter storm conditions. Given professional knowledge and the currently available information, the potential loss for this hazard is considered to be overestimated because of varying factors (building structure type, age, load distribution, building codes in place, etc.). Therefore, the following information should be used as estimates only for planning purposes with the knowledge that the associated losses for severe winter storm events vary greatly.

Impact on Critical Facilities

Full functionality of critical facilities such as police, fire and medical facilities is essential for response during and after a severe winter storm event. These critical facility structures are largely constructed of concrete and masonry; therefore, they should only suffer minimal structural damage from severe winter storm events. Because power interruption can occur, backup power is recommended. Infrastructure at risk for this hazard includes roadways that could be damaged due to the application of salt and intermittent freezing and warming conditions that can damage roads over time. Severe snowfall requires the clearing roadways and alerting citizens to dangerous conditions; following the winter season, resources for road maintenance and repair are required (NWS 2019).

Heavy accumulations of 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. Even small accumulations of ice may cause extreme hazards to motorists and pedestrians. Bridges and overpasses are particularly dangerous because they freeze before other surfaces (NWS 2019).

Impact on Economy

Heavy accumulations of ice can bring down trees and power lines, disabling electric power and communications for days or weeks. Heavy snow can immobilize a region and paralyze a city, shutting down all air and rail transportation and disrupting medical and emergency services. Storms near the coast can cause coastal flooding and erosion. The weight of snow can cause roofs to collapse and knock down trees and power lines. Homes and farms may be isolated for days, and unprotected livestock may be lost. The economic impact of winter weather each year is huge, with costs for snow removal, damage, and loss of business in the millions (NWS 2019).

The cost of snow and ice removal and repair of roads from the freeze/thaw process can drain local financial resources. Another impact on the economy includes impacts on commuting into, or 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.

Impact on Environment

Chemically based winter maintenance practices have its own effect on the natural environment. Melting snow and ice that carry de-icing chemicals onto vegetation and into soils can contaminate the local waterways. Elevated salt levels may hinder vegetation from absorbing nutrients, slowing plant growth.

Severe winter weather can have a major impact on the environment. Not only does winter weather create changes in natural processes, the residual impacts of a community's methods to maintain its infrastructure through winter weather maintenance may also have an impact on the environment. For example, an excess amount of snowfall and earlier warming periods may affect natural processes such as flow within water resources (NSIDC n.d.). Rain-on-snow events can also exacerbate runoff rates with warming winter weather. Consequentially, these flow rates and excess volumes of water can erode banks, tear apart habitat along the banks and coastline, and disrupt terrestrial plants and animals. Road-salt runoff can cause groundwater salinization, modify the soil structure, and result in loss or reduction in lake turnover. Additionally, road salt can cause changes in the composition of aquatic invertebrate assemblages and pose threats to birds, roadside vegetation, and mammals (Tiwari and Rachlin 2018).

Cascading Impacts on Other Hazards

Severe winter weather events may exacerbate flooding. As discussed, the freezing and thawing of snow and ice associated with winter weather events can create major flooding issues in the County. Maintaining winter weather hazards through snow and ice removal could minimize the potential risk of flooding during a warming period. Refer to 4.3.6 (Flood) for more information about the flood hazard of concern.

Severe winter weather events often coincide with or are followed by extreme cold events. For more information on the extreme cold hazard, refer to Section 4.3.5 (extreme temperature).

Severe winter weather events can escalate the impacts of utility failure. Ice and snow accumulation can be destructive to the functionality of utilities by breaching power lines and disconnecting the utility systems.

Further Changes that May Impact Vulnerability

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

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

Projected Development

As discussed in Sections 3 and 9, areas targeted for future growth and development have been identified across Burlington County. Any areas of growth could be potentially impacted by the severe winter storm hazard because the entire planning area is exposed and vulnerable. Any areas of growth could be potentially impacted by the severe winter weather hazard because the entire County is exposed and vulnerable. However, due to increased standards and codes, new development may be less vulnerable to the severe winter weather hazard compared with the aging building stock in the County.

Projected Changes in Population

Burlington County has experienced an increase in its population since 2010. According to the U.S. Census Bureau, the County's population increased by approximately 3-percent between 2010 and 2020 (U.S. Census Bureau 2020). 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, Burlington County is projected to have a population of 460,400 by 2024, 464,900 by 2029, and 472,700 by 2034 (State of New Jersey 2017). Overall, aging infrastructure may result in increased stress on existing infrastructure and related services. Municipalities that experience increases in population may require utility system upgrades to keep up with utility demands (e.g., water, electric) during winter weather events to prevent increased stresses on these systems. Refer to Section 3 (County Profile) for a detailed discussion on population change in Burlington County.

Climate Change

Climate is defined not simply as average temperature and precipitation but also by the type, frequency, and intensity of weather events. Both globally and at the local scale, climate change has the potential to alter the prevalence and severity of extremes such winter storms. While predicting changes of winter storm 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).

Change of Vulnerability Since 2019 HMP

Overall, the County's vulnerability has not changed, and the entire County will continue to be exposed and vulnerable to severe winter weather events. As existing development and infrastructure continue to age, they can be at increased risk of failed utility and transportation systems if they are not properly maintained and do not adapt to the changing environment.

4.3.9 Wildfire

2024 HMP Changes

- New and updated figures from federal and state agencies are incorporated.
- New Jersey Forest Fire Service (NJFFS) Wildfire Fuel Hazard data was used to identify wildfire fuel rankings in Burlington County.
- U.S. 2020 Census data was incorporated, where appropriate.
- Previous occurrences were updated with events that occurred between 2018 and 2023.

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

Hazard Description

A wildfire can be defined as any non-structural fire that occurs in the wildland. Three distinct types of wildfires have been defined and include: naturally occurring wildfire, human-caused wildfire, and prescribed fire. Many of these are highly destructive and can be difficult to control. They occur in forested, semi-forested, or less developed areas. Wildfires can be caused by lightning, human carelessness, and arson (NPS 2022, National Geographic 2022). Most frequently, wildfires in New Jersey are caused by humans (NJOEM 2019). Wildfires result in the uncontrolled destruction of forests, brush, field crops, grasslands, real estate, and personal property, and have secondary impacts on other hazards such as flooding, by removing vegetation and destroying watersheds (NPS 2022).

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).

Location

In the State of New Jersey, each year, an average of 1,500 wildfires damage or destroy 7,000 acres of the state’s forests. Wildfires not only damage woodlands but threaten homeowners who live within or adjacent to forest environments (NJFFS 2023). The height of wildfire season in New Jersey is typically March through May and culminates in early May, corresponding with the driest live fuel moisture periods of the year. Although the spring season is the most severe, summer and fall may also experience extensive fires in the state. While the spring season is historically the period in which wildfire danger is the highest, wildfires can occur every month of the year. Drought and local weather conditions can expand the length of the fire season. The early and late shoulders of the fire season usually are associated with human-caused fires. Lightning generally is the cause of most fires in the peak season (NJOEM 2019).

The New Jersey Forest Fire Service (NJFFS), a division of NJDEP, is responsible for protecting the 3.15 million acres of public and private wildland in the State. NJFFS is under the direction of the State fire warden and is headquartered in Trenton. It is broken up into three divisions (A, B, C). Each division is responsible for responding to wildfire events within their boundaries. Burlington County is located in Division B (see Figure 4.3.9-1). 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).

All of Burlington County is susceptible to wildfire and they can occur anywhere in the County. However, the greatest risk for wildfire is in the southeastern two thirds of the County which is located in the Pinelands National Reserve.

The Pinelands and Pine Barrens

The New Jersey Pine Barrens are characterized by low, dense forests of pine and oak, ribbons of cedar and hardwood swamps bordering drainage courses, pitch pine lowlands, and bogs and marshes combine to produce an expansive vegetative mosaic unsurpassed in the Northeast. The Pine Barrens was recognized as a nationally and internationally important ecological region when, in 1978, Congress created the Pinelands National Reserve, our country's first National Reserve and a U.S. Biosphere Reserve of the Man and the Biosphere Program. The Pinelands National Reserve encompasses approximately 1.1 million acres statewide, occupying 22 percent of New Jersey's land area and covering portions of seven counties and all or parts of 56 municipalities. It is the largest body of open space on the Mid-Atlantic seaboard between Richmond and Boston and is underlain by aquifers containing 17 trillion gallons of some of the purest water in the land. Through the creation of the Pinelands Commission, the State of New Jersey formed the necessary partnerships to preserve, protect and enhance the natural and cultural resources of the Pinelands (NPS 2018).

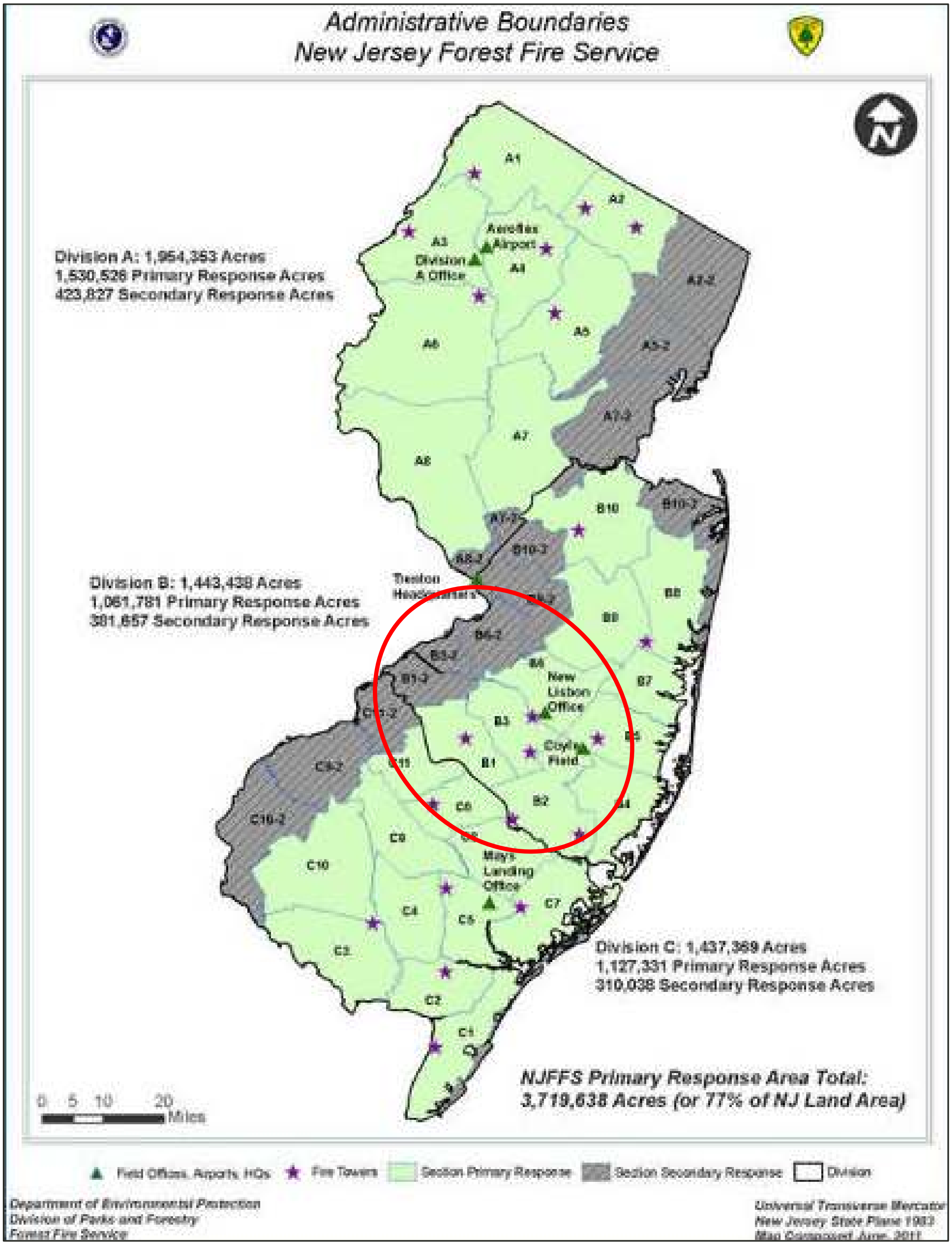
According to the New Jersey Pinelands Commission 2013 Pinelands Long-Term Economic Monitoring Program, 35 percent of Burlington County's municipalities (or 14 of the 40 municipalities) are located within the Pinelands Area, as shown in Figure 4.3.9-2 (NJ Pinelands Commission 2018). Approximately 21 percent of Burlington County's 2010 population (93,489 residents) resided in the Pinelands Area. Approximately 20 percent of the County's housing units (35,141 housing units) and 64 percent of the County's total land area (334,250 acres) were also reported as located within the Pinelands Area (NJ Pinelands Comsission 2014).

Naturally occurring wildfires burning several thousands of acres per year have been a common occurrence in the Pinelands for many hundreds of years. Development of the unique flora of the Pinelands is closely related to the occurrence of fire, with many plant species relying on fire for a part of their reproductive cycle (NJOEM 2019).

Pinelands fires tend to burn extremely hot and spread rapidly. Crown fires here are fairly common (spreading from treetop to treetop). While Pinelands fires generally do not cause casualties due to the low population residing within its limits, property loss can run in the thousands of dollars per event, not including costs associated with emergency response and firefighting. Often, State roads have closed because of smoke conditions (NJOEM 2019).

Conditions conducive to forest fires are some of the most consistent and serious impacts of drought, a hazard profiled earlier in this plan. This applies particularly to the Pine Barrens, where drying conditions favor the combustion of forest fuels. Generally, a relative humidity of less than 40 percent, winds greater than 13 miles an hour, and precipitation of less than 0.01 inches during a month are ideal conditions for forest fires in the Pine Barrens. The season of greatest fire threat runs from March through May, though extensive fires have occurred in the summer and autumn months (NJOEM 2019).

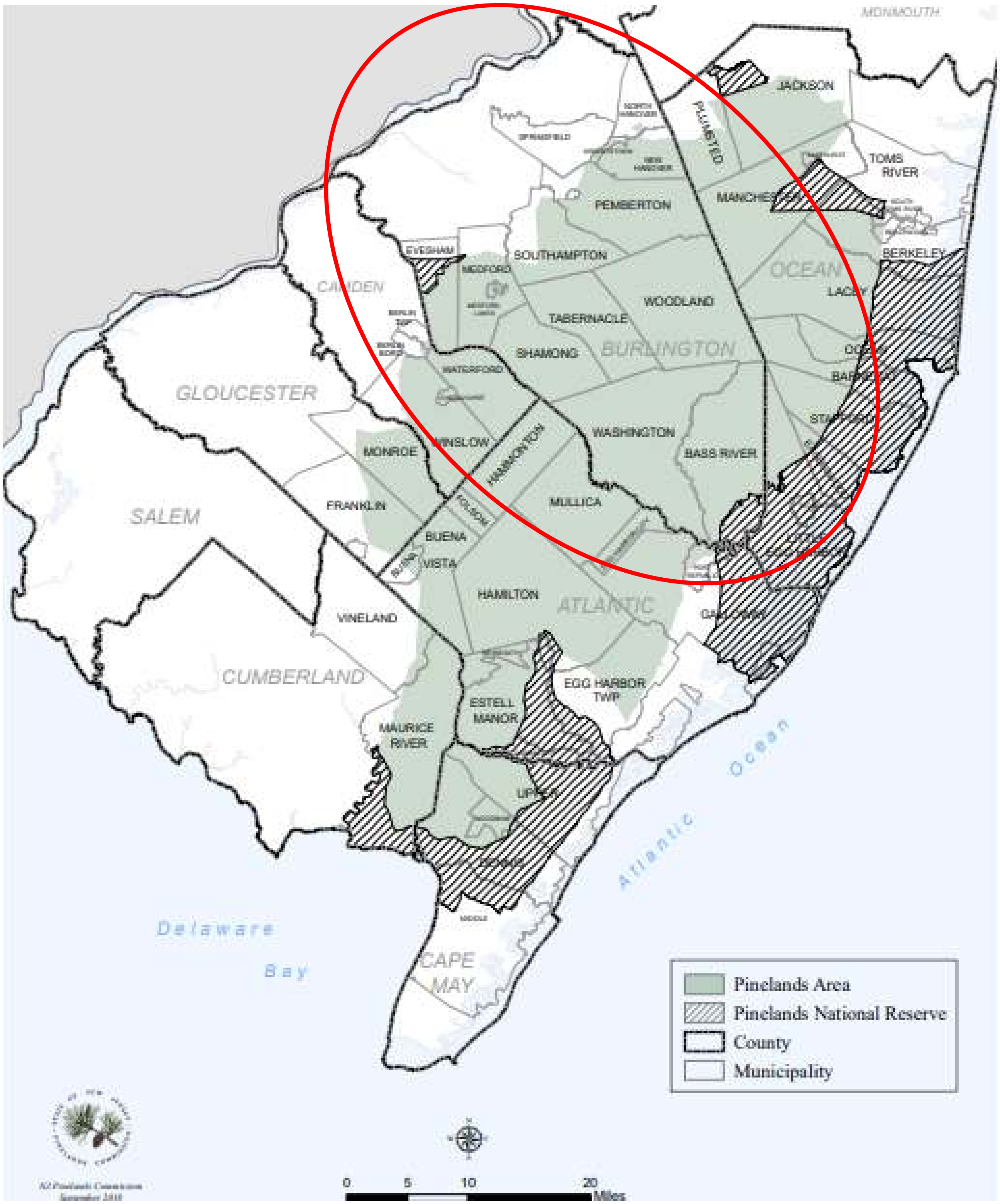
Figure 4.3.9-1. Fire Divisions of New Jersey



Source: NJDEP 2015

Note: The red circle indicates the location of Burlington County. The County is located in Fire Division B.

Figure 4.3.9-2. Pinelands Management and Planning Areas in Burlington County



Source: NJ Pinelands Commission 2018
Note: The red circle indicates the location of Burlington County.

Wildfire Fuel Hazard Areas

NJFFS developed Wildfire Fuel Hazard data for the entire State based on NJDEP data. For details on the information was developed, refer to: https://www.state.nj.us/dep/gis/njfh.html. Figure 4.3.9-3 illustrates the wildfire fuel hazard and wildfire risk for Burlington County. A majority of the County has extreme fuel hazard and moderate to high risk. With the exception of Fieldsboro, every municipality in Burlington County has at least a small portion of the community located within the high to extreme risk area.

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 2023).

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 2023). Table 4.3.9-1 displays Burlington County's Burn Probability; also refer to Figure 4.3.9-4.

Table 4.3.9-1. Burlington County Burn Probability

	Burn Probability Category	Acres	Percent
	1/10 - Little to No Burn Probability	119,578	22.8 %
	2/10 - Low Burn Probability	42,696	8.1 %
	3/10 - Low Burn Probability	45,519	8.7 %
	4/10 - Moderate Burn Probability	35,288	6.7 %
	5/10 - Moderate Burn Probability	35,018	6.7 %
	6/10 - High Burn Probability	53,168	10.1 %
	7/10 - Very High Burn Probability	171,864	32.7 %
	8/10 - Extreme Burn Probability	21,767	4.1 %
	9/10 - Extreme Burn Probability	0	0.0 %
	10/10 - Extreme Burn Probability	0	0.0 %
	Total	**524,898**	**100.0 %**

Source: New Jersey Forest Fire Service 2023

Figure 4.3.9-3. Wildfire Risk for Burlington County

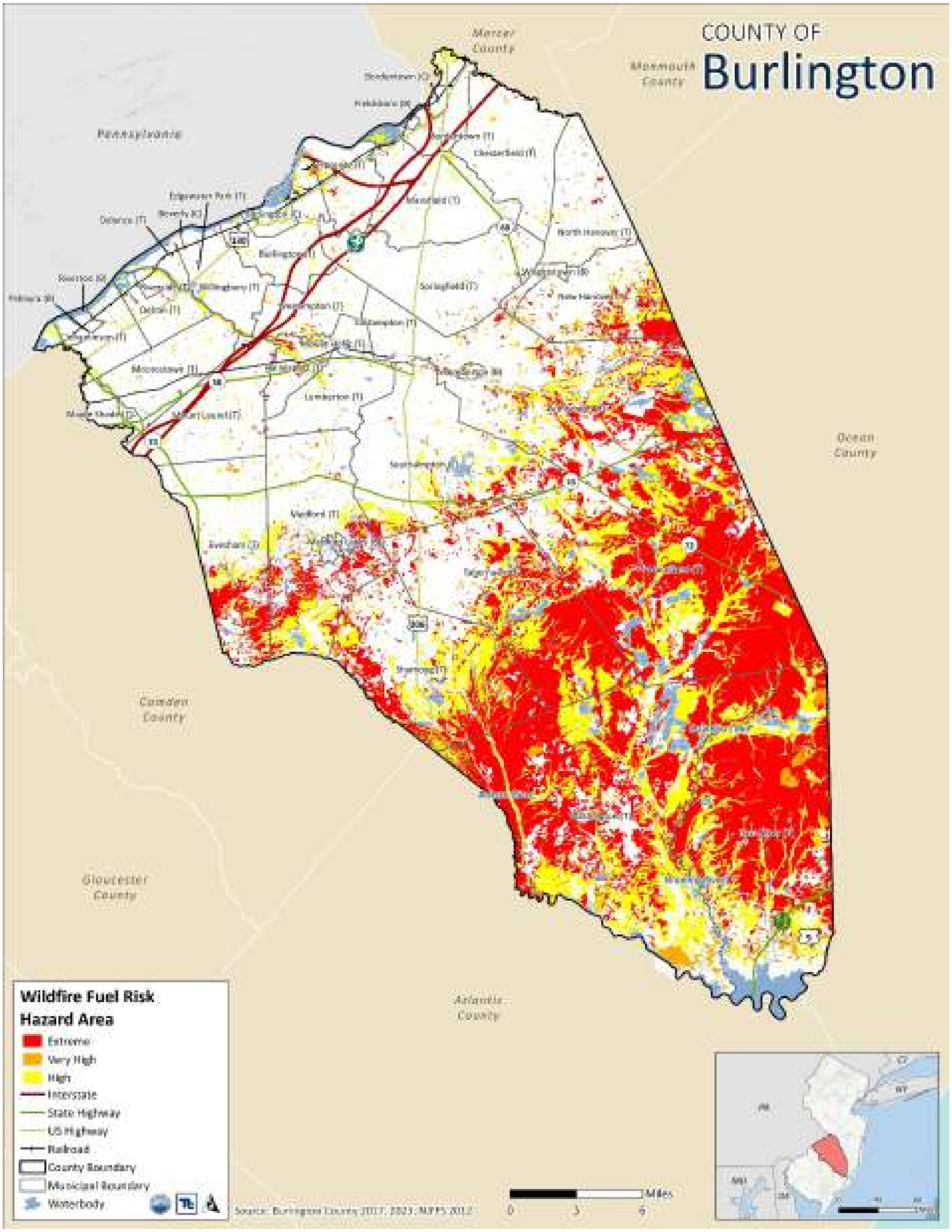
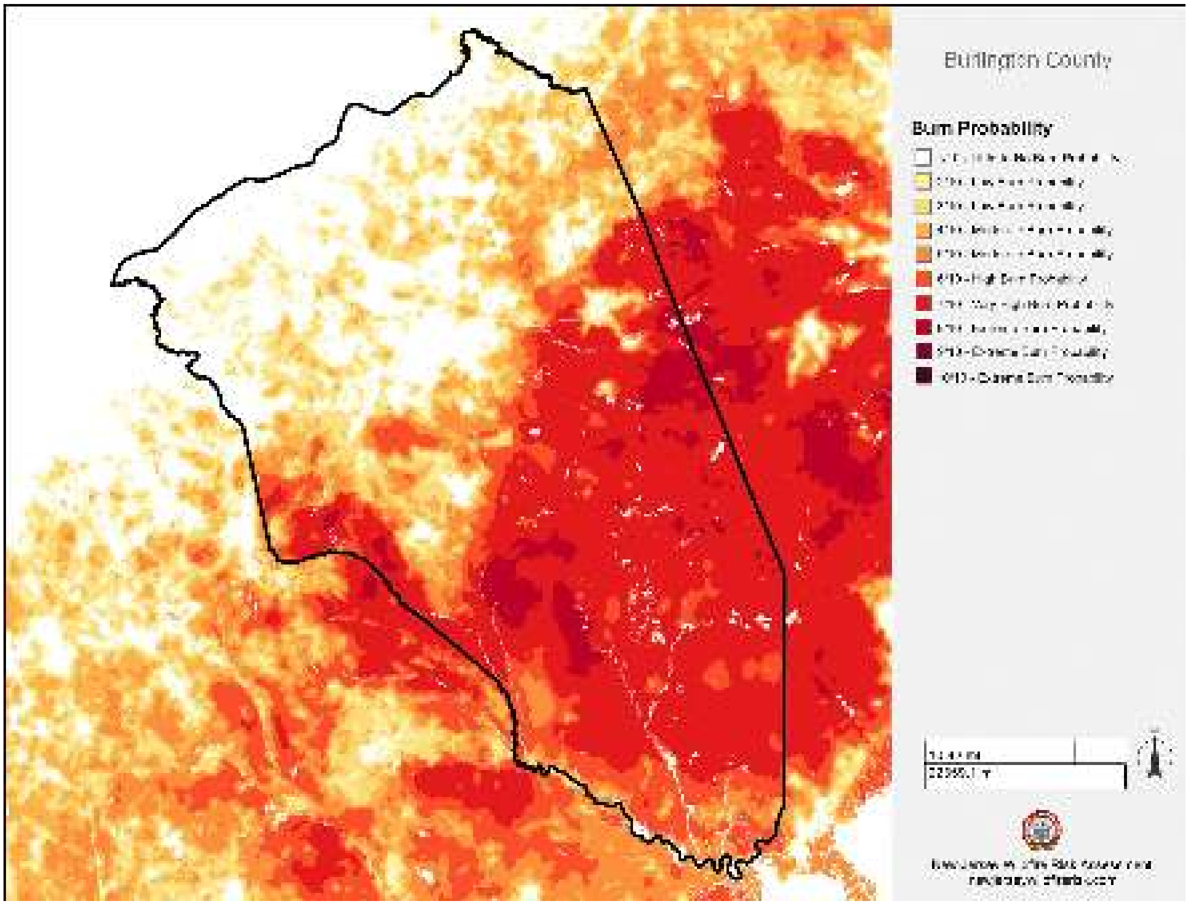


Figure 4.3.9-4. Burlington County Burn Probability



Source: New Jersey Forest Fire Service 2023

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 *Buildup Index* is a number that reflects the combined cumulative effects of daily drying and precipitation fuels with a 10-day time lag constant. It is a rating of the total amount of fuel available for combustion (NOAA 2020).
- The *Keetch-Byram Drought Index* is an index used to determining forest fire potential. The drought index is based on a daily water balance, where a drought factor is balanced with precipitation and soil moisture (assumed to have a maximum storage capacity of 8-inches) and is expressed in hundredths of an inch of soil moisture depletion (NPS 2023).

In addition to the two indices, the NJFFS uses the National Fire Danger Rating System to provide a measure of relative seriousness of burning conditions and threat of fire in the State. It allows the NJFFS to estimate the daily fire danger for a given area. The rating system uses a five-color coded system to help the public understand fire potential. The NJFFS slightly adapted the color system for their purposes. The National Fire Danger Rating System, with the NJFFS color scheme, can be seen in Table 4.3.9-2.

Table 4.3.9-2. National Fire Danger Rating System

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 burn 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 (trunks, branches, and tree tops) 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.

According to the NJFFS, a major fire is declared when a fire reaches 100 acres of forest (or 500 acres of marsh), this is when additional support is provided to the Incident, such as Mobile Command Post, overhead support, including the Incident management team (a type 2 Incident Command Team), and fleet maintenance personnel are dispatch. All specialized units may be called on smaller incidents as needed. Including large agriculture pumps, and other specialized equipment. Helicopters can be used on smaller fire to help access remote areas, by using Bambi buckets for water drops, or airlifting equipment and firefighters to reach remote areas, as well as lighting backfires. Major fires in Central and Southern New Jersey in the Pine Barrens areas, can be mostly contained in 24 to 48 hours, due to the use of mechanized attack with off road wildland engines, and tractor plows/dozers (New Jersey Forest Fire Service 2023).

Previous Occurrences and Losses

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

FEMA Major Disasters and Emergency Declarations

Between May 1953 and June 2023, FEMA declared that the State of New Jersey experienced 2 wildfire-related disasters (DR) or emergencies (EM). Generally, these disasters cover a wide region of the State; therefore, they may have impacted many counties. Burlington County was included in one of these wildfire-related declarations between 1954 and 2023. Table 4.3.9-3 lists declarations from May 1953 and June 2023 for this HMP update. Detailed information about the declared disasters since 1953 is provided in Section 3 (County Profile).

Table 4.3.9-3. FEMA Declarations for Wildfire Events in Burlington County

FEMA Declaration Number	Date of Declaration	Date of Event	Event Type	Event Title
FM-2695-NJ	May 16, 2007	May 15, 2007	Wildfire	New Jersey Warren Grove Fire

Source: FEMA 2023

U.S. Department of Agriculture Disaster Declarations

The Secretary of Agriculture from the U.S. Department of Agriculture (USDA) is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in counties that are contiguous to a designated county. Between August 2018 and June 2023, Burlington County was not included in any wildfire-related agricultural disaster declarations (USDA 2023).

Previous Events

For the 2024 HMP update, known wildfire events that impacted Burlington County between August 2018 and May 2023 are listed in Table 4.3.9-4. For events prior to August 2018, refer to the 2020 Burlington County HMP.

Table 4.3.9-4. Wildfire Events in Burlington County, 2018 to 2023

Date of Event	Event Type	Declaration Number	Burlington County Designated?	Losses / Impacts
April 22-24, 2018	Wildfire	N/A	N/A	During the afternoon of April 22nd, a wildfire was spotted by the Cedar Bridge and Batsto fire towers. At first, about 50 acres were involved but a sea breeze caused the fire to quickly grow to 843 acres. The fire was located in Washington Township, just north of Lake Oswego.
March 30 - April 1, 2019	Wildfire	N/A	N/A	On March 30, a wildfire ignited in the Penn State Forest region within the Pinelands of Burlington County, NJ. Gusty southerly winds helped to cause rapid fire to spread; however widespread showers helped with containment efforts on March 31. By the time the fire was fully contained, more than 11,000 acres of forest had burned. The fire continued burning early on April 1, but was considered contained the prior evening.

Date of Event	Event Type	Declaration Number	Burlington County Designated?	Losses / Impacts
June 19-21, 2022	Wildfire	N/A	N/A	A wildfire (Mullica River Fire) was detected in a remote section of the Wharton State Forest in Mullica Twp. Unseasonably dry, windy conditions, combined with difficulty in accessing the initial fire location, led to rapid fire spread. By the time the fire was fully contained an estimated 14,983 acres had burned. This made it the largest wildfire in New Jersey since 2007. No structures were lost during this fire, though several were threatened and protected in nearby campgrounds. No serious injuries were reported.
June 27, 2022	Wildfire	N/A	N/A	A wildfire (Brickworks Fire) was detected by the Apple Pie Hill Fire Tower. This fire reached 315 acres in size, with 100% containment reached the same day. Firing and burnout operations were successful in completing containment.
July 13, 2022	Wildfire	N/A	N/A	A wildfire (Maple Branch Wildfire) was detected by Batsto Village. This fire reached 98 acres in size, with 100% containment achieved the same day.
May 31, 2023 - June 2, 2023	Wildfire	N/A	N/A	A wildfire (Allen Road Fire) in Bass River State Forest of roughly 5,000 acres resulted in dense smoke. An inversion in the atmosphere caused a combination of smoke and fog to reduce visibility to dangerous levels. As a result, the Garden State Parkway was closed between the Exit 38 and Exit 63 for several hours.
June 3, 2023	Wildfire	N/A	N/A	A wildfire (Flatiron Fire) was reported on June 3, 2023. The fire was estimated at 20 acres and was 100% contained on the same as reported. One outbuilding/shed was destroyed.
June 12, 2023	Wildfire	N/A	N/A	A wildfire (Buzby Boggs Wildfire) was reported via Facebook, burning south of the Black Run preserve in Evesham Township. New Jersey Forest Fire Service resources along with local fire units responded immediately and discovered an active wildfire burning in a remote area estimated to be more than 20 acres. This fire reached an estimated 700 acres at containment.
June 12, 2023	Wildfire	N/A	N/A	At approximately 11:35am fire towers saw smoke, located in the area of City Line Road in Pemberton Township. This fire (City Line Wildfire) reached 850 acres at containment.
June 20, 2023	Wildfire	N/A	N/A	Fire was discovered by an aircraft from Fort Dix (Joint Base MDL). Fire was reported directly to the New Jersey Forest Fire Service at 11:00 am on June 19, 2023. Aircraft from the NJFFS on a previously planned flight diverted to the reported location, confirmed there was an active fire, then guided ground forces into the fire location. The fire (Acorn Hill Wildfire) reached 246 acres at containment.
August 20-23, 2023	Wildfire	N/A	N/A	A major forest fire (Dragway Fire) occurred in Wharton State Forest, Waterford, and Shamong Township. Road closures were issued by the municipalities and the County. The Shamong Local Fire Company undertook structural protection of Oak View Estates Mobile Home Park. Over 5,000 acres burned.

Source: NOAA NCEI 2023; FEMA 2023

The NJFFS keeps records of wildfires and prescribed burns in the State of New Jersey. In Burlington County, between 2018 and 2022, there have been a total of 244 fires with a total acres burned of 31,667. During the same timeframe, there have been 186 prescribed burns with 20,630 acres of land treated. Refer to Table 4.3.9-5 for an annual breakdown.

Table 4.3.9-5. Wildfires and Prescribed Burns in Burlington County 2018-2022

	Wildfires		Prescribed Burns	
Year	**Number of Fires**	**Acres Burned**	**Number of Treatments**	**Acres Treated**
2018	28	1,359	21	1,457
2019	49	12,036	44	4,034
2020	60	4,796	51	7,416
2021	58	1,972	39	4,285
2022	49	11,503	31	3,438
Total	**244**	**31,667**	**186**	**20,630**

Source: New Jersey Forest Fire Service 2023

Probability of Future Occurrence

For the 2024 HMP update, the most up-to-date data was collected to calculate the probability of future occurrence of wildfire events for the County. Information from NOAA-NCEI storm events database, the 2019 State of New Jersey HMP, and the 2019 Burlington County HMP, were used to identify the number of wildfire events that occurred between January 1950 and March 2023. Table 4.3.9-6 presents the probability of future events for wildfire in Burlington County.

Table 4.3.9-6. Probability of Future Occurrences of Wildfire Events

Hazard Type	Occurrences Between 1905 and 2023	% Chance of Occurring in Any Given Year	Recurrence Interval (in years) (# Years/Number of Events)
Wildfire	62	52.54%	1.90

Source: NOAA NCEI 2023; NJOEM 2019; Burlington County 2019

Note: Disaster occurrences include federally declared disasters since the 1950 Federal Disaster Relief Act, and selected events since 1968. Due to limitations in data, not all wildfire events occurring between 1954 and 1996 are accounted for in the tally of occurrences. As a result, the number of hazard occurrences is underestimated.

In Section 4.4, the identified hazards of concern for the County are ranked. The probability of occurrence, or likelihood of the event, is one parameter used for hazard rankings. Based on historical records and input from the Planning Team, the probability of occurrence rating for wildfires in the County is "occasional."

Climate Change Impacts

Providing projections of future climate change for a specific region is challenging. Shorter term projections are more closely tied to existing trends making longer term projections even more challenging. The further out a prediction reaches the more subject to changing dynamics it becomes.

Climate change includes major changes in temperature, precipitation, or wind patterns over many decades. Due to the increase in greenhouse gas concentrations since the end of the 1890s, New Jersey has experienced a 3.5 °F (1.9 °C) increase in average temperature, which is faster than the rest of the Northeast region (2 °F [1.1 °C]) and the world (1.5 °F [0.8 °C]). This warming trend is expected to continue. By 2050, temperatures in New Jersey are expected

TETRA TECH

to increase by 4.1 to 5.7 °F (2.3 °C to 3.2 °C). 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 (5.6 °C) 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. Changes in winter temperatures could result in a change in the frequency of ice jam events (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, New Jersey 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. New Jersey will experience more intense rain events, less snow, and more rainfalls. Also, small decreases in the amount of precipitation may occur in the summer months, resulting in greater potential for more frequent and prolonged droughts (NJDEP 2020).

A gradual change in temperatures will alter the growing environment of many tree species throughout the United States and New Jersey, reducing the growth of some trees and increasing the growth of others. Tree growth and regeneration may be affected more by extreme weather events and climatic conditions than by gradual changes in temperature or precipitation. Warmer temperatures may lead to longer dry seasons and multi-year droughts, creating triggers for wildfires, insects, and invasive species. An increase in invasive species, such as the emerald ash borer, can lead to the destruction and death of ash 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 while wildfires can burn during a given year (US EPA 2022). Climate change may also increase the frequency of lightning strikes. A warmer atmosphere holds more moisture which is one of the key items for triggering a lightning strike. Lightning strikes cause approximately half the wildfires in the United States. If the frequency of lightning strikes increases, the potential for wildfires from these strikes also increases (National Geographic 2014). 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).

As stated above, according to the temperature projections, Burlington 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).

Vulnerability Assessment

A spatial analysis was conducted using 2012 New Jersey Forest Fire Service hazard data. To determine what assets are exposed to wildfire, the various inventory datasets (critical facilities, general building stock, population, and new development) were overlaid with the hazard area. Assets with their centroid located in the hazard area were totaled to estimate the totals and values at risk to impacts from a wildfire event. Refer to Section 4.2 for additional details on the methodology used to assess wildfire risk.

Impact on Life, Health, and Safety

Wildfires have the potential to impact human health and life of residents and responders, structures, infrastructure, and natural resources. 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.

Table 4.3.9-7 summarizes the estimated population exposed to the wildfire hazard by municipality.

Based on the analysis, an estimated 6,406 residents, or 1.4 percent of the County's population, are located in the extreme, high, and very high wildfire hazard areas. Overall, the Township of Evesham has the greatest number of individuals located in the extreme, very high, and high hazard areas (i.e., 1,032 persons) and the Borough of Pemberton has the greatest proportion of its population exposed to the extreme, very high, and high hazard areas (i.e., 21.1 percent).

Socially Vulnerable Populations

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.

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.

According to the 2021 5-year ACS estimates, there are 27,947 total persons living below the poverty level, 78,093 persons over the age of 65 years, 23,350 persons under the age of 5 years, 9,103 non-English speakers, and 51,899 persons with a disability in Burlington County, as shown in Table 4.3.9-8.

Table 4.3.9-7. Population in Wildfire Fuel Hazard Areas

Jurisdiction	Total Population (Decennial Population 2020)	Estimated Population in Extreme, Very High, or High Wildfire Fuel Risk Hazard Area	
		Number of People	Percent of Total
Bass River (T)	1,355	108	7.9%
Beverly (C)	2,499	0	0.0%
Bordentown (C)	3,993	4	0.1%
Bordentown (T)	11,791	172	1.5%
Burlington (C)	9,743	4	<0.1%
Burlington (T)	23,983	63	0.3%
Chesterfield (T)	9,422	270	2.9%
Cinnaminson (T)	17,064	69	0.4%
Delanco (T)	4,824	75	1.5%
Delran (T)	17,882	223	1.2%
Eastampton (T)	6,191	24	0.4%

Jurisdiction	Total Population (Decennial Population 2020)	Estimated Population in Extreme, Very High, or High Wildfire Fuel Risk Hazard Area	
		Number of People	Percent of Total
Edgewater Park (T)	8,930	4	<0.1%
Evesham (T)	46,826	1,032	2.2%
Fieldsboro (B)	526	0	0.0%
Florence (T)	12,812	104	0.8%
Hainesport (T)	6,035	282	4.7%
Lumberton (T)	12,803	235	1.8%
Mansfield (T)	8,897	164	1.8%
Maple Shade (T)	19,980	0	0.0%
Medford (T)	24,497	589	2.4%
Medford Lakes (B)	4,264	24	0.6%
Moorestown (T)	21,355	118	0.6%
Mount Holly (T)	9,981	15	0.1%
Mount Laurel (T)	44,633	257	0.6%
New Hanover (T)	6,367	626	9.8%
North Hanover (T)	7,963	59	0.7%
Palmyra (B)	7,438	0	0.0%
Pemberton (B)	1,371	289	21.1%
Pemberton (T)	26,903	376	1.4%
Riverside (T)	8,003	3	<0.1%
Riverton (B)	2,764	3	0.1%
Shamong (T)	6,460	160	2.5%
Southampton (T)	10,317	218	2.1%
Springfield (T)	3,245	38	1.2%
Tabernacle (T)	6,776	318	4.7%
Washington (T)	693	55	7.9%
Westampton (T)	9,121	148	1.6%
Willingboro (T)	31,889	0	0.0%
Woodland (T)	1,544	249	16.1%
Wrightstown (B)	720	27	3.8%
Burlington County Total	**461,860**	**6,406**	**1.4%**

Source: Burlington County, 2023; NJOGIS 2023; Microsoft BING 2022; U.S. Census Bureau 2020; NJFFS 2012

Table 4.3.9-8. Burlington County Socially Vulnerable Populations by Municipality

Jurisdiction[a]	Decennial Population 2020		American Community Survey 5-Year Population Estimates (2021)									
			Population Over 65		Population Under 5		Non-English Speaking Population		Population with Disability		Population Below Poverty Level	
	Jurisdiction Total	% of County Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total
Bass River (T)	1,355	0.3%	248	18.3%	67	4.9%	0	0.0%	175	12.9%	95	7.0%
Beverly (C)	2,499	0.5%	292	11.7%	183	7.3%	0	0.0%	249	10.0%	300	12.0%
Bordentown (C)	3,993	0.9%	772	19.3%	216	5.4%	16	0.4%	422	10.6%	227	5.7%
Bordentown (T)	11,791	2.6%	1,601	13.6%	472	4.0%	289	2.4%	1,092	9.3%	194	1.6%
Burlington (C)	9,743	2.1%	1,301	13.4%	661	6.8%	208	2.1%	1,251	12.8%	1,422	14.6%
Burlington (T)	23,983	5.2%	3,526	14.7%	1,497	6.2%	385	1.6%	2,366	9.9%	2,185	9.1%
Chesterfield (T)	9,422	2.0%	760	8.1%	578	6.1%	153	1.6%	423	4.5%	165	1.8%
Cinnaminson (T)	17,064	3.7%	3,103	18.2%	929	5.4%	208	1.2%	1,661	9.7%	584	3.4%
Delanco (T)	4,824	1.0%	1,297	26.9%	191	4.0%	42	0.9%	676	14.0%	322	6.7%
Delran (T)	17,882	3.9%	2,570	14.4%	1,047	5.9%	723	4.0%	1,548	8.7%	902	5.0%
Eastampton (T)	6,191	1.3%	557	9.0%	264	4.3%	0	0.0%	478	7.7%	488	7.9%
Edgewater Park (T)	8,930	1.9%	1,571	17.6%	700	7.8%	367	4.1%	1,465	16.4%	1,645	18.4%
Evesham (T)	46,826	10.1%	8,574	18.3%	2,237	4.8%	749	1.6%	4,504	9.6%	1,476	3.2%
Fieldsboro (B)	526	0.1%	82	15.6%	64	12.2%	0	0.0%	62	11.8%	36	6.8%
Florence (T)	12,812	2.8%	2,122	16.6%	645	5.0%	260	2.0%	1,460	11.4%	827	6.5%
Hainesport (T)	6,035	1.3%	1,327	22.0%	58	1.0%	0	0.0%	744	12.3%	250	4.1%
Lumberton (T)	12,803	2.8%	2,048	16.0%	661	5.2%	107	0.8%	1,490	11.6%	805	6.3%
Mansfield (T)	8,897	1.9%	2,506	28.2%	394	4.4%	330	3.7%	1,465	16.5%	181	2.0%
Maple Shade (T)	19,980	4.3%	2,897	14.5%	1,159	5.8%	694	3.5%	2,433	12.2%	1,971	9.9%
Medford (T)	24,497	5.3%	5,151	21.0%	1,085	4.4%	31	0.1%	2,775	11.3%	724	3.0%
Medford Lakes (B)	4,264	0.9%	879	20.6%	211	4.9%	0	0.0%	407	9.5%	26	0.6%
Moorestown (T)	21,355	4.6%	3,480	16.3%	837	3.9%	603	2.8%	1,654	7.7%	807	3.8%
Mount Holly (T)	9,981	2.2%	1,199	12.0%	454	4.5%	133	1.3%	1,624	16.3%	958	9.6%
Mount Laurel (T)	44,633	9.7%	8,299	18.6%	2,011	4.5%	889	2.0%	4,203	9.4%	1,689	3.8%
New Hanover (T)	6,367	1.4%	311	4.9%	214	3.4%	29	0.4%	192	3.0%	116	1.8%
North Hanover (T)	7,963	1.7%	532	6.7%	975	12.2%	125	1.6%	631	7.9%	481	6.0%
Palmyra (B)	7,438	1.6%	1,077	14.5%	190	2.6%	44	0.6%	961	12.9%	616	8.3%
Pemberton (B)	1,371	0.3%	282	20.6%	56	4.1%	47	3.4%	308	22.5%	140	10.2%

Jurisdiction[a]	Decennial Population 2020		American Community Survey 5-Year Population Estimates (2021)									
			Population Over 65		Population Under 5		Non-English Speaking Population		Population with Disability		Population Below Poverty Level	
	Jurisdiction Total	% of County Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total
Pemberton (T)	26,903	5.8%	4,306	16.0%	1,429	5.3%	1,092	4.1%	4,006	14.9%	2,518	9.4%
Riverside (T)	8,003	1.7%	1,039	13.0%	354	4.4%	754	9.4%	972	12.1%	1,257	15.7%
Riverton (B)	2,764	0.6%	554	20.0%	80	2.9%	5	0.2%	187	6.8%	72	2.6%
Shamong (T)	6,460	1.4%	1,313	20.3%	324	5.0%	0	0.0%	671	10.4%	136	2.1%
Southampton (T)	10,317	2.2%	3,153	30.6%	293	2.8%	125	1.2%	1,551	15.0%	589	5.7%
Springfield (T)	3,245	0.7%	479	14.8%	129	4.0%	65	2.0%	311	9.6%	160	4.9%
Tabernacle (T)	6,776	1.5%	1,524	22.5%	380	5.6%	0	0.0%	747	11.0%	233	3.4%
Washington (T)	693	0.2%	138	19.9%	8	1.2%	8	1.1%	87	12.6%	21	3.0%
Westampton (T)	9,121	2.0%	1,139	12.5%	263	2.9%	81	0.9%	802	8.8%	268	2.9%
Willingboro (T)	31,889	6.9%	5,707	17.9%	1,916	6.0%	538	1.7%	5,100	16.0%	2,685	8.4%
Woodland (T)	1,544	0.3%	319	20.7%	49	3.2%	0	0.0%	627	40.6%	363	23.5%
Wrightstown (B)	720	0.2%	58	8.1%	69	9.6%	5	0.7%	119	16.5%	13	1.8%
Burlington County Total	**461,860**	**100.0%**	**78,093**	**16.9%**	**23,350**	**5.1%**	**9,103**	**2.0%**	**51,899**	**11.2%**	**27,947**	**6.1%**

Source: U.S. Census Bureau 2020, 2021

Note: Persons per household = 2.6

a. (B) = borough; (C) = city; (T) = township

Impact on General Building Stock

Buildings located within the NJDEP 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 4.3.9-9 summarizes the estimated building stock inventory located in the hazard area by municipality. The replacement cost value (RCV) of general building stock located in the extreme/very high/high hazard area $4.9 billion (2.6 percent of the countywide total). The Township of Evesham has the greatest number of buildings located in the wildfire hazard area (298 structures; 2.2 percent of its total), and the Borough of Pemberton has the greatest proportion of its buildings located in the wildfire hazard area (i.e., 18.9 percent).

Table 4.3.9-9. Estimated Number and Total Replacement Cost Value of Structures Located in the Extreme, Very High, or High Wildfire Fuel Risk Hazard Area

			Estimated Building Stock in the Extreme, Very High, or High Wildfire Fuel Risk Hazard Area			
			Building Count		RCV	
Jurisdiction	Total Number of Buildings	Total RCV	Number	Percent of Total	Value	Percent of Total
Bass River (T)	719	$881,423,037	62	8.6%	$209,639,006	23.8%
Beverly (C)	939	$1,218,790,334	0	0.0%	$0	0.0%
Bordentown (C)	1,041	$2,794,074,193	1	0.1%	$404,984	<0.1%
Bordentown (T)	3,389	$5,866,485,431	50	1.5%	$85,775,137	1.5%
Burlington (C)	3,165	$5,813,312,404	1	<0.1%	$313,504	<0.1%
Burlington (T)	6,525	$8,819,483,894	26	0.4%	$350,605,710	4.0%
Chesterfield (T)	2,673	$2,243,175,804	64	2.4%	$69,215,640	3.1%
Cinnaminson (T)	5,833	$6,206,033,564	29	0.5%	$113,838,056	1.8%
Delanco (T)	1,717	$1,777,428,934	26	1.5%	$14,048,583	0.8%
Delran (T)	5,008	$5,342,639,406	64	1.3%	$55,900,779	1.0%
Eastampton (T)	1,947	$1,223,958,808	10	0.5%	$42,252,750	3.5%
Edgewater Park (T)	2,210	$2,391,677,740	4	0.2%	$10,387,539	0.4%
Evesham (T)	13,368	$11,128,366,531	298	2.2%	$359,847,666	3.2%
Fieldsboro (B)	224	$241,524,257	0	0.0%	$0	0.0%
Florence (T)	4,084	$6,582,323,116	40	1.0%	$975,513,479	14.8%
Hainesport (T)	2,546	$3,283,651,920	128	5.0%	$557,105,713	17.0%
Lumberton (T)	3,724	$4,304,673,748	64	1.7%	$65,834,861	1.5%
Mansfield (T)	3,805	$3,398,330,024	67	1.8%	$59,834,774	1.8%
Maple Shade (T)	5,120	$5,835,178,181	2	<0.1%	$5,072,980	0.1%
Medford (T)	8,792	$10,042,226,056	212	2.4%	$279,010,351	2.8%
Medford Lakes (B)	1,804	$967,238,228	10	0.6%	$4,902,485	0.5%
Moorestown (T)	7,173	$12,232,463,125	47	0.7%	$94,829,163	0.8%
Mount Holly (T)	2,987	$3,763,298,318	5	0.2%	$37,041,713	1.0%
Mount Laurel (T)	13,150	$15,418,468,979	112	0.9%	$498,657,930	3.2%
New Hanover (T)	1,068	$2,868,939,587	38	3.6%	$34,205,426	1.2%
North Hanover (T)	2,176	$2,404,670,347	12	0.6%	$5,543,827	0.2%
Palmyra (B)	2,482	$2,133,107,140	0	0.0%	$0	0.0%
Pemberton (B)	519	$736,141,491	98	18.9%	$60,839,592	8.3%
Pemberton (T)	9,729	$6,973,242,840	133	1.4%	$189,790,177	2.7%
Riverside (T)	2,532	$2,459,954,166	2	0.1%	$34,927,702	1.4%
Riverton (B)	989	$1,096,729,598	1	0.1%	$394,654	<0.1%

Jurisdiction	Total Number of Buildings	Total RCV	Estimated Building Stock in the Extreme, Very High, or High Wildfire Fuel Risk Hazard Area			
			Building Count		RCV	
			Number	Percent of Total	Value	Percent of Total
Shamong (T)	2,494	$2,504,926,736	59	2.4%	$88,580,000	3.5%
Southampton (T)	5,368	$4,593,018,255	110	2.0%	$120,593,923	2.6%
Springfield (T)	1,826	$2,140,517,320	18	1.0%	$30,851,057	1.4%
Tabernacle (T)	2,938	$2,200,440,237	135	4.6%	$142,700,222	6.5%
Washington (T)	538	$604,084,949	43	8.0%	$71,812,466	11.9%
Westampton (T)	2,795	$4,620,292,645	50	1.8%	$133,583,131	2.9%
Willingboro (T)	10,830	$8,789,434,159	1	<0.1%	$2,629,502	<0.1%
Woodland (T)	782	$1,333,495,830	110	14.1%	$153,193,076	11.5%
Wrightstown (B)	296	$748,872,423	8	2.7%	$3,653,448	0.5%
Burlington County Total	**149,305**	**$167,984,093,756**	**2,140**	**1.4%**	**$4,963,331,009**	**3.0%**

Source: Burlington County, 2023; NJOGIS 2023; Microsoft BING 2022; RS Means 2022; NJFFS 2012

Impact on Critical Facilities

In Burlington County, there are 56 critical facilities and lifelines located in the wildfire hazard area. There are 35 safety and security lifelines located in the wildfire fuel hazard area. Refer to Table 4.3.9-10 which summarizes the number of critical lifelines in the wildlife fuel hazard area.

Table 4.3.9-10. Estimated Number of Lifelines Located in the Wildfire Fuel Hazard Area

FEMA Lifeline Category	Number of Lifelines	Number of Lifelines Located in the Extreme, Very High, or High Wildfire Fuel Risk Hazard Area
Communications	2	0
Energy	31	0
Food, Hydration, Shelter	189	1
Hazardous Materials	207	6
Health and Medical	113	8
Safety and Security	1,101	35
Transportation	53	3
Water Systems	119	3
Burlington County (Total)	**1,813**	**56**

Source: Burlington County, 2023; NOAA 2022

As mentioned previously, 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. Route 206, which runs north to south through the County is located in portions of the wildfire hazard areas that are associated with the Pineland forests. This should be considered for evacuation route purposes since it serves as the major north/south corridor in the interior of the County. No major utilities such as power generation facilities are located in fire hazard areas.

Impact on Economy

Wildfire events can have major economic impacts on a community from the initial loss of structures and the subsequent loss of revenue from destroyed 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.

Table 4.3.9-9 displays the replacement cost value of buildings located in the extreme, very high, or high wildfire fuel risk area. Overall, approximately $5 billion of the County's replacement cost value (3 percent) is located in the extreme, very high, or high wildfire fuel risk area. The Town of Florence has the highest replacement cost value exposed ($975,513,479). Bass River Township has the highest percentage of replacement cost value exposed (23.8 percent).

Closure of major roadways, such as the Garden State Parkway, and cancellation of outdoor events due to nearby fire and smoke can also result in economic impacts.

Impact on Environment

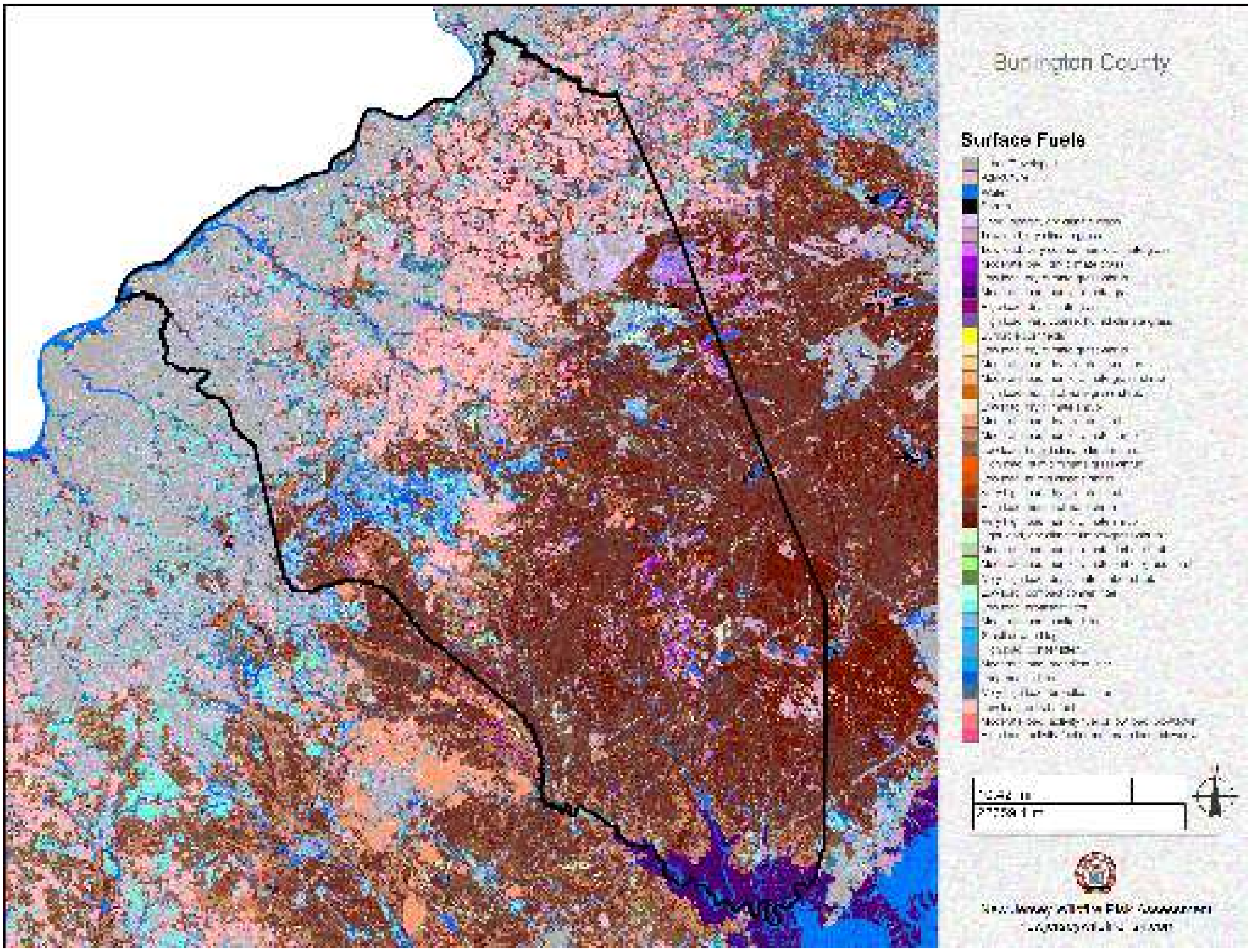
While wildfire is a necessary part of ecosystem health in Burlington County, particularly in the Pinelands areas, intense wildfire that burns too hot can result in severe damage to the environment, including burning and killing of plant and animal life. Intense fire can also heat narrow and shallow waterways, resulting in damage to aquatic systems.

Surface fuels are defined by fire behavior fuel models. A fuel model contains the parameters required by the surface fire spread model to compute surface fire behavior characteristics, including rate of spread, flame length, fire line intensity, and other fire behavior metrics. As the name might suggest, surface fuels account only for surface fire potential and surface fuels are generally defined to be less than six feet in height off the ground. Surface fuels typically are categorized into one of six primary fuel types based on the primary carrier of the surface fire: 1) Grass, 2) Grass/Shrub, 3) Shrub, 4) Timber/Understory, 5) Timber Litter and 6) Slash. These surface fuel models provide the input parameters needed to compute surface fire behavior. Figure 4.3.9-5 and Table 4.3.9-11 visualize the surface fuel in Burlington County (New Jersey Forest Fire Service 2023).

According to the USGS, post-fire runoff polluted with debris and contaminates can be extremely harmful to terrestrial ecosystems and aquatic life (USGS 2023). Studies show that urban fires in particular are more harmful to the environment compared to forest fires (Harvard University 2022). The age and density of infrastructure within Burlington County can exacerbate consequences of fires on the environment because of the increased amount of chemicals and contaminates that would be released from burning infrastructure. These chemicals, such as iron lead, and zinc, may leach into the stormwater, contaminate nearby streams, and impair aquatic life.

Intense wildfire events that destroy existing ecosystems can result in an increase in invasive species that may be able to move into an area with a lack of natural competitors (U.S. Department of the Interior 2012).

Figure 4.3.9-5. Surface Fuels in Burlington County



Source: New Jersey Forest Fire Service 2023

Table 4.3.9-11. Surface Fuels in Burlington County

	Surface Fuel Model	Description	Acres	Percent		Surface Fuel Model	Description	Acres	Percent
	NB1	Urban/Developed	67,070	12.8 %		SH5	High load, humid climate grass-shrub	0	0.0 %
	NB3	Agriculture	53,975	10.3 %		SH6	Low load, humid climate shrub	4,513	0.9 %
	NB8	Water	13,736	2.6 %		SH7	Very high load, dry climate shrub	21	0.0 %
	NB9	Barren	421	0.1 %		SH8	High load, humid climate shrub	155,327	29.6 %
	GR1	Short, sparse, dry climate grass	22,862	4.4 %		SH9	Very high load, humid climate shrub	46,841	8.9 %
	GR2	Low load, dry climate grass	16,224	3.1 %		TU1	Light load, dry climate timber-grass-shrub	7,527	1.4 %
	GR3	Low load, very coarse, humid climate grass	8,993	1.7 %		TU2	Moderate load, humid climate timber-shrub	276	0.1 %
	GR4	Moderate load, dry climate grass	1,741	0.3 %		TU3	Moderate load, humid climate timber-grass-shrub	1,116	0.2 %
	GR5	Low load, dry climate grass-shrub	1,408	0.3 %		TU5	Very high load, dry climate timber-shrub	71	0.0 %
	GR6	Moderate load, humid climate grass	8,491	1.6 %		TL1	Low load, compact conifer litter	413	0.1 %
	GR7	High load, dry climate grass	0	0.0 %		TL2	Low load, broadleaf litter	13,319	2.5 %
	GR8	High load, very coarse, humid climate grass	0	0.0 %		TL3	Moderate load, conifer litter	15,623	3.0 %
	AG9	Burnable cornfields	0	0.0 %		TL4	Small downed logs	0	0.0 %
	GS1	Low load, dry climate grass-shrub	3,284	0.6 %		TL5	High load, conifer litter	3,607	0.7 %
	GS2	Moderate load, dry climate grass-shrub	4,250	0.8 %		TL6	Moderate load, broadleaf litter	5,771	1.1 %
	GS3	Moderate load, humid climate grass-shrub	2	0.0 %		TL8	Long-needle litter	5,713	1.1 %
	GS4	High load, humid climate grass-shrub	0	0.0 %		TL9	Very high load, broadleaf litter	10,308	2.0 %
	SH1	Low load, dry climate shrub	157	0.0 %		SB1	Low load, activity fuel	0	0.0 %
	SH2	Moderate load, dry climate shrub	2,181	0.4 %		SB2	Moderate load, activity fuel or low load, blowdown	0	0.0 %
	SH3	Moderate load, humid climate shrub	29,575	5.6 %		SB3	High load, activity fuel or moderate load, blowdown	0	0.0 %
	SH4	Low load, humid climate timber-shrub	20,077	3.8 %					
							Total	524,893	100.0 %

Source: New Jersey Forest Fire Service 2023

Cascading Impacts on Other Hazards

Following wildfires, cascading hazards such as debris flow, landslides, and flooding may occur due to loss of stabilizing vegetation, resulting in potentially catastrophic sequences. When wildfire hits in drought-stricken areas, watersheds and reservoirs can be further impacted by ash and debris flows, water treatment facilities may shut down with damage or loss of power, crops can be destroyed, and smoke can affect animal and human health (NIDIS 2023).

Flooding after a wildfire is often more severe, as debris and ash left from the fire can form mudflows. During and after a rain event, as water moves across charred and denuded ground, it can also pick up soil and sediment and carry it in a stream of floodwaters. These mudflows have the potential to cause significant damage to impacted areas. Areas directly affected by fires and those located below or downstream of burn areas are most at risk for flooding (FEMA 2020). For detailed information regarding flooding, see Section 4.3.6 (Flood).

As previously mentioned, intense wildfire events that destroy existing ecosystems can result in an increase in invasive species that may be able to move into an area with a lack of natural competitors (U.S. Department of the Interior 2012).

Further Changes that May Impact Vulnerability

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

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

Projected Development

As discussed and illustrated in Section 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.

Projected Changes in Population

According to the U.S. Census Bureau, the County's population increased by approximately 3 percent between 2010 and 2020 (U.S. Census Bureau 2020). 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, Burlington County is projected to have a population of 460,400 by 2024, 464,900 by 2029, and 472,700 by 2034 (State of New Jersey 2017). Any changes in the density of population can 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.

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 conductive 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 (USFS 2011).

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.

Change of Vulnerability Since 2019 HMP

The 2024 HMP has been updated to reflect the 2020 Decennial Census and the 2021 ACS 5-year estimates for population changes. The building stock inventory was updated using data from Burlington County. Further, the building stock inventory replacement cost values were updated using RS Means 2022 values providing an overall update to the assets assessed in this risk assessment. The New Jersey Forest Fire Service data has not been updated since the last HMP; therefore, changes and any increases in overall wildfire hazard exposure are attributed to increases in population and new development.

4.4 HAZARD RANKING

A comprehensive range of hazards that pose a significant risk to Burlington County were selected and considered during the development of this plan. Each community has differing levels of exposure and vulnerability to each of these hazards. It is important for each community participating in this plan to recognize the hazards that pose the greatest risk to their community and direct their attention and resources accordingly to most effectively and efficiently manage risk and reduce losses. To this end, a hazard risk ranking process was conducted using the method described below.

4.4.1 Hazard Ranking Methodology

Estimates of hazard risk for Burlington County were developed using methodologies promoted by FEMA's hazard mitigation planning guidance, results from FEMA's Hazus risk assessment tool, and input from Burlington County and participating jurisdictions. The ranking method includes four risk assessment categories—probability of occurrence, impact (population, property, and economy), adaptive capacity, and changing future conditions (i.e., climate change). Each was assigned a weighting factor to calculate an overall ranking value for each hazard of concern. Depending on the calculation, each hazard was assigned a high, medium, or low ranking. Details regarding each of these categories is described below.

As described in Section 4.1 (Methodology and Tools), three levels of analysis were used to estimate potential impacts: 1) historic loss/qualitative analysis; 2) exposure analysis; and 3) loss estimation. All three levels of analysis are suitable for planning purposes; however, with any risk analysis, there is underlying uncertainty resulting from assumptions used to describe and assess vulnerability and the methodologies available to model impacts.

The hazard ranking methodology for some hazards of concern is based on a scenario event with mapping of hazard areas, while the methodology for others is based on their potential risk to the Planning Area as a whole. In order to account for these differences, the quantitative hazard ranking methodology was adjusted using professional judgement. Although the scenarios do not all have the same likelihood of occurrence, there is value in summarizing and comparing the hazards using a standardized approach to evaluate relative risk.

The following categories were considered when evaluating the relative risk of the hazards of concern:

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

- Population—Numeric value x 3
- Buildings—Numeric value x 2
- Economy—Numeric value x 1

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

Weighting factors were assigned to each of the categories above to represent its relative importance:

- Probability of occurrence: Weighting factor = 0.3 (30 percent)
- Impacts: Weighting factor = 0.3 (30 percent)
- Adaptive capacity: Weighting factor = 0.3 (30 percent)
- Climate change: Weighting factor = 0.1 (10 percent)

Based on the category scores and weights as described above, the risk ranking for each hazard is calculated as follows:

Risk Ranking Equation

[Probability of Occurrence x 0.3] + [(Impact on Population x 3) + (Impact on Property x 2) + (Impact on Economy x 1) x 0.3] + [Adaptive Capacity x 0.3] + [Climate Change x 0.1]

Table 4.4-1 summarizes the categories, benchmark values, and weights used to calculate the risk factor for each hazard. Using the weighting applied, the highest possible risk factor value is 6.9. The higher the number, the greater the relative risk. Based on the total for each hazard, a priority ranking is assigned to each hazard of concern (high, medium, or low). The rankings were categorized as follows: Low = Values less than 3.9; Medium = Values between 3.9 and 4.9; High = Values greater than 4.9.

4.4.2 Hazard Ranking Results

Using the process described above, the ranking for the identified hazards of concern was determined for the entire County as shown in Table 4.4-2 and Table 4.4-3. The County and the participating jurisdictions all applied the same methodology to develop risk rankings to ensure consistency in the overall ranking of risk However, the ranking for the entire planning area may not reflect the highest risk for any of the participating jurisdictions. The ranks for each municipality indicate the differing degrees of risk exposure and vulnerability. Jurisdictions had the ability to alter rankings based on local knowledge and experience in handling each hazard. Hazard rankings for individual planning partners are in the jurisdictional annexes in Volume II of this plan. The results support the appropriate selection and prioritization of initiatives to reduce the highest levels of risk for each municipality.

4.4.3 Confidence Level

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

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

Table 4.4-1. Summary of Hazard Ranking Approach

Category		Level / Category	Degree of Risk / Benchmark Value	Numeric Value	Weighted Value
Probability of Occurrence		Unlikely	A hazard event is not likely to occur or has less than a 1% annual chance probability.	0	30%
		Rare	Between 1 and 10% annual probability of a hazard event occurring.	1	
		Occasional	Between 10 and 100% annual probability of a hazard event occurring.	2	
		Frequent	100% annual probability; a hazard event may occur multiple times per year.	3	
Impact (Sum of all 3)	Population (Numeric Value x 3)	Low	14% or less of the population is exposed to a hazard with potential for measurable life safety impact, due to its extent and location.	1	30%
		Medium	15% to 29% of the population is exposed to a hazard with potential for measurable life safety impact, due to its extent and location.	2	
		High	30% or more of the population is exposed to a hazard with potential for measurable life safety impact, due to its extent and location.	3	
	Property (Numeric Value x 2)	Low	Property exposure is 14% or less of the total number of structures for the community.	1	
		Medium	Property exposure is 15% to 29% of the total number of structures for the community.	2	
		High	Property exposure is 30% or more of the total number of structures for the community.	3	
	Economy (Numeric Value x 1)	Low	Loss estimate is 9% or less of the total replacement cost for the community.	1	
		Medium	Loss estimate is 10% to 19% of the total replacement cost for the community.	2	
		High	Loss estimate is 20% or more of the total replacement cost for the community.	3	
Adaptive Capacity		Weak	Weak/outdated/inconsistent plans, policies, codes/ordinances in place; no redundancies; limited to no deployable resources; limited capabilities to respond; long recovery.	1	30%
		Moderate	Plans, policies, codes/ordinances in place, meeting minimum requirements; mitigation strategies identified but not implemented on a widespread scale; jurisdiction can recover but needs outside resources; moderate jurisdiction capabilities.	0	
		Strong	Plans, policies, codes/ordinances in place that exceed minimum requirements; mitigation/protective measures in place; jurisdiction has ability to recover quickly because resources are readily available, and capabilities are high.	-1	
Climate Change		Low	No local data is available; modeling projections are uncertain on whether there is increased future risk; confidence level is low (inconclusive evidence).	1	10%
		Medium	Studies and modeling projections indicate a potential for exacerbated conditions due to climate change; confidence level is medium to high (suggestive to moderate evidence).	2	
		High	Studies and modeling projections indicate exacerbated conditions/increased future risk due to climate change; very high confidence level (strong evidence, well documented and acceptable methods).	3	

Note: A numerical value of zero is assigned if there is no impact.

**For the purposes of this exercise, "impacted" means exposed for population and property and estimated loss for economy. For non-natural hazards, although they may occur anywhere in the Planning Area, an event will not likely cause countywide impacts; therefore, impact to population was scored using an event-specific scenario.*

Table 4.4-2. Ranking for Hazards of Concern for Burlington County

Hazard of Concern	Probability		Impact										Adaptive Capacity	Climate Change
			Population			Property			Economy			Total Impact Value		
	Category	Numeric Value	Impact	Numeric Value	Weighted Value (x3)	Impact	Numeric Value	Weighted Value (x2)	Impact	Numeric Value	Weighted Value (x1)			
Dam/Levee Failure	Rare	1	High	3	3 x 3 = 9	Low	1	1 x 2 = 2	Medium	2	2 x 1 = 2	13	Moderate	High
Disease Outbreak	Occasional	2	High	3	3 x 3 = 9	Low	1	1 x 2 = 2	Medium	2	2 x 1 = 2	13	Strong	Low
Drought	Rare	1	Medium	2	2 x 3 = 6	Low	1	1 x 2 = 2	Medium	2	2 x 1 = 2	10	Moderate	High
Earthquake	Unlikely	0	Low	1	1 x 3 = 3	Low	1	1 x 2 = 2	Low	1	1 x 1 = 1	6	Moderate	Low
Extreme Temperature	Frequent	3	High	3	3 x 3 = 9	Low	1	1 x 2 = 2	Low	1	1 x 1 = 1	12	Strong	High
Flood	Frequent	3	Low	1	1 x 3 = 3	Low	1	1 x 2 = 2	Low	1	1 x 1 = 1	6	Moderate	High
Severe Weather	Frequent	3	High	3	3 x 3 = 9	Low	1	1 x 2 = 2	Low	1	1 x 1 = 1	12	Moderate	High
Severe Winter Weather	Frequent	3	High	3	3 x 3 = 9	Low	1	1 x 2 = 2	Low	1	1 x 1 = 1	12	Strong	Medium
Wildfire	Occasional	2	Medium	2	2 x 3 = 6	Medium	2	2 x 2 = 4	Low	1	1 x 1 = 1	11	Moderate	High

Table 4.4-3. Total Hazard Ranking Values for the Hazards of Concern for Burlington County

Hazard of Concern	Probability x 30%	Total Impact x 30%	Adaptive Capacity x 30%	Changing Future Conditions x 10%	Total Hazard Ranking Value
Dam/Levee Failure	0.3	3.9	0	0.3	4.5
Disease Outbreak	0.6	3.9	-0.3	0.1	4.3
Drought	0.3	3.0	0	0.3	3.6
Earthquake	0.0	1.8	0	0.1	1.9
Extreme Temperature	0.9	3.6	-0.3	0.3	4.5
Flood	0.9	1.8	0	0.3	3.0
Severe Weather	0.9	3.6	0	0.3	4.8
Severe Winter Weather	0.9	3.6	-0.3	0.2	4.4
Wildfire	0.6	3.3	0	0.3	4.2

SECTION 5. CAPABILITY ASSESSMENT

2024 HMP Changes

- In the 2019 HMP, the capability assessment section was presented as part of the mitigation strategy. For the 2024 HMP update, the capability assessment has been expanded and presented as a stand-alone section, with capabilities expanded in each jurisdictional annex as well (Volume II).

According to FEMA, a capability assessment is an inventory of a community's missions, programs, and policies and an analysis of its capacity to carry them out. Each jurisdiction has a unique set of capabilities available to accomplish mitigation and reduce long-term vulnerability to future hazard events. Capabilities include authorities, policies, programs, staff, and funding. Reviewing existing capabilities helps identify how a community currently implements mitigation to reduce losses or has the potential to implement mitigation in the future.

This assessment includes identification, review, and analysis of current federal, state, and local programs, policies, regulations, funding, and practices that could either facilitate or hinder mitigation.

During the original planning process, the county and all jurisdictions assessed their capabilities in the areas of planning and regulatory, administrative, and technical, and fiscal to determine the following:

- Limitations on undertaking actions
- Local and state resources available to assist in implementing mitigation actions
- Mitigation actions that are not feasible because they are currently outside the scope of capabilities
- Mitigation actions that could be challenging or infeasible due to technical, legal (regulatory), administrative, political, or fiscal limitations
- Opportunities to enhance local capabilities to support long term mitigation and risk reduction

During the 2024 plan update process, all participating jurisdictions were tasked with developing or updating their capability assessment, paying particular attention to evaluating the effectiveness of their capabilities in supporting hazard mitigation and identifying opportunities to enhance local capabilities to integrate hazard mitigation into their plans, programs, and day-to-day operations. The contracted consultant met virtually with Burlington County and each municipality to review the capability assessment from the 2019 HMP and update accordingly. In addition, the consultant reviewed plans, codes, and ordinances to enhance the information provided by the jurisdictions.

This section describes federal, state, and County capabilities available to support mitigation in Burlington County, as well as general types of municipal capabilities. Further specific information on County and municipal capabilities is presented in the jurisdictional annexes in Volume II.

5.1 PLANNING AND REGULATORY CAPABILITY

Planning and regulatory capabilities are based on the implementation of ordinances, policies, local laws and state statutes, as well as plans and programs that relate to guiding and managing growth and development. Planning and regulatory capabilities refer not only to the current plans and regulations, but also to a jurisdiction's ability to change and improve those plans and regulations as needed. The following sections provide a review of planning and regulatory capabilities available within Burlington County.

5.1.1 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 Burlington County.

National Flood Insurance Program

The National Flood Insurance Program (NFIP) is a federal program that was established to allow property owners in participating communities to purchase insurance against losses from flooding. 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). As of October 2023, there are 2,543 flood insurance policies in force within Burlington County (National Flood Insurance Program 2023).

Risk Rating 2.0: Equity in Action

Since the 2019 HMP, FEMA introduced "Risk Rating 2.0: Equity in Action" to provide more modern, individualized, and equitable flood insurance rates by considering specific characteristics of each insured building. The new rating methodology considers frequency of flooding, multiple flood types, proximity to flood sources, and building characteristics such as first floor heights and costs to rebuilt. 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.

Across the country, officials are finding it to be increasingly difficult to communicate the benefits of mitigation to some property owners where insurance rates are likely to stay high even after mitigation due to factors such as proximity to flood sources and frequency of flooding. Continued shifts in flood insurance costs and, coverage, impacts of mitigation for flood prone properties, and potential updates to Risk Rating 2.0 will be monitored by Burlington County throughout the period of performance of the 2024 HMP.

Community Rating System

The Community Rating System (CRS) is a voluntary program within the NFIP that encourages floodplain management activities that exceed the minimum NFIP requirements. 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 2023, two municipalities in Burlington County participate in the CRS program as Class 7 communities: the Borough of Palmyra and the City of Burlington (FEMA 2023).

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).

Summary

Table 5-1 summarizes the planning and regulatory capabilities available to Burlington County at the federal level.

Table 5-1. Federal Planning and Regulatory Capabilities in Burlington County

<table>
<tr><th>Agency, Program, or Regulation</th><th colspan="2">Details</th></tr>
<tr><td rowspan="2">Disaster Mitigation Act of 2000 (DMA 2000) Public Law 106-390</td><td>Responsible Agency:</td><td>FEMA</td></tr>
<tr><td>Hazard:</td><td>All natural hazards</td></tr>
<tr><td colspan="3">The DMA is the current federal legislation addressing hazard mitigation planning. DMA 2000 provides an opportunity for states, tribes, and local governments to take a new and revitalized approach to mitigation planning. DMA 2000 amended the Robert T. Stafford Disaster Relief and Emergency Assistance Act (the Act) by repealing the previous mitigation planning provisions (Section 409) and replacing them with a new set of mitigation plan requirements (Section 322). This new section emphasizes the need for state, tribal, and local entities to closely coordinate mitigation planning and implementation efforts. It emphasizes planning for disasters before they occur. It specifically addresses planning at the local level, requiring plans to be in place before Hazard Mitigation Assistance grant funds are available to communities. HMPs designed to meet the requirements of DMA will remain eligible for future FEMA Hazard Mitigation Assistance funds. This plan is designed to meet the requirements of DMA, improving eligibility for future hazard mitigation funds.

The 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. The NJOEM Mitigation Unit is the lead agency within New Jersey to promote mitigation planning.</td></tr>
<tr><td rowspan="2">Code of Federal Regulations, Local Mitigation Plans (44 CFR PART 201.6)</td><td>Responsible Agency</td><td>FEMA</td></tr>
<tr><td>Hazard</td><td>All natural hazards</td></tr>
<tr><td colspan="3">FEMA has prepared policies and procedures for FEMA's review and approval of state and local hazard mitigation plans.

The local 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 will also serve as the basis for the State to provide technical assistance and to prioritize project funding.</td></tr>
<tr><td rowspan="2">Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act)</td><td>Responsible Agency</td><td>FEMA</td></tr>
<tr><td>Hazard</td><td>All natural hazards</td></tr>
</table>

TETRA TECH

Agency, Program, or Regulation	Details	
The Stafford Act provides an orderly and continuing means of assistance by the federal government to state and local governments in carrying out their responsibilities to alleviate the suffering and damage that results from disasters. The provisions of the Act include (1) revising and broadening the scope of existing disaster relief programs; (2) encouraging the development of comprehensive disaster preparedness and assistance plans, programs, capabilities, and organizations by state and local governments; (3) achieving greater coordination and responsiveness of disaster preparedness and relief programs; (4) encouraging individuals, and state and local governments to protect themselves by obtaining insurance coverage to supplement or replace governmental assistance; (5) encouraging hazard mitigation measures to reduce losses from disasters, including development of land-use and construction regulations; and (6) providing federal assistance programs for both public and private losses sustained in disasters. The NJOEM Mitigation Unit is the lead agency that reviews, submits, and administers federal funding to programs that mitigate hazards in New Jersey. These programs help fund projects that are cost beneficial to help reduce damage from hazards.		
Disaster Recovery Reform Act	**Responsible Agency:**	FEMA
	Hazard:	All natural hazards
This bill amends the Stafford Act to modify the Pre-disaster Hazard Mitigation Grant Program to permit the use of technical and financial assistance to establish and carry out enforcement activities to implement codes, specifications, and standards that incorporate the latest hazard-resistant designs; direct the President to establish a National Public Infrastructure Pre-disaster Mitigation Fund; authorize the President's contribution to the cost of hazard mitigation measures to be used to increase resilience in any area affected by a major disaster; and direct FEMA to issue a final rulemaking that defines the terms "resilient" and "resiliency." The NJOEM Mitigation Unit is the lead agency that reviews, submits, and administers federal funding to programs that mitigate hazards in New Jersey. These programs help fund projects that are cost beneficial to help reduce damage from hazards.		
Presidential Policy Directive 8 (PPD-8)	**Responsible Agency:**	Department of Homeland Security and New Jersey Office of Homeland Security and Preparedness
	Hazard:	All hazards
PPD-8 requires that a Threat Hazard Identification and Risk Assessment (THIRA) be developed for a state to remain eligible for Homeland Security Grant Program (HSGP) and Emergency Management Program Grant (EMPG) funding. The New Jersey Office of Homeland Security and Preparedness is the lead agency in preparing the state's THIRA.		
National Flood Insurance Program (NFIP)	**Responsible Agency:**	FEMA
	Hazard	Flood
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. Full compliance and good standing under the NFIP are application prerequisites for all FEMA grant programs for which participating jurisdictions are eligible under this plan.		
Bunning-Bereuter-Blumenauer Flood Insurance Reform Act of 2004	**Responsible Agency**	FEMA. NJDEP and NJOEM at state level.
	Hazard	Flood
The Flood Insurance Reform Act of 2004 amended the 1994 National Flood Insurance Reform Act of 1968 to reduce losses to properties for which repetitive flood insurance claim payments have been made. This Act established a program for mitigation of severe repetitive loss properties and gave FEMA the authority to fund mitigation activities for individual repetitive loss claims properties. The Act provides additional coverage for compliance with land-use and control measures. The 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 states and communities to mitigate severe repetitive loss properties.		

Agency, Program, or Regulation	Details	
Biggert Waters National Flood Insurance Reform Act of 2012	**Responsible Agency:**	FEMA
	Hazard:	Flood
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 may translate into significant future flood insurance savings.		
Homeowner's Flood Insurance Affordability Act	**Responsible Agency:**	FEMA
	Hazard:	Flood
This 2014 law repeals and modifies certain provisions of the Biggert-Waters Flood Insurance Reform Act, which was enacted in 2012, and makes additional program changes to other aspects of the program not covered by that Act. The new law lowers the recent rate increases on some policies, prevents some future rate increases, and implements a surcharge on all policyholders. The Act also repeals certain rate increases that have already gone into effect and provides for refunds to those policyholders. The Act also authorizes additional resources for the National Academy of Sciences to complete the affordability study. FEMA, Congress, private insurance companies, and other stakeholders work together to implement these Congressionally mandated reforms and to work toward shared goals of helping families maintain affordable flood insurance, ensuring the financial stability of the NFIP, and reducing the risks and consequences of flooding nationwide.		
NFIP Community Rating System (CRS)	**Responsible Agency:**	FEMA
	Hazard:	Flood
As an additional component of the NFIP, 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. Municipalities could expect significant cost savings on premiums if enrolled in the CRS program. CRS premium discounts on flood insurance range from 5 percent for Class 9 communities up to 45 percent for Class 1 communities. As of April 2023, 2 communities in Burlington County participate in the CRS program. • Borough of Palmyra, Class 7 • City of Burlington, Class 7		
U.S. Army Corps of Engineers – Dam Safety Program	**Responsible Agency:**	USACE
	Hazard:	Dam Failure
The U.S. Army Corps of Engineers (USACE) is responsible for safety inspections of federal and non-federal dams in the United States that meet the size and storage limitations specified in the National Dam Safety Act. USACE has inventoried dams and has surveyed each state and federal agency's capabilities, practices, and regulations regarding design, construction, operation, and maintenance of the dams. USACE has also developed guidelines for inspection and evaluation of dam safety (USACE 1997).		
Emergency Support Function (ESF) #14, Long-Term Recovery Planning	**Responsible Agency:**	FEMA
	Hazard:	All hazards

TETRA TECH

Agency, Program, or Regulation		Details
Long-Term Community Recovery provides a mechanism for coordinating federal support to state, tribal, regional, and local governments, nongovernmental organizations, and the private sector to enable community recovery from the long-term consequences of extraordinary disasters. ESF #14 accomplishes this by identifying and facilitating availability and use of sources of recovery funding and providing technical assistance (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 an 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	**Responsible Agency:**	Federal Highway Administration
	Hazard:	All hazards
This study was part of a series of research projects funded by FHWA with a goal of mainstreaming the consideration of climate vulnerability and risk in transportation decision making. The study was intended to inform the collective understanding of how to integrate climate resilience at multiple levels: in planning, during project development, and as part of operations and maintenance strategies, including asset management and emergency management.		

5.1.2 State

Table 5-2 summarizes the planning and regulatory capabilities available to Burlington County at the state level.

Table 5-2. State Planning and Regulatory Capabilities in Burlington County

Capability		Details
Municipal Land Use Law	**Responsible Agency:**	State of New Jersey
	Hazard	All hazards
The State of New Jersey Municipal Land Use Law, MLUL (L.1975, c. 291, s. 1, effective August 1, 1976) is the legislative foundation for the land use process in the State of 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. In 2017 the MLUL was amended to add a new subparagraph (f) to NJSA (New Jersey Statutes Annotated) 40-55D-28.b.(2), which requires 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 on February 4, 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 shall 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. The MLUL requires that each municipality prepare a comprehensive plan and update that plan every 10 years.		

<table>
<tr><th>Capability</th><th colspan="2">Details</th></tr>
<tr><td rowspan="2">New Jersey Soil Erosion and Sediment Control Act (NJSA 4:24</td><td>Responsible Agency:</td><td>Soil Conservation Districts</td></tr>
<tr><td>Hazard:</td><td>Flood</td></tr>
<tr><td colspan="3">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.</td></tr>
<tr><td rowspan="2">Uniform Construction Code (UCC)</td><td>Responsible Agency:</td><td>New Jersey Department of Community Affairs</td></tr>
<tr><td>Hazard:</td><td>All hazards</td></tr>
<tr><td colspan="3">Building codes mandate best practices and technology, largely designed to reduce or prevent damage when structures are under stress. The UCC adopts up-to-date building codes as its Building Subcode and One- and Two-Family Subcode. These Subcodes contain requirements that address construction in both A and V flood zones. Also, all new construction is required to comply with the UCC for flood zone construction.

New Jersey has enacted legislation directing the Department of Community Affairs to adopt a radon hazard code or revise the state building code to establish "adequate and appropriate standards to ensure that schools and residential buildings within tier one areas [as defined by the state]… are constructed in a manner that minimizes radon gas and radon progeny entry and facilitates any subsequent remediation that might prove necessary." See N.J. Stat. Ann. 52:27D-123a.

The Department adopted a radon hazard sub-code that does not reference existing model standards or guidance but 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.

All of incorporated New Jersey has adopted standardized building codes (IBC 2021 New Jersey edition (as of 2022)).</td></tr>
<tr><td rowspan="2">Growth Management Policy</td><td>Responsible Agency:</td><td>State Planning Commission</td></tr>
<tr><td>Hazard:</td><td>All Hazards</td></tr>
<tr><td colspan="3">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 New Jersey State Development and Redevelopment Plan (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.

The State Planning Act has enhanced the traditionally limited role of county land-use planning and control. The Act also provides tools for municipalities when preparing their master land use plans and better opportunity for a comprehensive approach to planning so not to harm or be in conflict with neighboring municipalities' plans.

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.</td></tr>
</table>

<table>
<tr><th>Capability</th><th colspan="2">Details</th></tr>
<tr><td rowspan="2">Flood Hazard Area Control Act (NJSA 58:16A-52) Flood Hazard Area Control Regulation (N.J.A.C. 7:13)</td><td>Responsible Agency:</td><td>NJDEP</td></tr>
<tr><td>Hazard:</td><td>Flood</td></tr>
<tr><td colspan="3">New Jersey enacted this law to delineate and mark flood hazard areas; authorize NJDEP to adopt land-use regulations for the flood hazard area; control stream encroachments; coordinate effectively the development, dissemination, and use of information on floods and flood damage that may be available; authorize the delegation of certain administrative and enforcement functions to county governing bodies; and integrate the flood control activities of the municipal, county, state, and federal governments. The intent of the regulations is to minimize potential on- and off-site damage to public or private property caused by development that, at times of flood, subject structures to flooding and increase flood heights and/or velocities both upstream and downstream. These rules are intended to safeguard the public from the dangers and damage caused by materials being swept onto nearby or downstream lands, to protect and enhance the public’s health and welfare by minimizing the degradation of water quality from point and non-point pollution sources, and to protect wildlife and fisheries by preserving and enhancing water quality and the environment associated with the floodplain and the watercourses that create them.</td></tr>
<tr><td rowspan="2">Inland Flood Protection Rule</td><td>Responsible Agency:</td><td>NJDEP</td></tr>
<tr><td>Hazard:</td><td>Flood</td></tr>
<tr><td colspan="3">The Inland Flood Protection Rule became effective July 17, 2023. The Rule 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.
• A new design flood elevation (DFE) raises fluvial (non-tidal) flood elevation mapped by NJDEP by 2 feet.
• The Rule requires use of future projected precipitation when calculating flood elevations.
• The Rule ensures that NJDEP’s Flood Hazard Area permits conform to New Jersey Uniform Construction Code standards and meet or exceed minimum FEMA National Flood Insurance Program requirements.
• The Rule requires stormwater best management practices to be designed to manage runoff for both today’s storms and future storms.
• The Rule removes use of rational and modified rational methods for stormwater calculations (NJDEP 2023).</td></tr>
<tr><td rowspan="2">Wetlands Act of 1970 (NJSA 13:9A – 1 to 10) Coastal Zone Management Rules Program (N.J.A.C.7:7E)

Coastal Zone Management Adopted Amendment (N.J.A.C. 7:7-16.9)</td><td>Responsible Agency:</td><td>NJDEP</td></tr>
<tr><td>Hazard:</td><td>Flood, Severe Weather</td></tr>
<tr><td colspan="3">In 1970, the New Jersey Legislature declared that one of the most vital and productive areas of the state’s natural world is the area between the sea and the land known as the “estuarine zone.” This area protects the land from the force of the sea, moderates the weather, provides a home for waterfowl, fish, and shellfish, and assists in absorbing sewage discharge by the rivers of the land. It is necessary to preserve the ecological balance of this area and prevent its further deterioration and destruction by regulating dredging, filling, removing, or otherwise altering or polluting these areas.</td></tr>
<tr><td rowspan="2">Coastal Zone Management Rules Program (N.J.A.C.7:7E)

Coastal Zone Management Adopted Amendment (N.J.A.C. 7:7-16.9)</td><td>Responsible Agency:</td><td>National Oceanic and Atmospheric Administration, NJDEP</td></tr>
<tr><td>Hazard:</td><td>Flood, Severe Weather</td></tr>
<tr><td colspan="3">Coastal Zone Management (CZM) rules mandate the use and development of coastal resources, to be used primarily by the Land Use Regulation Program in the Department in reviewing permit applications under the Coastal Area Facility Review Act (CAFRA), NJSA 13:19-1 et seq. (as amended to July 19, 1993); Wetlands Act of 1970, NJSA 13:9A-1 et seq.; Waterfront Development Law, NJSA 12:5-3; Water Quality Certification (401 of the Federal Clean Water Act); and Federal Consistency Determinations (307 of the Federal Coastal Zone Management Act). The rules also provide a basis for recommendations by the Program to the Tidelands Resource Council on applications for riparian grants, leases, and licenses. The most recent amendment, effective as of September 18, 2017, creates rules that update several provisions in the Department’s requirements to provide public access to tidal waterways and their shores.</td></tr>
</table>

<table>
<tr><th>Capability</th><th colspan="2">Details</th></tr>
<tr><td rowspan="2">Freshwater Wetland Protection Act (NJSA 13: B:1) Freshwater Wetland Protection Rules (N.J.A.C. 7:7A)</td><td>Responsible Agency:</td><td>NJDEP</td></tr>
<tr><td>Hazard:</td><td>Flood</td></tr>
<tr><td colspan="3">New Jersey enacted this law to support development and enhancement of state and local wetland protection programs. Projects must 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 support the New Jersey freshwater wetlands program. The Freshwater Wetlands Protection Act was last amended in 2016 and the Freshwater Wetland Protection Rules were last amended April 16, 2018.</td></tr>
<tr><td rowspan="2">Waterfront Development Statute (NJSA 12:5-1) Coastal Permit Program (N.J.A.C. 7:7)</td><td>Responsible Agency:</td><td>NJDEP</td></tr>
<tr><td>Hazard:</td><td>Flood, Severe Weather</td></tr>
<tr><td colspan="3">This law sets forth the requirements of filling or dredging of, or placement or construction of structures, pilings, or other obstructions in any tidal waterway or in certain upland areas adjacent to tidal waterways outside the area regulated under Coastal Area Facility Review Act. These requirements are fully explained in N.J.A.C.7:7-2.3. The implementing rules establish the procedures by which the NJDEP will review permit applications and appeals from permit decisions under the Waterfront Development Law.</td></tr>
<tr><td rowspan="2">Coastal Area Facility Review Act (CAFRA) (NJSA 13:19)</td><td>Responsible Agency:</td><td>NJDEP</td></tr>
<tr><td>Hazard:</td><td>Flood, Severe Weather</td></tr>
<tr><td colspan="3">CAFRA applies to projects near coastal waters in the southern part of the state. The law divides the CAFRA area into sections or zones and regulates different types of development in each zone. Generally, the closer it is to the water, the more likely a development will be regulated. The CAFRA law regulates almost all activities involved in residential, commercial, or industrial development, including construction, relocation, and enlargement of buildings or structures and all related work, such as excavation, grading, shore protection structures, and site preparation. This law is implemented through New Jersey's CZM Rules N.J.A.C. 7:7E-1.1 et seq.

Permits issued require construction in accordance with the NFIP requirements in A and V zones. Effective July 1994, the CAFRA jurisdiction was expanded to include every single-family residential development within 150 feet of the mean high-water line, beach, or dune. The threshold for regulation over commercial development was lowered to capture smaller commercial developments, and NJDEP gained authority over any disturbance to a beach or dune area or the placement of a structure in these areas. Effective November 5, 2007, the CZM rules incorporate the more stringent Flood Hazard Area Control Act standards, including protection of riparian buffers along tidal water courses that can be 50, 150, and 300 feet along environmentally sensitive (Category-1) waterways.

In Burlington County, Bass River Township is the only municipality subject to CAFRA.</td></tr>
<tr><td rowspan="2">Safe Dam Act of 1981 N.J.A.C.7:24A</td><td>Responsible Agency</td><td>NJDEP</td></tr>
<tr><td>Hazard:</td><td>Flood, Dam Failure</td></tr>
<tr><td colspan="3">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 this state or between this state 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.</td></tr>
<tr><td rowspan="2">Pinelands Protection Act (NJSA 13: 18A-30 to 49)</td><td>Responsible Agency:</td><td>Pinelands Commission</td></tr>
<tr><td>Hazard:</td><td>Flood, Wildfire</td></tr>
<tr><td colspan="3">In 1979 the New Jersey Legislature declared the protection of the New Jersey Pinelands and established a regional planning and management commission empowered to prepare and oversee the implementation of a comprehensive management plan for the pinelands area.

Management programs and minimum standards have been established under the Pinelands Comprehensive Management Plan that are intended to provide protection of wetlands, vegetation, fish and wildlife, water quality management, and forest fire management. Flood and wildfire mitigation is a secondary benefit of the development constraints placed on environmentally sensitive areas.</td></tr>
</table>

<table>
<tr><th>Capability</th><th colspan="2">Details</th></tr>
<tr><td rowspan="2">Pinelands Comprehensive Management Plan (N.J.A.C.7:50)</td><td>Responsible Agency:</td><td>Pinelands Commission</td></tr>
<tr><td>Hazard:</td><td>Flood, Wildfire</td></tr>
<tr><td colspan="3">The Pinelands Comprehensive Management Plan implements the regulations and standards designed to promote orderly development of the Pinelands to preserve and protect the significant and unique natural, ecological, agricultural, archaeological, historical, scenic, cultural, and recreational resources of the Pinelands. The Pinelands Commission bears the ultimate responsibility for implementing and enforcing the provisions of the Pinelands Protection Act and this Plan.

Under the Pinelands Comprehensive Management Plan, management programs and minimum standards have been established to provide for the protection of wetlands, vegetation, fish and wildlife, water quality management, and forest fire management. Flood and wildfire mitigation is a secondary benefit of the development constraints placed on environmentally sensitive areas.</td></tr>
<tr><td rowspan="2">Tidelands Act (NJSA 12:3)</td><td>Responsible Agency:</td><td>Tidelands Resource Council</td></tr>
<tr><td>Hazard:</td><td>Flood, Severe Weather</td></tr>
<tr><td colspan="3">Tidelands, also known as “riparian lands,” are lands now or formerly flowed by the tide of a natural waterway. This includes lands that were previously flowed by the tide but have been filled and are no longer flowed by the tide. These lands are owned by the people of the State of New Jersey. Individuals must first 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.

The management of tidelands in New Jersey is overseen by the Tidelands Resource Council, a board of 12 Governor-appointed volunteers, along with NJDEP staff at the Bureau of Tidelands Management. Grants, licenses, and leases are issued by the Tidelands Resource Council, which makes all ultimate decisions with regard to tidelands.</td></tr>
<tr><td rowspan="2">State Planning Act (NJSA § 52:18A-196 et seq)</td><td>Responsible Agency:</td><td>New Jersey State Planning Commission (SPC)</td></tr>
<tr><td>Hazard:</td><td>All hazards</td></tr>
<tr><td colspan="3">The State Planning Act (1985) created the New Jersey State Planning Commission (SPC) and the Office of State Planning (now the Office for Planning Advocacy) as staff to the SPC. Duties of the SPC are 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; and to review any bill introduced in either house of the Legislature which appropriates funds for a capital project.</td></tr>
<tr><td rowspan="2">Stormwater Management Rules (N.J.A.C.7:8)</td><td>Responsible Agency:</td><td>NJDEP</td></tr>
<tr><td>Hazard:</td><td>Flood</td></tr>
<tr><td colspan="3">These rules set forth the required components of regional and municipal stormwater management plans and establish the stormwater management design and performance standards for new proposed development. The design and performance standards for new development include groundwater recharge, runoff quantity controls, runoff quality controls, and buffers around Category 1 waters.

New Jersey’s Stormwater Management rules are implemented by NJDEP through the review of permits issued by the Division of Land Use Regulation (Flood Hazard, Freshwater Wetlands, CAFRA, Waterfront Development, and Coastal Wetlands). The Stormwater Management rules are also implemented by local authorities through the Municipal Land Use Law (MLUL) and the Residential Site Improvement Standards (RSIS). Per the New Jersey Department of Community Affairs, the RSIS are applicable to any residential application that goes before a local board. Through the RSIS, the stormwater rules are activated whenever a municipality requires the control of runoff from a site that is the subject of a site or subdivision application.</td></tr>
</table>

Capability	Details	
New Jersey Pollutant Discharge Elimination System (NJPDES) Stormwater Regulation Program (NJPDES) Rules (N.J.A.C.7:14A).	**Responsible Agency:**	NJDEP
	Hazard:	Flood
The NJPDES Stormwater Rules are intended to address and reduce pollutants associated with existing stormwater runoff. The NJPDES Rules 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 adoption of ordinances (litter control, pet waste, wildlife feeding, proper waste disposal, etc.); the development of a municipal stormwater management plan and implementing ordinances; requiring certain maintenance activities (such as street sweeping and catch basin cleaning); implementing solids and floatables control; locating discharge points and stenciling catch basins; and a public education component. Guidance for the development of Municipal Mitigation Plans was developed and made available in February 2004. This has been effective in guiding the community for stormwater runoff. The program was developed in response to the EPA Phase II rules published in December 1999. The department issued final stormwater rules on February 2, 2004, 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. There are 462 Tier A municipalities and 100 Tier B municipalities. The general permits address stormwater quality issues related to new development, redevelopment, and existing development by requiring municipalities to implement several Statewide Basic Requirements. All municipalities have a local stormwater coordinator, and the department has case managers assigned to each municipality for compliance assistance (see N.J.A.C. 7:22 below). Long-term water quality trends in rivers and streams indicate dramatic improvement over the past 30 years, likely the result of elimination or minimization of point sources, upgrades of wastewater treatment plants and natural attenuation of pollutants. Municipal stormwater management renewal permits have changed for Tier A and Tier B municipalities, effective as of January 1, 2018. 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.		
Construction Permits (NJSA 13: 1D-29 to 34)	**Responsible Agency:**	NJDEP
	Hazard:	Flood
The law mandates that NJDEP make timely decisions on construction permit applications to ensure adequate public notice of procedures and to continue effective administration of the substantive provisions of other laws. This law ensures that NJDEP issues permits in a timely manner so as not to delay necessary construction projects. Historical records indicate NJDEP's conformance with this law. This does not apply to freshwater wetland rules, only coastal and flood hazard regulations. As part of the effort to recover from the impacts of Superstorm Sandy, this law was amended March 25, 2013, in conjunction with the amendment of R.2013d to the Flood Hazard Area Control Act.		
New Jersey Green Acres Land Acquisition Act of 1961	**Responsible Agency:**	NJDEP
	Hazard:	Flood, Severe Weather
The Legislature enacted the New Jersey Green Acres Land Acquisition Act to achieve, in partnership with others, 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. On November 3, 1998, New Jersey voters approved a referendum that created a stable source of funding for open space, farmland, and historic preservation and recreation development. On June 30, 1999, the Garden State Preservation Trust Act was signed into law. The law establishes, for the first time in history, a stable source of funding for preservation efforts. These rules implement the Green Acres laws, governing the award of loans or matching grants, or both, to local government units for the acquisition or development of land, and 50% matching grants to nonprofits for the acquisition or development of land, for outdoor recreation and conservation purposes. These rules establish project eligibility requirements, application requirements, funding award categories and criteria, matching grant and loan terms, and program administrative requirements. The rules also contain procedures for the disposal, or diversion to a use other than recreation and conservation, of those lands acquired or developed with Green Acres funding or otherwise encumbered with Green Acres restrictions.		

<table>
<tr><th colspan="1">Capability</th><th colspan="2">Details</th></tr>
<tr><td rowspan="2">New Jersey Pinelands

Development Credit Program</td><td>Responsible Agency:</td><td>New Jersey Pinelands Commission</td></tr>
<tr><td>Hazard:</td><td>All hazards</td></tr>
<tr><td colspan="3">The Pinelands Development Credit (PDC) Program is a transfer of development rights program that helps to redirect growth in the Pinelands Area from the preservation and agricultural districts to infrastructure-supported Regional Growth Areas. PDCs are development rights that are allocated to certain lands (“sending areas”) that can be transferred to increase the amount of residential development permitted on other lands (“receiving areas”). Each PDC transfers the right to build four homes and can be bought and sold in 1/4 (or 1 right) increments. Sending areas include the Preservation Area District, Agricultural Production Area, and Special Agricultural Production Area. PDCs may also be allocated to other properties that cannot be developed due to of environmental constraints. Conservation or agricultural easements are placed on the sending properties when the PDCs are transferred (New Jersey Pinelands Commission 2023).</td></tr>
<tr><td rowspan="2">Emergency Building Inspection Act (NJSA 52:27D-126.3)</td><td>Responsible Agency:</td><td>Department of Community Affairs</td></tr>
<tr><td>Hazard:</td><td>All hazards</td></tr>
<tr><td colspan="3">Enacted on January 17, 2007, this Act addresses how building code officials would be compensated if called to support damage assessment outside of their jurisdiction. 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 human-caused disaster or emergency.</td></tr>
<tr><td rowspan="2">New Jersey Civilian Defense and Disaster Control Act</td><td>Responsible Agency:</td><td>New Jersey Office of Emergency Management</td></tr>
<tr><td>Hazard:</td><td>All hazards</td></tr>
<tr><td colspan="3">The purpose of this act is to provide for the health, safety, and welfare of the people of the State of New Jersey and to aid in the prevention of damage to property during any emergency as herein defined by prescribing a course of conduct for the civilian population of the state during such emergency and by centralizing control of all civilian activities having to do with such emergency under the Governor and for that purpose to give to the Governor control over such resources of the state government and of each and every political subdivision thereof as may be necessary to cope with any condition that shall arise out of such emergency and to invest the Governor with all other power convenient or necessary to effectuate such purpose.

Implementation is overseen by the State Department of Defense, Office of Civilian defense director. The director is appointed by the Governor. The Act is implemented through coordination and established lines of communication through the State Office of Emergency Management and county emergency management coordinators.</td></tr>
<tr><td rowspan="2">NJSA 38A:17-1</td><td>Responsible Agency:</td><td>New Jersey Office of Emergency Management</td></tr>
<tr><td>Hazard:</td><td>All hazards</td></tr>
<tr><td colspan="3">The Governor is authorized 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.

The New Jersey Office of Emergency Management (NJOEM) is responsible for the implementation of the Governor’s directive to assist emergency response counterparts in bordering states. NJOEM manages inter-state assistance through delineated lines of communication and standard operating procedures.</td></tr>
</table>

<table>
<tr><th>Capability</th><th colspan="2">Details</th></tr>
<tr><td rowspan="2">Forest Fire Prevention and Control Act (NJSA 13:9-44 to 44.10)</td><td>Responsible Agency:</td><td>New Jersey Forest Fire Service</td></tr>
<tr><td>Hazard:</td><td>Wildfire</td></tr>
<tr><td colspan="3">The Forest Fire Service is responsible for 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; and making regulations for burning brush. The Forest Fire Service has the authority to summon any male person between the ages of 18 and 50, who may be within the jurisdiction of the state, to assist in extinguishing fires. The Fire 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.

The laws that apply are 13:9-2, 9-23, and 9-24. Also, Forest Fire mitigation efforts are not exempted in other environmental regulations. Certain mitigation efforts sometimes occur where there is threatened and endangered habitat, even when that habitat was caused by past prescribed burning operations.</td></tr>
<tr><td rowspan="2">NJSA 52:14E-11 (3-10-2003) The Fire Service Resource Emergency Deployment Act</td><td>Responsible Agency:</td><td>New Jersey Community Affairs, Fire Service Division</td></tr>
<tr><td>Hazard:</td><td>All hazards</td></tr>
<tr><td colspan="3">This Act 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 as well as move assets to a pre-designated location to avoid assets being damaged. This has been used successfully in every disaster since the Act was passed.</td></tr>
<tr><td rowspan="2">Best Management Practices for Creating and Maintaining Wildfire Fuelbreaks in New Jersey's Wildland Urban Interface, 2011</td><td>Responsible Agency:</td><td>New Jersey Forest Fire Service</td></tr>
<tr><td>Hazard:</td><td>Wildfire</td></tr>
<tr><td colspan="3">In New Jersey, residential communities and development continue to spread into new, previously undisturbed natural areas which create a "Wildland Urban Interface" - where rural land and developed areas meet. This fragmented rural landscape has greater ignition sources and more frequent fires, which makes it difficult for the Forest Fire Service to manage land for wildfire protection and preparedness. This problem can be seen throughout New Jersey, especially with the State having such a rapidly growing population. In a study done by the American Planning Association, 46 percent of homes in New Jersey are located in the Wildland Urban Interface, which stresses the importance of the problem in New Jersey.</td></tr>
</table>

<table>
<tr><th>Capability</th><th colspan="2">Details</th></tr>
<tr><td rowspan="2">New Jersey Statewide Water Supply Plan</td><td>Responsible Agency:</td><td>NJDEP</td></tr>
<tr><td>Hazard:</td><td>Drought</td></tr>
<tr><td colspan="3">The Water Supply Management Act of 1981 requires NJDEP to develop and periodically update the New Jersey Statewide Water Supply Plan to guide future water supply management. The Statewide Water Supply Plan addresses the following issues:
• Identify surface and ground water 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:
    o Improvements, new construction, and interconnections
    o Diversions for aquaculture
    o Legislative and administrative actions to protect watershed areas
    o Identification and purchase of land for water supply facilities
    o Administrative actions to protect surface and ground water supplies
The 2023-2028 plan addresses the following issues (NJDEP n.d.):
• Climate change implications for water availability and water supply demands
• Extending the planning period from 2040 to 2050
• 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</td></tr>
<tr><td rowspan="2">New Jersey's Rising Seas and Changing Coastal Storms: Report of the 2019 Science and Technical Advisory Panel</td><td>Responsible Agency:</td><td>Rutgers University, NJDEP</td></tr>
<tr><td>Hazard:</td><td>Flood, Severe Weather, Severe Winter Weather</td></tr>
<tr><td colspan="3">A Science and Technical Advisory Panel was convened by Rutgers University in 2016, culminating in a report that identified planning options for practitioners to enhance the resilience of New Jersey's people, places, and assets to sea-level rise, coastal storms, and the resulting flood risk. The same team at Rutgers University was engaged by the NJDEP to update the 2016 report based on the most current scientific information. Similar to the inaugural work, the 2019 Panel was charged with identifying and evaluating the most current science on sea-level rise projections and changing coastal storms, considering the implications for the practices and policies of local and regional stakeholders, and providing practical options for stakeholders to incorporate science into risk-based decision processes. The 2019 Panel's report is used by multiple state agencies including NJDEP and NJOEM for sea level rise and coastal flooding planning and project design purposes.</td></tr>
<tr><td rowspan="2">2020 New Jersey Scientific Report on Climate Change</td><td>Responsible Agency:</td><td>NJDEP</td></tr>
<tr><td>Hazard:</td><td>Drought, Extreme Temperature, Flood, Severe Weather, Severe Winter Weather, Wildfire</td></tr>
<tr><td colspan="3">NJDEP's first scientific report on climate change summarizes 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).</td></tr>
</table>

Capability	Details	
2021 New Jersey Climate Change Resilience Strategy	**Responsible Agency:**	NJDEP
	Hazard:	Drought, Extreme Temperature, Flood, Severe Weather, Severe Winter Weather, Wildfire
New Jersey's first Statewide Climate Change Resilience Strategy provides a suite of forward-looking policy options to promote the long-term resilience of New Jersey to climate change. As a framework for policy, regulatory, and operational changes, the Resilience Strategy 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		
Coordinate Efforts to Protect and Enhance Tidal Marshes	**Responsible Agency:**	NJDEP, NJSEA, Pinelands Commission, Highlands Council
	Hazard:	Disease Outbreak, Extreme Temperatures, Flood, Severe Weather
In 2023, NJDEP, the New Jersey Sports and Exposition Authority (NJSEA), the Pinelands Commission, and the Highlands Council coordinated to develop the first fully integrated statewide Wetland Program Plan, which directs current and future wetland protection, management and restoration efforts along a coordinated path to the benefit of New Jersey's wetland resources and the quality of life for future generations. An environmental justice component is woven into the program's core elements to lessen environmental and public health stressors in historically overburdened communities.		
Stormwater Management: Pinelands	**Responsible Agency:**	Pinelands Commission
	Hazard:	Flood
In December 2021, the Commission adopted new rules to better protect Pinelands resources by requiring the use of green infrastructure and other more stringent standards to manage stormwater. The new rules integrate the stormwater management standards previously adopted by the NJDEP and incorporate additional standards to provide enhanced protection to the Pinelands environment. For the first time, the Commission's rules require stormwater management for all residential development, including projects involving only one new housing unit, and stricter standards for nitrogen removal that apply to larger projects in the Pinelands area. The new rules are intended to reduce the volume of stormwater runoff, lower the potential for localized flooding, and help to maintain water levels in the Kirkwood-Cohansey aquifer, which underlies the Pinelands, provides fresh drinking water, and supports the region's special ecosystem.		
Water Supply: Water Management Rules	**Responsible Agency:**	Pinelands Commission
	Hazard:	Drought, Extreme Temperature
After decades of study, the Pinelands Commission adopted new water management rules on Sept. 8, 2023, to strengthen protections to the Kirkwood-Cohansey aquifer and the Pinelands ecology as a whole, while ensuring sufficient water supply for authorized development in the growth-oriented portions of the Pinelands. The Kirkwood-Cohansey is a freshwater reservoir underlying the Pinelands, which contains an estimated 17 trillion gallons of water. Withdrawals from the aquifer can negatively impact the essential character of the Pinelands environment; therefore, the Commission set clear, quantifiable standards to address potential adverse local and regional impacts.		

5.1.3 County and Regional

Table 5-3 summarizes the planning and regulatory capabilities available to Burlington County at the county and regional levels.

Table 5-3. County and Regional Planning and Regulatory Capabilities in Burlington County

Capability	Details	
Connections 2050 Plan for Greater Philadelphia, September 2021	**Responsible Agency:**	The Delaware Valley Regional Planning Commission (DVRPC) and four New Jersey participating counties.
	Hazard:	Flood, Severe Weather
The Connections 2050 Plan is a nine-county greater Philadelphia regional plan (five Pennsylvania counties and four New Jersey counties, including Burlington County). The Plan is about transportation infrastructure. Infrastructure underpins the society and economy that makes much of what gets done possible. In order for the transportation network to continue to serve the region's residents and its economy, and to find the means to invest to modernize and improve the condition of the infrastructure, coordination is necessary across public and private sectors to make the necessary safety, information, multimodal, and reliability improvements needed for the digital age. At the same time, climate change and shifting ideologies around equity are joining with the digital revolution to drive change and reshape the region's economy, along with its environment, land use and communities, and the transportation network. A major focus going forward will be to incorporate the Plan's strategies into projects and investments undertaken throughout the nine-county region and to ensure that decision-making is consistent with the Plan's vision and goals. Many of the strategy recommendations in the Plan are for the region and go beyond what DVRPC and its planning partners can do on their own. As a result, it is critical to continue to coordinate and build partnerships across the public and private sectors, as well as at the individual level to help implement the Plan.		
Burlington County Highway Master Plan (June 2019)	**Responsible Agency:**	Board of Commissioners
	Hazard:	Flood, Severe Weather
Burlington County has grown by more than 50,000 residents and 25,000 jobs since the county last prepared a Highway Master Plan in 1989. An almost equal number of people and jobs are forecasted to be added by 2040. The DVRPC was commissioned to update the Highway Master Plan to supply a vision and implementation framework for the county highway network that can sustainably complement long-term county growth patterns. The Burlington County Highway Master Plan is the product of a technical, collaborative planning process to supply a vision and implementation framework for the county highway network that can sustainably complement long-term county growth patterns. The report document serves as a companion to a web map, which is an online tool containing traffic management strategies for transportation deficiencies along specific county routes. The County Route network is vital to everyday movement in the county, and it plays an important role in interconnecting with the New Jersey Turnpike and interstate highway system. The County Route Network carries NJ Transit and BurLink bus routes, provides access to stations along the NJ Transit RiverLINE, and serves as a scenic route network in the Pinelands.		
Growing Greater Philadelphia Comprehensive Economic Development Strategy, 2019	**Responsible Agency:**	DVRPC, Burlington County Chamber of Commerce
	Hazard:	Flood, Severe Weather
Adopted in 2019, *Growing Greater Philadelphia*, the Comprehensive Economic Development Strategy (CEDS) is the region's strategy-driven framework to increase economic productivity, diversify local wealth, improve the culture for underrepresented businesses, and increase individual prosperity for the region's residents. The CEDS covers a nine-county region—Bucks, Chester, Delaware, Montgomery, and Philadelphia in Pennsylvania, and Burlington, Camden, Gloucester, and Mercer in New Jersey. The CEDS was developed through guidance and support of the Economic Development Committee made up of public-and private-sector representatives.		
2019-2022 Annual Report, Burlington County Department of Health (2023)	**Responsible Agency:**	Burlington County Department of Health
	Hazard:	All Hazards
The Burlington County Health Department (BCHD) protects and improves the health and well-being of the community, as well as the environmental resources depended upon. The BCHD continuously surveils information across national, state, and local sources to assist in making data-driven decisions that will improve the well-being of the community and respond to emerging public health threats.		

<table>
<tr><th>Capability</th><th colspan="2">Details</th></tr>
<tr><td rowspan="2">Burlington County Wastewater Management Plan, 2017</td><td>Responsible Agency:</td><td>Water Resources Program</td></tr>
<tr><td>Hazard:</td><td>Flood</td></tr>
<tr><td colspan="3">Wastewater management plans delineate areas that are to be served by centralized wastewater treatment facilities ("sewer service areas") and evaluate the capability of existing treatment facilities to handle future sewage flows from within those delineated areas. The 2008 rules also require that wastewater management plans include: 1) a delineation of those areas designated to be served by individual subsurface sewage disposal systems (septic systems); 2) an analysis of whether build-out at current zoning will negatively impact groundwater quality (dilution capacity will not sustain a nitrate level of 2 parts per million); and 3) a plan to ensure the proper management of septic systems. On May 24, 2017, by Resolution No. 2017-00240, the Commissioners authorized submission of the Burlington County Wastewater Management Plan to NJDEP for adoption into the Tri-County Water Quality Management Plan. The submission did not include the required septic management component of the plan.</td></tr>
<tr><td rowspan="2">Soil Survey of Burlington County, New Jersey</td><td>Responsible Agency:</td><td>Burlington County Soils Division</td></tr>
<tr><td>Hazard:</td><td>All Hazards</td></tr>
<tr><td colspan="3">This soil survey updates an earlier survey of Burlington County (USDA SCS 1971). It provides a digital soil survey on orthophotography and contains additional interpretive information. The soils and miscellaneous areas in Burlington County are in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the county and relating their position to specific segments of the landform, a soil scientist develops a concept or model of how they were formed. During mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location.</td></tr>
<tr><td rowspan="2">Burlington County Comprehensive Farmland Preservation Plan (2022 Update)</td><td>Responsible Agency:</td><td>Burlington County Agriculture Development Board</td></tr>
<tr><td>Hazard:</td><td>All Hazards</td></tr>
<tr><td colspan="3">The Burlington County Farmland Preservation Program exists to advance the quality of life in Burlington County by preserving a permanent agricultural land base and by maintaining a regulatory environment that supports a viable agricultural industry. The Burlington County Comprehensive Farmland Preservation Plan (the "Plan") was initially prepared for the purpose of creating one document that would guide Burlington County's Farmland Preservation Program through its next 10 years (2009-2018). This Plan since became a requirement of State Agriculture Development Committee Regulations (N.J.A.C. 4:76-17.3) for funding through the Garden State Preservation Trust in 2009 and beyond. In addition, this Plan evaluated the implementation of Burlington County's 1998 Strategic Farmland Preservation Plan and put into action county-wide agriculture viability strategies that were recommended by the Strategies for Farm Viability (December 2004) report prepared in conjunction with the Northern Burlington County Strategic Plan. This updated plan shall serve as the one document to guide the County's Farmland Preservation Program for the next 10 years. Aside from updating as much information as possible, this Plan intentionally shifts focus from acquisition of farms for preservation toward efforts to ensure enhanced stewardship of farms that have already been preserved and to focus on the economic viability of these farms and the agricultural industry within Burlington County moving forward. Goals of the Plan include preservation of an additional 10,000 acres of farmland, stewardship of protected land and natural resources, coordination of land use planning activities, and promotion of stewardship efforts focused on mitigating the impacts of climate change on preserved farms.</td></tr>
<tr><td rowspan="2">Burlington County Parks and Open Space Master Plan</td><td>Responsible Agency:</td><td>Department of Resource Conservation</td></tr>
<tr><td>Hazard:</td><td>All Hazards</td></tr>
<tr><td colspan="3">The County Parks and Open Space Master Plan calls for an interconnected system of regional parks, greenways and trails that will give every resident an opportunity to enjoy the outdoors and the scenic landscapes in Burlington County.</td></tr>
<tr><td rowspan="2">Emergency Operations Plan</td><td>Responsible Agency:</td><td>County and Local Offices of Emergency Management</td></tr>
<tr><td>Hazard:</td><td>All Hazards</td></tr>
<tr><td colspan="3">According to State Police Directive 101, each County and municipality shall prepare, adopt, and maintain an emergency operation plan that meets the requirements of the State Emergency Operations Plan guidelines and checklist. The plan describes the hazards faced by the jurisdiction as well as the jurisdiction's capabilities, needs, demands, and emergency management structure. Burlington County and all participating municipalities have emergency operations plans.</td></tr>
</table>

<table>
<tr><th>Capability</th><th colspan="2">Details</th></tr>
<tr><td rowspan="2">Climate Change Vulnerability and Risk Assessment of New Jersey's Transportation Infrastructure (December 2011)</td><td>Responsible Agency:</td><td>North Jersey Transportation Planning Authority</td></tr>
<tr><td>Hazard:</td><td>All Hazards</td></tr>
<tr><td colspan="3">The primary objective of this project is to pilot the Federal Highway Administration's (FHWA) vulnerability and risk assessment Conceptual Model using New Jersey as a case study, providing feedback for the advancement of the Conceptual Model as well as a heightened awareness and understanding of the potential effects of climate change on transportation infrastructure in New Jersey. The project was led by the North Jersey Transportation Planning Authority.

The Conceptual Risk Assessment Model was developed to assist transportation agencies in identifying infrastructure at risk for exposure to climate change stressors and determining which threats carry the most significant consequences. It incorporates the following summary steps:
1. Build an inventory of relevant assets and determine which are critical
2. Gather information on potential future climate scenarios
3. Assess the potential vulnerability and resilience of critical assets

A portion of the study is conducted for the Central Study Area to quantify the potential impact of climate change on the exiting riverine 1 percent annual chance floodplain. The central study area covers portions of Burlington, Camden, Mercer, Salem, and Middlesex Counties. The impact of climate change on the riverine floodplain has been assessed through analysis of the effects of extreme precipitation as well rising temperatures. In this analysis, years 2050 and 2100 were considered.</td></tr>
<tr><td rowspan="2">Best Management Practices for Creating and Maintaining Wildfire Fuel Breaks in New Jersey's Wildland Urban Interface, 2011</td><td>Responsible Agency:</td><td>Federal, State & County</td></tr>
<tr><td>Hazard:</td><td>Wildfires</td></tr>
<tr><td colspan="3">In New Jersey, residential communities and development continue to spread into new, previously undisturbed natural areas, which creates a "Wildland Urban Interface" where rural land and developed areas meet. This fragmented rural landscape has greater ignition sources and more frequent fires, which makes it difficult for the Forest Fire Service to manage land for wildfire protection and preparedness. This problem can be seen throughout New Jersey, especially with the state having such a rapidly growing population. In a study done by the American Planning Association, 46 percent of homes in New Jersey are located in the Wildland Urban Interface, which stresses the importance of the problem in New Jersey.</td></tr>
<tr><td rowspan="2">New Jersey Back Bays Coastal Storm Risk Management Study</td><td>Responsible Agency:</td><td>USACE, NJDEP</td></tr>
<tr><td>Hazard:</td><td>Flood</td></tr>
<tr><td colspan="3">The study area includes the bays and river mouths located landward of the barrier islands and Atlantic Ocean-facing coastal areas in the State of New Jersey. The report outlines a "Tentatively Selected Plan" framework, which includes three storm surge barriers, two cross-bay barriers, and the elevation of more than 18,000 structures to reduce the risk of flood damage associated with storm surge. The plan has not yet been approved by higher authorities, including Congress, and has not been funded for implementation at the federal or state level.

Municipalities in Burlington County located along the Mullica River in the southeastern portion of the County may be impacted positively by implemented flood risk reduction projects in Great Bay.</td></tr>
<tr><td rowspan="2">Community Health Improvement Plan, 2014</td><td>Responsible Agency:</td><td>Burlington County Department of Health</td></tr>
<tr><td>Hazard:</td><td>All Hazards</td></tr>
<tr><td colspan="3">The BCHD Community Health Improvement Plan is a summation of health disparity in the county and interventions to guide efforts to keep residents healthy. With data gathered from the Tri-County Health Assessment Collaborative, Burlington County worked with Camden County, Gloucester County, local area hospitals and health systems to conduct a comprehensive regional community health needs assessment (CHNA). From September 2012 to June 2013, the counties, partners, and residents were contributing valuable information to help identify areas of health concern to be targeted for strategic interventions.

Using an independent contractor, the CHNA conducted a Behavioral Risk Factor Surveillance System-based telephone survey that collected data from a statistically representative sample population from the county. Focus groups, key-informant interviews and a secondary data profile were also conducted to bolster the data gathered from the survey. The results of these efforts led to the identification of health disparities that informed key priority areas. With the identification of these issues, BCHD collated and compiled interventions and available resources to initiate actions.</td></tr>
</table>

Capability		Details	
Community Health Needs Assessment, 2022		**Responsible Agency:**	Burlington County Department of Health
		Hazard:	All Hazards
Since 2013, the South Jersey Health Collaborative has combined efforts to better understand the factors that influence the health of people living in the South Jersey region. Member institutions have committed to conducting a collaborative Community Health Needs Assessment and Community Health Improvement Plan. By working together, sharing strengths, and generating ideas, the Collaborative fosters a common understanding of the resources and challenges among the communities of South Jersey. Leveraging the collective and individual strengths across each institution, the Collaborative is working toward a healthier, more equitable South Jersey for all. The 2022 Community Health Needs Assessment reviewed health indicators, engaged community participation through 14 focus groups with diverse populations, including youth, and solicited feedback through a key informant survey and stakeholder interviews to interpret the quantitative and qualitative information collected through a lens of health equity – working towards equitable outcomes for all people - and a focus on the social determinants of health.			

5.1.4 Local

Plans are often developed at the county and regional level in the State of New Jersey, but the majority of regulations are adopted and enforced by local municipalities. New Jersey's municipalities are granted the ability to establish and enforce various ordinances and planning requirements. New Jersey's Home Rule Act (1917) grants municipal governments broad authorities to enact ordinances and regulations providing for public welfare and order and stands as one of the major sources of authorization for local autonomy in the state. 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 so that jurisdictions may add additional requirements but cannot have fewer requirements than the state.

For more information on the local plans and regulations adopted by each municipality in Burlington County that contribute to risk reduction, refer to the jurisdictional annexes in Volume II.

Master Plans

The Municipal Land Use Law (MLUL) of 1975 (N.J.S. 40:55D-1 et seq.) grants municipalities the power to enact a master plan which has a land use element. 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 as well as the volunteer planning and zoning board members have the responsibility to interpret and enforce the municipality's master plan.

In recognition of the critical need for climate science to inform land use planning, on February 4, 2021, Governor Phil Murphy signed into law Public Law 2021, c6. This law requires municipalities to incorporate a climate change-related hazard vulnerability assessment into any master plan land use element adopted after the signing. The vulnerability assessments must rely on the most recent natural hazard projections and best available science provided by the NJDEP. They must also 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 authority to regulate land use is encompassed within the powers granted to the legislative branch of government by Article III of the New Jersey Constitution of 1947. The legislature, however, is authorized by Article IV, Section VI, paragraph 2, to delegate some of its power to municipalities. This has been done by virtue of several land use laws, including the MLUL, which grants municipalities the power to enact a master plan which has a land use element and to adopt a zoning ordinance (N.J.S. 40:55D-28 and 40:55D-62). Under the MLUL, each municipality must adopt a zoning ordinance. 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. 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.

Each municipal clerk is required to file a copy of the planning and zoning ordinances of the municipality with the county planning board (New Jersey Statute 40:27-6.10). The local zoning administrator, as well as the volunteer planning and zoning board members, have the responsibility to interpret and enforce the municipality’s zoning and other land development ordinances.

Subdivisions

The MLUL dictates subdivisions in New Jersey. It allows every municipality in the state to adopt its own building and land use laws within a municipal boundary, and all property owners must abide by these laws. The board of commissioners provides for the review of all subdivisions of land within the county by the county planning board and for the approval of those subdivisions affecting county road or drainage facilities (New Jersey Statute 40:27-6.2).

Building Codes

Building codes mandate best practices and technology, largely 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 permits every municipality in the state to adopt its own building regulations, and 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 to be more lax.

The UCC Act authorizes the Commissioner of the Department of Community Affairs to adopt and enforce rules pertaining to construction codes and provides for the administration and enforcement of those rules throughout the state. The UCC (N.J.A.C. 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 (NJDCA n.d.).

Stormwater Management Ordinances

Title 7 of the New Jersey Administrative Code (N.J.A.C. 7:8) establishes design and performance standards for management of stormwater that address water quality, water quantity, and recharge. All municipal stormwater control ordinances must be designed to:

- 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 ground water 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

Municipal ordinances can be amended to be more stringent than the requirements of the Stormwater Management rules but not to be more lax. The Residential Site Improvement Standards (RSIS) 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 as provided in the RSIS at N.J.A.C. 5:21-7.1 (NJDEP 2023).

Amendments to New Jersey's stormwater management rules in 2021 include the required use of green infrastructure practices that use or mimic the natural water cycle to capture, filter, absorb, and/or re-use stormwater.

Stormwater Management Plan and Ordinances

In response to the U. S. Environmental Protection Agency's Phase II rules published in December 1999, the NJDEP Storm Water Management Rule (N.J.A.C. 7:8, et seq.) was developed. This rule includes establishment of the Municipal Stormwater Regulation Program 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 (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 (NJDEP 2004).

Emergency Operations Plans

Local municipalities in the State of 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.

5.2 ADMINISTRATIVE AND TECHNICAL CAPABILITIES

5.2.1 Federal

Numerous federal agencies have specific capabilities that support pre- and post-disaster hazard management in Burlington County, as described in the subsections below.

FEMA

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.

FEMA evaluates NFIP minimum compliance through compliance audits known as Community Assistance Visits (CAV) and Community Assistance Contacts (CAC). CAVs and CACs are performed to ascertain community compliance with the NFIP, at entry into the CRS, and to maintain participation in the CRS. FEMA may conduct these with Region 2 staff, with NJDEP staff under the Compliance Assistance Program – State Support Services Element grant, or with private contractors. While there is some flexibility in how a CAV or a CAC is conducted, CAVs are generally more rigorous than CACs (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 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 by 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; and creating a National Inventory of Dams (FEMA 2023).

HURREVAC

HURREVAC is the decision support tool of the National Hurricane Program, administered by FEMA, USACE, and the National Oceanic and Atmospheric Administration (NOAA) National Hurricane Center (HURREVAC n.d.). NJOEM has established a strong working group with all 21 county offices of emergency management (OEMs) to use HURREVAC software for tracking hurricanes. HURREVAC allows NJOEM and counties to work as a unified team, coordinating notification, communication, activations, public warning, and evacuation and sheltering efforts. By operating together, the state and the counties serve the public better by providing 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). Passaic, Bergen, Essex, Hudson, and Union County are covered by the New York WFO. NJOEM uses conference calling with the NWS and county OEMs 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 with NJOEM's direction. Resources are deployed as early as possible to prepare for storm impacts. The NWS also offers various education and training programs on weather-related hazards (NWS 2023).

StormReady Program

The NWS operates the StormReady program, which encourages communities to take a proactive approach to improving local hazardous weather operations by providing emergency managers with clear-cut guidelines on how to improve their hazardous weather operations. To be recognized by the program, a community must establish a 24-hour warning point and emergency operations center; have more than one way to receive severe weather warnings and forecasts and to alert the public; create a system that monitors weather conditions locally; promote the importance of public readiness through community seminars; and develop a formal hazardous weather plan, which includes training severe weather spotters and holding emergency exercises (NWS n.d.). In Burlington County, the Borough of Palmyra and the City of Burlington are StormReady communities. Joint Base McGuire-Dix-Lakehurst is a government/military participant in the program.

U.S. Army Corps of Engineers

The U.S. Army Corps of Engineers (USACE) works to strengthen the nation's security by building and maintaining America's infrastructure and providing military facilities where service members train, work, and live. 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.

U.S. Geological Survey

The U.S. Geological Survey (USGS) maintains a network of gauges across New Jersey that continuously measure lake, reservoir table, stream, and tide levels. These data sets are transmitted to the USGS and made available over the internet. As project needs and funding levels change, gauges may be added or deactivated, and deactivated gauges may be reactivated (USGS 2023). The USGS provides data to NJDEP for drought determinations. The USGS also recovers high water marks following coastal flood events (USGS 2018). In the back bays and along tidal waters, the USGS manages the New Jersey Tide Telemetry System. All systems transmit telemetry continuously to the NWS, USGS, the state climatologist, NJDEP, NJOEM, all affected counties, and many municipalities. These systems were created and installed with federal assistance through NOAA and USACE.

5.2.2 State

Numerous state agencies have specific capabilities that also support pre- and post-disaster hazard management in Burlington County. Major state agencies that support hazard mitigation include:

- New Jersey Department of Community Affairs (NJDCA)
- New Jersey Economic Development Authority
- New Jersey Department of Environmental Protection (NJDEP)
- New Jersey Department of Transportation (NJDOT)
- New Jersey Department of Treasury: Division of Administration and the Emergency Response Unit
- New Jersey Office of Homeland Security and Preparedness

- New Jersey Office of Emergency Management (NJOEM)
- NJ Transit
- New Jersey Turnpike Authority

For more information about these agencies, refer to the State of New Jersey All-Hazard Mitigation Plan.

5.2.3 Regional

Numerous regional organizations have capabilities that support pre- and post-disaster hazard management in Burlington County.

Delaware River Basin Commission

The Delaware River Basin Commission (DRBC) provides a unified approach to managing the Delaware River without regard to political boundaries. Commission programs include water quality protection; water supply allocation, water conservation initiatives and watershed planning; regulatory review (permitting); flow and drought management; flood loss reduction; and recreation (DRBC 2023). The signatory members of this regional body include the state governors of Delaware, New Jersey, New York, and Pennsylvania and the USACE Division Engineer, North Atlantic Division. The DRBC established an Advisory Committee on Climate Change in 2019 to provide the Commission with vital expertise, information, and advice as it endeavors to maintain and improve stream flows, water quality, habitat, wetlands, and watersheds in the face of changing hydrologic conditions and sea-level rise.

Pinelands Commission

The Pinelands Commission is an independent state agency whose mission is to “preserve, protect, and enhance the natural and cultural resources of the Pinelands National Reserve, and to encourage compatible economic and other human activities consistent with that purpose.” Through its implementation of the Pinelands Comprehensive Management Plan, the New Jersey Pinelands Commission protects the Pinelands in a manner that maintains the region’s unique ecology while permitting compatible development. The Comprehensive Management Plan contains provisions for fire hazard mitigation, wetlands protection, and permanent land preservation programs that reduce risk and vulnerability to wildfires and flooding (Pinelands Commission 2023). The plan also has stricter stormwater management regulations. The Commission also has a climate committee.

Delaware Valley Regional Planning Commission

The Delaware Valley Regional Planning Commission (DVRPC) is the federally designated Metropolitan Planning Organization for the Greater Philadelphia region (MPO ID# 42196501), established by an interstate compact between the Commonwealth of Pennsylvania and the State of New Jersey. The DVRPC includes Burlington, Camden, Gloucester, and Mercer County in New Jersey as well Bucks, Chester, Delaware, Montgomery, and Philadelphia County in Pennsylvania. DVRPC provides municipalities with tools and resources to assist communities with land use planning. DVRPC also provides resources for funding opportunities, technical assistance programs, consultant opportunities, economic development, smart growth, and workshops on integrating comprehensive planning and hazard mitigation. DVRPC was contracted to update and reformat emergency detour route maps for all limited access highways within the region, replacing outdated paper maps with digital PDF maps (DVRPC n.d.).

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. Sustainable Jersey certification is a designation for municipal governments in New Jersey. All actions taken by municipalities to score points toward certification must be accompanied by documentary evidence. The certification is free and voluntary (Sustainable Jersey 2023). Many municipalities in Burlington County participate in Sustainable Jersey, but only the following municipalities are certified: Bordentown City (silver), Bordentown Township (silver), Burlington City (bronze), Chesterfield Township (bronze), Delran Township (bronze), Evesham Township (bronze), Florence Township (bronze), Maple Shade Township (bronze), Medford Township (silver), Moorestown Township (silver), Mount Holly Township (silver), and Mount Laurel Township (bronze) (Sustainable Jersey 2023).

Rutgers Cooperative Extension for Burlington County

Rutgers New Jersey Agricultural Experiment Station Cooperative Extension helps the diverse population of New Jersey adapt to a rapidly changing society and improve their lives and communities through an educational process that uses science-based knowledge. Through science-based educational programs, Rutgers Cooperative Extension enhances the quality of life for residents of New Jersey and brings the wealth of knowledge of the state university to local communities. The office provides research-based information to county residents in the areas of 4-H youth development, agriculture and natural resources, and family and community health sciences (Rutgers 2023).

Jacques Cousteau National Estuarine Research Reserve

Portions of southeastern Burlington County are located in the Jacques Cousteau National Estuarine Research Reserve (JC NERR). The JC NERR encompasses approximately 116,000 acres in southeastern New Jersey, including a great variety of terrestrial, wetland and aquatic habitats within the Mullica River-Great Bay ecosystem. The JC NERR is one of two national estuarine reserves created to promote the responsible use and management of the nation’s estuaries through a program combining scientific research, education, and stewardship. The Coastal Training Program provides up-to date scientific information and skill-building programs for New Jersey’s coastal management community. Program formats include seminars, hands-on skill training, participatory workshops, lectures, and technology demonstrations (JC NERR 2017).

5.2.4 County

Numerous County departments have capabilities that support pre- and post-disaster hazard management in Burlington County. The following section summarizes administrative and technical capabilities in Burlington County. Detailed information regarding administrative and technical capabilities in the County and the municipalities can be found in the jurisdictional annexes in Volume II.

Burlington County Department of Human Services

The Department of Human Services consists of a wealth of services to support individuals in the community from all backgrounds, with various needs (Burlington County n.d.):

- The **Office on Aging** provides information, assistance and outreach services to seniors in a variety of areas, including legal assistance, transportation, Meals on Wheels, weekend meal program, congregate nutrition sites, home health services, respite care, home security, adult day care and care management. The Office on Aging is part of the statewide Aging and Disability Resource Connection, which provides "one-stop shopping" access to services.
- The **Division of Behavioral Health and Youth Services** provides coordination, planning and funding for behavioral health, addiction and disabilities services for youth, families, and adults throughout the County.
- The **Division of Community Development** administers federally funded Housing and Urban Development programs, Home Improvement Loan Programs, Home Investment Partnership Program, First-Time Home Buyers Program and Community Development Block Program.
- The **Division of Community Outreach and Special Projects** maintain relationships with local neighborhoods, community groups, nonprofits, and residents. The Division seeks to build a network of trust among County residents and the department or local government by increasing collaborative efforts.
- The **Division of Employment and Training** provides resources for businesses and jobseekers to ensure that a well-trained workforce is equipped to meet the business needs of the future.
- The **Burlington County Housing Hub** provides housing advocacy and supportive services to all Burlington County residents.
- The **BurLink deviated fixed route service** is committed to improving the efficiencies of the transportation network for Burlington County residents who most need transportation.

Burlington County Health Department

The Burlington County Health Department protects and improves the health and well-being of the County's communities, as well as the environmental resources of the County. The Health Department contracts with all 40 local boards of health in Burlington County to provide residents, businesses, and visitors a variety of health-related programs and services. The Health Department works to prevent disease, conducts education and outreach, trains staff, and takes part in developing new policies and standards that address existing and emerging challenges to communities' health while enforcing a range of laws pertaining to public health and safety (Burlington County n.d.).

Burlington County Department of Information Technology

The Burlington County Department of Information Technology (IT) provides various services to County residents and other County departments.

Communications Division

The Communications Division provides data and telephone connectivity and information security to the County's local area network (LAN) and wide area network (WAN) resources through a variety of cutting-edge technologies. In addition to maintaining the County LAN / WAN infrastructure for County employees, the Communications Division provides IT support for the County municipal police departments, fire, and EMS communities.

Development Division

The Development Division supports software on multiple platforms and develops systems to solve County department needs. The division supports almost all of Burlington County's business functions, including personnel, payroll, fiscal operations, county clerk records management, surrogate system administration, and other department-specific applications.

Geographic Information Systems

The GIS Section creates, maintains, acquires and serves digital geographic data layers that are useful to the County's GIS users. The GIS Section also provides GIS software, training, technical support, and project development assistance and mapping to County departments. Departmental users of the GIS include Public Safety/Emergency Management, Engineering, Health, Resource Conservation, Prosecutors, Highway, Board of Elections, Legal and the Burlington County Bridge Commission's Economic Development Office. Each department has a different level of autonomy, thus requiring various degrees of support. The Burlington County Bridge Commission's Economic Development Office employs its own full time GIS specialists.

Public Safety

The Public Safety IT Division, located at the County Public Safety Center in Westampton Township, is the primary provider of IT services to the Department of Public Safety (County 9-1-1 Communications Center; Office of Emergency Management / County EOC; Forensic Science Lab; Radio Maintenance; Emergency Services Training Center; County Fire Marshal's Office). This section provides 24/7 technical support to all County law enforcement agencies participating in the Burlington County Integrated Law Enforcement Computer Project, which is the primary records management, computer aided dispatch (CAD)/dispatch software and mobile computing solution for county public safety agencies. Our staff also provides training in the technologies utilized by County public safety agencies:

- Fire and EMS—Fire and EMS agencies in Burlington County participate with our staff in the Fire and EMS IT Working Group, a steering committee comprised of appointed members from the County Fire Chiefs Association, County First Aid Council, Central Communications, and County government. The committee is chaired by the director of County IT. This committee provides a forum to discuss information technology solutions for fire and EMS services in the County.
- FIREHOUSE Software—The FIREHOUSE Software platform provides participating agencies with the ability to access and enter fire incidents, hydrant information, staff, training, and other records via the internet, as well as complete and submit National Fire Incident Reporting System reports to the state. Personnel from our section maintain the servers and CAD interface and provide 24/7 technical support.
- EMS—The EMS Service benefits from a CAD interface with EMS Charts, a software package sanctioned by the State of New Jersey for use by EMS agencies, as well as other reporting services from the CAD system.

Records Management

The Division of Records Management holds the public records of the County of Burlington. The Division ensures the security, integrity, and efficiency of record-keeping within County government agencies. The Division recently implemented a state-of-the-art records information management system to enhance the operational efficiency of records creation, maintenance, storage, and access while reducing operational costs. The Division maintains and operates a large County storage facility located in Westampton, New Jersey. The Division coordinates and supports records management activities for County of Burlington municipalities. In conjunction with Burlington County's shared services strategy, the Division recently implemented and successfully concluded a countywide records management needs assessment for County municipalities.

Systems

The Systems Section is responsible for the maintenance and support of over 150 physical and virtual servers and over 1,000 computers throughout the County (Burlington County n.d.).

Burlington County Department of Public Safety

The Department of Public Safety has a wide range of responsibilities and services pertaining to hazard mitigation (Burlington County n.d.):

- The **Communications Center** is a consolidated countywide operation handling 9-1-1 emergency calls, police, fire, and emergency medical dispatch. It acts as a point of contact after hours for all County agencies.
- The **Communications Support Division**) is the provider of public safety radio communications for all public safety agencies in Burlington County. The division has an infrastructure of 17 countywide radio tower sites, with their attendant equipment and buildings.

- Emergency Management's **Emergency Operations Center** handles large-scale or long-term natural or human-caused emergencies.
- The **Office of Fire Marshal** investigates fires. It also provides education on all aspects of fire safety, including workplace safety and senior citizen fire safety. The unit conducts programs all year long for schools, civic groups, senior citizens, and businesses.
- The **Emergency Services Training Center** provides training to firefighters, law enforcement, emergency medical technicians (EMTs) and many other government agencies.

Burlington County Department of Public Works

Public Works is comprised of several divisions and houses the Planning Board:

- The **Engineers Office** works to identify innovative ways to minimize congestion and promote the health, safety, and welfare of the traveling public. This includes the use of Intelligent Transportation System (ITS) technologies, which allow the Office to coordinate traffic signals and revise traffic signal timings and detection along the County's busiest corridors from the Engineers Office.
- The **Planning Board** is responsible for reviewing proposed development projects and making decisions on them in accordance with state statutes and local bylaws and regulations. The Planning Board is also charged with long-range planning for the County.
- Burlington County has large areas that have potential to breed mosquitoes. These areas include farmland, wetlands (fresh and salt water), home yards, stormwater facilities, and sewer plants. The **Division of Mosquito Control** employs an integrated mosquito control program, blending chemical and biological control and water management. In addition, the division conducts a comprehensive mosquito surveillance program, as well as a variety of maintenance programs.
- The **Division of Roads and Bridges** (formerly, the Highway Department) repairs and corrects any hazard or complaints that affect the road system, such as road repair, mowing, and snow removal. The Stormwater Section of the Roads and Bridges Division maintains, inspects, and cleans the storm systems on County roads and within the right-of-way. There are over 7,000 inlets within the County. The Division also cleans and maintains roadside ditches on County roads.

Burlington County Department of Economic Development

The Burlington County Department of Economic Development is housed within the Burlington County Bridge Commission. It is responsible for helping to improve business aspects in the County (Burlington County n.d.).

Burlington County Department of Resource Conservation

The Department of Resource Conservation's mission is to preserve and protect the land and water resources of the County, to protect taxpayers' investment in farmland preservation through programs and services designed to assist the agricultural community, and to provide families with places to play, learn, and enjoy. It includes the following (Burlington County n.d.):

- The **Division of Parks** is responsible for maintaining the County Parks System, which includes regional parks, canoe and hiking trails, museums, historic sites, the County Fairgrounds, and the Rancocas Nature Center. The Division is responsible for more than 1,000 acres of developed parkland, with 3,500 acres of land slated for park development and a regional trail system that will provide a link between the parks.
- The **Farmland Preservation Program** is committed to preserving a permanent agricultural land base and maintaining an environment that supports a viable agricultural industry. Over 28,000 acres of farmland have been preserved to date through this County program.
- The **Burlington County Agriculture Development Board** is a state-mandated advisory body to the Commissioner Board for farmland preservation matters and other issues relating to agriculture, such as the review of proposed state policies and regulations that may impact agriculture. The County Agriculture Development Board is also required to address matters that may arise as a result of the New Jersey Right to Farm Act and is statutorily required to handle these matters independently of Commissioner Board involvement.
- The **Open Space Preservation Program/Trail Development Program** is responsible for acquisition of the land that will become part of the County Parks System and developing that land for public enjoyment.
- The **Water Resources Program** provides planning coordination for water resource management related activities of the County, including wastewater management.

Burlington County Sheriff's Office

The Burlington County Sheriff's Office includes multiple bureaus and units relating to hazard mitigation, including a Community Outreach Unit, Emergency Services Unit, and Senior Services Unit (Burlington County n.d.).

Burlington County Finance and Administration

Finance and Administration is comprised of the following key functional areas: Financial Operations, which includes banking operations, accounts payable and departmental operating budgets; Capital & Debt Management; Grants Management; Purchasing & Contract Management; Risk Management; Human Resources; and Payroll & Employee Benefits (Burlington County n.d.).

Burlington County Boards and Commissions

In addition to County departments, various County boards and commissions provide services or have responsibilities relating to hazard mitigation:

- The **Burlington County Board of Social Services** provides services to individuals, to families, and to the community by preserving and restoring families, promoting self-sufficiency, providing information and referrals, and protecting the well-being of children, the elderly, and people with disabilities. The Board works to build partnerships with community organizations and service providers (Burlington County Board of Social Services 2023).

- The **Burlington County Bridge Commission** provides Burlington County's residents, commuters, and visitors with safe, accessible, and affordable bridges, roads, and facilities. The Commission is dedicated to serving customers courteously and to helping Burlington County prosper by saving taxpayers money through innovative financing programs and by fostering and assisting neighbors in their economic development and community revitalization projects to ease the burden on local property taxpayers (Burlington County Bridge Commission 2019).
- Burlington County's **Community Development Advisory Committee** studies the County's community development needs, prioritizes funding, and recommends activities to be funded (Burlington County n.d.).
- The New Jersey State Uniform Construction Code Act mandates that each County create a board to hear any construction appeals from within that County. The **Burlington County Construction Board of Appeals** was formed to allow appeals from decisions made by municipal construction officials and municipal fire officials (Burlington County 2009).
- The mission of the **Burlington County Emergency Services Advisory Board** is to review the fire and EMS emergency services' needs, resources, and related issues within Burlington County and to provide advice to the Burlington County Board of County Commissioners (Burlington County 2009).
- The **Burlington County Human Services Advisory Council** reviews county-level human services activities and serves as the primary vehicle for making local recommendations to assist Commissioners and the state in their decision making (Burlington County n.d.).
- The **Burlington County Library Commission** determines policies and oversees the budget of the Burlington County Library System (Burlington County Library System 2023).
- The **Burlington County Minority and Equality Rights Task Force** was established to help combat systemic racism and support equality for all, regardless of race, color, gender, nationality, religion, or sexual orientation (Burlington County n.d.).
- The **Burlington County Solid Waste Advisory Council** assists in the development and formulation of a solid waste management plan and establishes minimum criteria for the composition of the council (Burlington County n.d.).
- By the State of New Jersey stormwater regulation, Burlington County was required to establish an agency to review adopted municipal stormwater management plans. The Planning Board appointed the **Burlington County Stormwater Management Committee** to review submitted draft and adopted municipal stormwater plans and ordinances for consistency with the state's stormwater regulations (Burlington County n.d.).
- The **Burlington County Transportation Advisory Committee** assists the Board of County Commissioners by providing input on the development of the County's Comprehensive Transportation Plan, NJDOT's transportation project prioritization process within the county, major transportation projects, and related issues of concern as assigned by the Board of County Commissioners (Burlington County n.d.).

5.3 FISCAL CAPABILITIES

Fiscal capabilities are the resources that a jurisdiction has access to or is eligible to use to fund mitigation actions. The sections below list funding programs for jurisdictions seeking funding. This section is not intended to be a comprehensive list, but rather a tool to help identify potential funding sources.

5.3.1 Federal

Burlington County and its municipalities continue to apply for and secure federal funding to support hazard mitigation. As noted on the FEMA Hazard Mitigation Assistance (HMA) website (https://www.fema.gov/hazard-mitigation-assistance), FEMA administers six programs that provide funding for eligible mitigation planning and projects that reduce disaster losses and protect life and property from future disaster damage:

- Building Resilient Infrastructure and Communities (BRIC)
- Flood Mitigation Assistance (FMA)
- Hazard Mitigation Grant Program (HMGP)
- Public Assistance (PA) Section 406 Funds
- Legislative Pre-Disaster Mitigation (PDM)
- Safeguarding Tomorrow through Ongoing Risk Mitigation (STORM) Revolving Loan Fund

Since the 2019 HMP, the County has received numerous HMGP awards for generators, an FMA award for an elevation project in Lumberton Township, and BRIC funding for planning (NJOEM 2023). The establishment of FEMA -identified Community Disaster Resilience Zones provides geographic focus for financial assistance for underserved communities for technical assistance and increased mitigation activities (FEMA 2023).

Table 5-4 provides an overview of HMA program funding eligibility and cost share. Table 5-5 summarizes the fiscal capabilities available at the federal level to support hazard mitigation in Burlington County.

Table 5-4. FEMA HMA Grant Cost Share Requirements

Programs	Cost Share (Percent of Federal / Non-Federal Share)
HMGP(1)	75 / 25
HMGP Post Fire	75 / 25
FMA (community flood mitigation, project scoping, individual mitigation of insured properties, and planning grants)	75 / 25
FMA—repetitive loss property(2)	90 / 10
FMA—severe repetitive loss property(2)	100 / 0
PDM	75 / 25
PDM—small and impoverished community	Up to 90 / 10
BRIC	75 / 25

TETRA TECH

Programs	Cost Share (Percent of Federal / Non-Federal Share)
BRIC—small and impoverished community	Up to 90 / 10

Source: FEMA 2023; FEMA 2023

1. Subapplicants should consult their state hazard mitigation officer for the percentage of HMGP subrecipient management cost funding their state has determined to be passed through subrecipients.

2. To be eligible for an increased federal cost share, a FEMA-approved state or tribal mitigation plan (standard or enhanced) that addresses repetitive loss properties must be in effect at the time of award, and the property being submitted for consideration must be a repetitive loss property.

Table 5-5. Federal Funding Capabilities Available to Support Mitigation in Burlington County

Capability	Details	
Hazard Mitigation Grant Program	**Responsible Agency:**	FEMA
	Hazard:	All hazards
The HMGP is a post-disaster mitigation program. It is made available to states by FEMA after each federal disaster declaration. The HMGP can provide up to 75 percent funding for hazard mitigation measures. The HMGP can be used to fund cost-effective projects that will protect public or private property in an area covered by a federal disaster declaration or that will reduce the likely damage from future disasters. Examples of projects include acquisition and demolition of structures in hazard-prone areas, flood-proofing or elevation to reduce future damage, minor structural improvements, and development of state or local standards. Projects must fit into an overall mitigation strategy for the area identified as part of a local planning effort. All applicants must have a FEMA-approved hazard mitigation plan (this plan). Applicants who are eligible for the HMGP are state and local governments, certain nonprofit organizations or institutions that perform essential government services, and Indian tribes and authorized tribal organizations. Individuals or homeowners cannot apply directly for the HMGP; a local government must apply on their behalf. Applications are submitted to NJOEM and placed in rank order for available funding and submitted to FEMA for final approval. Eligible projects not selected for funding are placed in an inactive status and may be considered as additional HMGP funding becomes available. For additional information regarding HMGP, see: https://www.fema.gov/hazard-mitigation-grant-program		
Flood Mitigation Assistance Program	**Responsible Agency:**	FEMA
	Hazard:	Flood, Severe Weather
The FMA program combines the previous Repetitive Flood Claims and Severe Repetitive Loss Grants into one grant program. The FMA provides funding to assist states and communities in implementing measures to reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, and other structures insurable under the NFIP. The FMA is funded annually; no federal disaster declaration is required. Only NFIP-insured homes and businesses are eligible for mitigation in this program. Funding for FMA is very limited, and as with the HMGP, individuals cannot apply directly for the program. Applications must come from local governments or other eligible organizations. The federal cost share for an FMA project is at least 75 percent; at most 25 percent of the total eligible costs must be provided by a non-federal source. Of this 25 percent, no more than half can be provided as in-kind contributions from third parties. At minimum, a FEMA-approved local flood mitigation plan is required before a project can be approved. The FMA funds are distributed from FEMA to the state. NJOEM serves as the grantee and program administrator for the FMA program. The FMA program is detailed on the FEMA website: https://www.fema.gov/flood-mitigation-assistance-grant-program		

Capability	Details	
Building Resilient Infrastructure and Communities Program	**Responsible Agency:**	FEMA
	Hazard:	All hazards
Building Resilient Infrastructure and Communities (BRIC) supports states, local communities, tribes, and territories as they undertake hazard mitigation projects, reducing the risks they face from disasters and natural hazards. The BRIC program guiding principles are supporting communities through capability- and capacity-building; encouraging and enabling innovation; promoting partnerships; enabling large projects; maintaining flexibility; and providing consistency. For additional information regarding the BRIC program, see: https://www.fema.gov/grants/mitigation/building-resilient-infrastructure-communities		
Hazard Mitigation Grant Program Post Fire	**Responsible Agency:**	FEMA
	Hazard:	Wildfire
The HMGP Post Fire program provides funding to help communities implement hazard mitigation measures focused on reducing the risk of harm from wildfire. HMGP Post Fire funding is authorized under Sections 404 and 420 of the Stafford Act and provides hazard mitigation grant funding to states, federally recognized tribes, and territories affected by fires resulting in a Fire Management Assistance Grant declaration on or after October 5, 2018. For more information regarding the HMGP Post Fire program, see https://www.fema.gov/grants/mitigation/post-fire.		
Pre-Disaster Mitigation Program	**Responsible Agency:**	FEMA
	Hazard:	All Hazards
The Pre-Disaster Mitigation (PDM) grant program makes federal funds available to state, local, tribal, and territorial governments to plan for and implement sustainable cost-effective measures designed to reduce the risk to individuals and property from future natural hazards, while also reducing reliance on federal funding from future disasters. The program is authorized by Section 203 of the Stafford Act. While previously an annual program, the PDM program is currently dependent on annual congressional authorization. For additional information regarding the PDM program, see: https://www.fema.gov/grants/mitigation/pre-disaster		
Safeguarding Tomorrow Revolving Loan Fund Program	**Responsible Agency:**	FEMA
	Hazard:	All hazards
The Safeguarding Tomorrow through Ongoing Risk Mitigation (STORM) Act became law on Jan. 1, 2021. This Act authorizes FEMA to provide capitalization grants for eligible entities to make funding decisions and award loans directly to local communities. Eligible entities are states, eligible federally recognized tribes, territories, and the District of Columbia. These revolving loan funds provide hazard mitigation assistance for local governments to reduce risks from natural hazards and disasters. For additional information regarding STORM funding, see: https://www.fema.gov/fact-sheet/femas-safeguarding-tomorrow-revolving-loan-fund-program		

Capability	Details	
Extraordinary Circumstances	**Responsible Agency:**	FEMA
	Hazard:	All hazards

For PDM and FMA project subawards, the FEMA region may apply extraordinary circumstances when justification is provided and with concurrence from FEMA Headquarters (Risk Reduction and Risk Analysis Divisions) prior to granting an exception. If an exception is granted, a local mitigation plan must be approved by FEMA within 12 months of the award of the project subaward to that community.

For HMGP, PDM, and FMA, extraordinary circumstances exist when a determination is made by the applicant and FEMA that the proposed project is consistent with the priorities and strategies identified in the state mitigation plan (standard or enhanced) and that the jurisdiction meets at least one of the criteria below:

- The jurisdiction meets the small, impoverished community criteria (see Part VIII, B.2).
- The jurisdiction has been determined to have had insufficient capacity due to lack of available funding, staffing, or other necessary expertise to satisfy the mitigation planning requirement prior to the current disaster or application deadline.
- The jurisdiction has been determined to have been at low risk from hazards because of low frequency of occurrence or minimal damage from previous occurrences as a result of sparse development.
- The jurisdiction experienced significant disruption from a declared disaster or another event that impacts its ability to complete the mitigation planning process prior to award or final approval of a project award.
- The jurisdiction does not have a mitigation plan for reasons beyond the control of the state, federally recognized tribe, or local community, such as Disaster Relief Fund restrictions that delay FEMA from granting a subaward prior to the expiration of the local or Tribal Mitigation Plan.

If the jurisdiction does not meet at least one of these criteria, the Region must coordinate with FEMA Headquarters (Risk Reduction and Risk Analysis Divisions) for HMGP; however, for PDM and FMA the Region must coordinate and seek concurrence prior to granting an exception:

For HMGP, PDM, and FMA, the Applicant must provide written justification that identifies the specific criteria or circumstance listed above, explains why there is no longer an impediment to satisfying the mitigation planning requirement, and identifies the specific actions or circumstances that eliminated the deficiency.

When an HMGP project funding is awarded under extraordinary circumstances, the Recipient shall acknowledge in writing to the Regional Administrator that a plan will be completed within 12 months of the subaward. The Recipient must provide a work plan for completing the local or Tribal Mitigation Plan, including milestones and a timetable, to ensure that the jurisdiction will complete the plan in the required time. This requirement shall be incorporated into the award (both the planning and project subaward agreements, if a planning subaward is also awarded).

Individual Assistance	**Responsible Agency:**	FEMA
	Hazard:	All hazards

Individual Assistance (IA) provides help for homeowners, renters, businesses, and some non-profit entities after disasters occur. This program is largely funded by the U.S. Small Business Administration. For homeowners and renters, those who suffered uninsured or underinsured losses could be eligible for a Home Disaster Loan to repair or replace damaged real estate or personal property. Renters are eligible for loans to cover personal property losses. Individuals are allowed to borrow up to $200,000 to repair or replace real estate, $40,000 to cover losses to personal property, and an additional 20 percent for mitigation. For businesses, loans could be made to repair or replace disaster damages to property owned by the business, including real estate, machinery and equipment, inventory, and supplies. Businesses of any size are eligible. Non-profit organizations, such as charities, churches, and private universities are eligible. An Economic Injury Disaster Loan provides necessary working capital until normal operations resume after a physical disaster but are restricted by law to small businesses only. IA is detailed on the FEMA website: https://www.fema.gov/individual-disaster-assistance

Capability	Details	
Public Assistance	**Responsible Agency:**	FEMA
	Hazard:	All hazards
Public Assistance (PA) provides cost reimbursement aid to local governments (state, county, local, municipal authorities, and school districts) and certain non-profit 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. PA is detailed on the FEMA website: https://www.fema.gov/public-assistance-local-state-tribal-and-non-profit		
Department of Homeland Security Grant Program	**Responsible Agency:**	FEMA
	Hazard:	All hazards
The Homeland Security Grant Program (HSGP) plays an important role in the implementation of the National Preparedness System by supporting the building, sustainment, and delivery of core capabilities essential to achieving the National Preparedness Goal of a secure and resilient nation. In FY 2019, the total amount of funds available under HSGP was $1.095 billion. HSGP is comprised of three interconnected grant programs, including the State Homeland Security Program, Urban Areas Security Initiative, and Operation Stonegarden. Together, these grant programs fund a range of preparedness activities, including planning, organization, equipment purchase, training, exercises, and management and administration. Additional information regarding HSGP is available on the website: https://www.fema.gov/homeland-security-grant-program.		
Fire Management **Assistance Grant Program**	**Responsible Agency:**	FEMA
	Hazard:	Wildfire
Assistance for the mitigation, management, and control of fires on publicly or privately-owned forests or grasslands that threaten such destruction as would constitute a major disaster. Provides a 75 percent federal cost share, and the state pays the remaining 25 percent for actual cost. Before a grant can be awarded, a state must demonstrate that total eligible costs for the declared fire meet or exceed either the individual fire cost threshold - which is applies to single fires, or the cumulative fire cost threshold, which recognizes numerous smaller fires burning throughout a state. Eligible firefighting costs may include expenses for field camps; equipment use, repair and replacement; tools, materials and supplies; and mobilization and demobilization activities. Information on this program is available on the website: https://www.fema.gov/fire-management-assistance-grant-program.		
Assistance to Firefighters Grant Program	**Responsible Agency:**	FEMA
	Hazard:	Wildfire
The primary 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. Information regarding this grant program is available on the website: https://www.fema.gov/welcome-assistance-firefighters-grant-program.		
High Hazard Potential Dams Grant Program	**Responsible Agency:**	FEMA
	Hazard:	Flood
The Rehabilitation of High Hazard Potential Dams Grant Program provides technical, planning, design, and construction assistance in the form of grants to non-Federal governmental organizations or nonprofit organizations for rehabilitation of eligible high-hazard potential dams. Information regarding this program is available on the website: https://www.grants.gov/web/grants/view-opportunity.html?oppId=316238		

Capability	Details	
National Dam Safety Program	**Responsible Agency:**	FEMA
	Hazard:	Dam Failure
The National Dam Safety Program, which is led by FEMA, is a partnership of the states, federal agencies, and other stakeholders to encourage individual and community responsibility for dam safety. Grant assistance is provided to states, providing vital support for the improvement of state dam safety programs that regulate most of the dams in the United States.		
Small Business Administration Loan	**Responsible Agency:**	SBA
	Hazard:	All hazards
The Small Business Administration (SBA) provides low-interest disaster loans to homeowners, renters, businesses of all sizes, and most private nonprofit organizations. SBA disaster loans can be used to repair or replace the following items damaged or destroyed in a declared disaster: real estate, personal property, machinery and equipment, and inventory and business assets. Homeowners could apply for up to $200,000 to replace or repair their primary residence. Renters and homeowners could borrow up to $40,000 to replace or repair personal property such as clothing, furniture, cars, and appliances that were damaged or destroyed in a disaster. Physical disaster loans of up to $2 million are available to qualified businesses or most private nonprofit organizations. Additional information regarding SBA loans is available on the SBA website: https://www.sba.gov/managing-business/running-business/emergency-preparedness/disaster-assistance.		
Community Development Block Grant Program	**Responsible Agency:**	HUD
	Hazard:	All hazards
CDBG are federal funds intended to provide low and moderate-income households with viable communities, including decent housing, a suitable living environment, and expanded economic opportunities. Eligible activities include community facilities and improvements, roads and infrastructure, housing rehabilitation and preservation, development activities, public services, economic development, and planning and administration. Public improvements could include flood and drainage improvements. In limited instances and during the times of "urgent need" (e.g., post-disaster) as defined by the CDBG National Objectives, CDBG funding could 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. Funding is split into two programs: *Community Development Block Grant Disaster Recovery (CDBG-DR) Program:* This program provides grant funds, which are appropriated by Congress and allocated by HUD to rebuild disaster-impacted areas and provide crucial seed money to start the long-term recovery process. These flexible grants help cities, counties, Indian tribes, and States recover from Presidentially declared disasters, especially in low-income areas, subject to availability of supplemental appropriations. Since CDBG-DR assistance may fund a broad range of recovery activities, HUD can help communities and neighborhoods that otherwise might not recover due to limited resources. *Community Development Block Grant Mitigation (CDBG-MIT):* This program funds pose a unique opportunity for eligible grantees to use this assistance in areas impacted by recent disasters to carry out strategic and high-impact activities to mitigate disaster risks and reduce future losses. CDBG-MIT defines mitigation as activities that increase resilience to disasters and reduce or eliminate the long-term risk of loss of life, injury, damage to and loss of property, and suffering and hardship by lessening the impact of future disasters. Goals of CDBG-MIT funds: • Support data-informed investments, focusing on repetitive loss of property and critical infrastructure. • Build capacity to comprehensively analyze disaster risks and update hazard mitigation plans. • Support the adoption of policies that reflect local and regional priorities that will have long-lasting effects on community risk reduction, including risk reduction to community lifelines and decreasing future disaster costs. • Maximize the impact of funds by encouraging leverage, private/public partnerships, and coordination with other Federal dollars. Additional information regarding CDBG is available on the website: https://www.hudexchange.info/programs/cdbg-entitlement/		

Capability	Details	
Federal Highway Administration-Emergency Relief	**Responsible Agency:**	U.S. DOT
	Hazard:	All hazards
The Federal Highway Administration (FHWA) Emergency Relief is a grant program through the U.S. Department of Transportation (DOT) that can be used for 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 Department of Transportation serves as the liaison between local municipalities and FHWA. Additional information regarding the FHWA Emergency Relief Program is available on the website: https://www.fhwa.dot.gov/programadmin/erelief.cfm		
Federal Transit Administration - Emergency Relief	**Responsible Agency:**	U.S. DOT
	Hazard:	All hazards
The Federal Transit Authority (FTA) Emergency Relief is a grant program that funds capital projects to protect, repair, reconstruct, or replace equipment and facilities of public transportation systems. Administered by the Federal Transit Authority at the U.S. DOT and directly allocated to Metropolitan Transit Authority (MTA) and Port Authority, this transportation-specific fund was created as an alternative to FEMA PA. Currently, a total of $5.2 billion has been allocated to New Jersey-related entities. Additional information regarding the FTA Emergency Relief Program is available on the website: https://www.transit.dot.gov/funding/grant-programs/emergency-relief-program/emergency-relief-program		
Disaster Housing Program	**Responsible Agency:**	HUD
	Hazard:	All hazards
Emergency assistance for housing, including minor repair of home to establish livable conditions, mortgage and rental assistance available through the U.S. Department of Housing and Urban Development (HUD). Information on this program is available on the website: https://www.hud.gov/program_offices/public_indian_housing/publications/dhap		
HOME Investment Partnerships Program	**Responsible Agency:**	HUD
	Hazard:	All hazards
Grants to local and state government and consortia for permanent and transitional housing (including financial support for property acquisition and rehabilitation for low-income persons). Information on this program is available on the website: https://www.hud.gov/program_offices/comm_planning/affordablehousing/programs/home/		
HUD Disaster Recovery Assistance	**Responsible Agency:**	HUD
	Hazard:	All hazards
Grants to fund gaps in available recovery assistance after disasters (including mitigation). Information on this program is available on the website: https://www.hud.gov/info/disasterresources		
Section 108 Loan Guarantee	**Responsible Agency:**	HUD
	Hazard:	All hazards
Enables states and local governments participating in the CDBG program to obtain federally guaranteed loans for disaster-distressed areas. Information on this program is available on the website: https://www.hudexchange.info/programs/section-108/		

Capability	Details	
HOME Investment Partnerships Program	**Responsible Agency:**	HUD
	Hazard:	All hazards
The HOME Investment Partnerships Program (HOME) provides formula grants to states and localities that communities use - often in partnership with local nonprofit groups - to fund a wide range of activities including building, buying, and/or rehabilitating affordable housing for rent or homeownership. **https://www.hud.gov/program_offices/comm_planning/home**		
Smart Growth Implementation Assistance program	**Responsible Agency:**	EPA
	Hazard:	All hazards
The Smart Growth Implementation Assistance program through the U.S. Environmental Protection Agency (EPA) focuses on complex or cutting-edge issues, such as stormwater management, code revision, transit-oriented development, affordable housing, infill development, corridor planning, green building, and climate change. Applicants can submit proposals under four categories: community resilience to disasters, job creation, the role of manufactured homes in sustainable neighborhood design, or medical and social service facilities siting. Information on this program is available on the website: https://www.epa.gov/smartgrowth		
Partners for Fish and Wildlife	**Responsible Agency:**	U.S. Fish and Wildlife Service
	Hazard:	All natural hazards
Financial and technical assistance to private landowners interested in pursuing restoration projects affecting wetlands and riparian habitats. Information on this program is available on the website: https://www.fws.gov/partners/		
National Fish Passage Program	**Responsible Agency:**	U.S. Fish and Wildlife Service
	Hazard:	All natural hazards
The National Fish Passage Program partners with local communities on a voluntary basis to remove or bypass barriers, such as dams, to restore rivers and conserve aquatic resources. The program provides both financial and technical assistance for fish passage projects, which is any activity that improves the ability of fish or other aquatic species to move by reconnecting habitat that has been fragmented by a barrier.		
Transportation Investment Generating Economic Recovery (TIGER)	**Responsible Agency:**	U.S. DOT
	Hazard:	All hazards
Investing in critical road, rail, transit, and port projects across the nation. Information on this program is available on the website: https://www.transportation.gov/tags/tiger-grants		
Community Facilities Direct Loan & Grant Program	**Responsible Agency:**	USDA
	Hazard:	All hazards
This program provides affordable funding to develop essential community facilities in rural areas. An essential community facility is defined as a facility that provides an essential service to the local community for the orderly development of the community in a primarily rural area and does not include private, commercial, or business undertakings. Information on this program is available on the website: https://www.rd.usda.gov/programs-services/community-facilities-direct-loan-grant-program		
Emergency Loan Program	**Responsible Agency:**	USDA
	Hazard:	All natural hazards
USDA's Farm Service Agency provides emergency loans to help producers recover from production and physical losses due to drought, flooding, other natural disasters, or quarantine. Information on this program is available on the website: https://www.fsa.usda.gov/programs-and-services/farm-loan-programs/emergency-farm-loans/index		

Capability	Details	
Emergency Watershed Protection Program	**Responsible Agency:**	USDA
	Hazard:	All natural hazards
The Emergency Watershed Protection (EWP) program provides assistance to relieve imminent hazards to life and property caused by floods, fires, drought, windstorms, and other natural occurrences through the Natural Resources Conservation Service. Information on this program is available on the website: https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/landscape/ewpp/		
Financial Assistance	**Responsible Agency:**	NRCS
	Hazard:	All hazards
Financial assistance to help plan and implement conservation practices that address natural resource concerns or opportunities to help save energy, improve soil, water, plant, air, animal, and related resources on agricultural lands and non-industrial private forest land. Information on this program is available on the website: https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/		
Watershed Rehabilitation Program	**Responsible Agency:**	NRCS
	Hazard:	Flood, dam failure
The Watershed Rehabilitation Program helps project sponsors rehabilitate aging dams that are reaching the end of their design lives. This rehabilitation addresses critical public health and safety concerns. NRCS selects projects based on the risks to life and property if a dam failure were to occur.		
Watershed and Flood Prevention Operations Program	**Responsible Agency:**	NRCS
	Hazard:	Flood, dam failure
The purpose of the program is to protect and restore watersheds up to 250,000 acres.		
Emergency Management Performance Grants (EMPG) Program	**Responsible Agency:**	US DHS
	Hazard:	All hazards
Emergency Management Performance Grant (EMPG) funding is available to the State of New Jersey to educate people and protect lives and structures from natural and technical hazards. The grant is to encourage the development of comprehensive emergency management, including terrorism consequence management, at the state and local level and to improve emergency management planning, preparedness, mitigation, response and recovery capabilities. Information on this program is available on the website: https://www.fema.gov/emergency-management-performance-grant-program		
Reimbursement for Firefighting on Federal Property	**Responsible Agency:**	US DHS
	Hazard:	Wildfire
Provides reimbursement only for direct costs and losses over and above normal operating costs. Information on this program is available on the website: https://www.usfa.fema.gov/grants/firefighting_federal_property.html		
Land & Water Conservation Fund	**Responsible Agency:**	National Park Service
	Hazard:	All hazards
Matching grants to states and local governments for the acquisition and development of public outdoor recreation areas and facilities (as well as funding for shared federal land acquisition and conservation strategies). Information on this program is available on the website: https://www.nps.gov/subjects/lwcf/index.htm		

Capability	Details	
Clean Water Act Section 319(h) Grants	**Responsible Agency:**	U.S. EPA
	Hazard:	Flood
Clean Water Act Section 319(h) funds are provided only to designated state and tribal agencies to implement their approved nonpoint source management programs. State and tribal nonpoint source programs include a variety of components, including technical assistance, financial assistance, education, training, technology transfer, demonstration projects, and regulatory programs. Each year, EPA awards Section 319(h) funds to states in accordance with a state-by-state allocation formula that EPA has developed in consultation with the states (EPA 2022). Section 319(h) funding decisions are made by the states. States submit their proposed funding plans to EPA. If a state's funding plan is consistent with grant eligibility requirements and procedures, EPA then awards the funds to the state (EPA 2022). In New Jersey, NJDEP uses these funds can be used to fund water quality improvements and to target restoration and tree planting projects, including impervious removal, retrofitting of stormwater management basins with green infrastructure within communities, specifically overburdened communities.		
Coastal Zone Management Act	**Responsible Agency:**	NOAA
	Hazard:	Flood
This act, administered by NOAA, provides for the management of the nation's coastal resources. The goal is to "preserve, protect, develop, and where possible, to restore or enhance the resources of the nation's coastal zone." The Coastal Zone Management Act outlines three national programs, the National Coastal Zone Management Program, the National Estuarine Research Reserve System, and the Coastal and Estuarine Land Conservation Program. The National Coastal Zone Management Program aims to balance competing land and water issues through state and territorial coastal management programs, the reserves serve as field laboratories that provide a greater understanding of estuaries and how humans impact them, and Coastal and Estuarine Land Conservation Program provides matching funds to state and local governments to purchase threatened coastal and estuarine lands or obtain conservation easements (NOAA 2023). Grant opportunities are often made available from additional CZM funding. Funding is also provided to the Jacques Cousteau National Estuarine Research Reserve.		
Community-Based Restoration	**Responsible Agency:**	NOAA
	Hazard:	Flood, Dam Failure
The program grants support restoration projects that use a habitat-based approach to rebuild productive and sustainable fisheries, contribute to the recovery and conservation of protected resources, and promote healthy ecosystems and resilient communities.		
USACE Planning Assistance to States (PAS) Program	**Responsible Agency:**	USACE
	Hazard:	Flood
Section 22 of the 1974 Water Resources Development Act provides authority for the US Army Corps of Engineers Planning Assistance to the States (PAS) and Indian Nations. Under this program, USACE assists the states, local governments, Native American Tribes, and other non-federal entities in the preparation of comprehensive plans for the development and conservation of water and related land resources. Types of work that can be done include Water Quality Studies, Wetland Evaluation Studies, Flood Plain Management Studies, Coastal Zone Management/Protection Studies, Harbor/Port Studies, or other water resource planning investigations. The needed planning assistance is determined by the individual non-federal sponsors.		
USACE Continuing Authorities Program (CAP)	**Responsible Agency:**	USACE
	Hazard:	Flood, Dam Failure
Congress has provided USACE with several standing authorities to study and build water resource projects for various purposes without additional project-specific congressional authorization. The types of projects addressed by the CAP include emergency streambank and shoreline erosion, flood control projects, snagging and clearing for flood control, and small beach erosion control projects. Cost-share varies based on subprograms.		

Capability	Details	
USACE General Investigation (GI)	**Responsible Agency:**	USACE
	Hazard:	Flood
These are congressionally authorized studies under USACE's Civil Works program. Congress can authorize USACE to study, design, and construct major flood risk management projects. The feasibility study is cost-shared 50/50 and construction is cost-shared 65/35 between the federal government and non-federal sponsor. These are generally large-scale projects that cost more than $10 million. Congress can also authorize USACE to conduct other water-related studies/projects such as watershed assessments, ecosystem restoration, and navigation improvements.		
Section 206 Aquatic Ecosystem Restoration Projects	**Responsible Agency:**	USACE
	Hazard:	Dam failure
The purpose of the USACE ecosystem restoration activities is to restore significant ecosystem function, structure, and dynamic processes that have been degraded. Ecosystem restoration efforts involve examining the problems contributing to the system degradation and developing alternative means to solve these problems. This program has previously been used to fund dam removal and provide for fish passage. Cost shares vary by project type.		
Planning Assistance to the States	**Responsible Agency:**	USACE
	Hazard:	Flood, dam failure
USACE is authorized to provide planning assistance, usually for a specific technical item rather than detailed designs for construction. Dam safety/failure studies have been conducted in recent years. To request assistance, state, local, or tribal entities should submit a letter to the Chief of the Planning Division in their USACE district detailing the location and nature of the problem to be investigated.		
Small Flood Control Program	**Responsible Agency:**	USACE
	Hazard:	Flood, dam failure
Under the Small Flood Control Program, USACE works with communities to plan, design, and construct certain small flood control projects that have not already been specifically authorized by Congress. Studies are required to evaluate potential projects. Each project selected must be: • economically justified, meaning the benefits of the project outweigh the cost of construction • environmentally acceptable • complete within itself		

5.3.2 State

Table 5-6 summarizes the fiscal capabilities available to Burlington County, at the state level.

Table 5-6. Pre- and Post-Disaster Funding Capabilities – State

Capability	Details	
New Jersey Clean Energy Program	**Responsible Agency:**	New Jersey Board of Public Utilities
	Hazard:	Hazards impacted by climate change
The New Jersey Clean Energy Program promotes increased energy efficiency and the use of clean, renewable sources of energy, including solar, wind, geothermal, and sustainable biomass. The results for New Jersey are a stronger economy, less pollution, lower costs, and reduced demand for electricity. The Clean Energy Program offers financial incentives, programs, and services for residential, commercial, and municipal customers. Refer to https://www.njcleanenergy.com/main/about-njcep/about-njcep for additional details on the program. 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 within a community or county). 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.		
NJDEP Grant and Loan Programs	**Responsible Agency:**	NJDEP
	Hazard:	All Hazards
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. Information on each of the programs can be found on the NJDEP website: https://www.nj.gov/dep/grantandloanprograms/.		
Green Acres Program	**Responsible Agency:**	NJDEP
	Hazard:	All hazards
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. Green Acres 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. Over the years, voters have authorized $3.3 billion in Green Acres funding, approving every bond referendum put before them.		
Blue Acres Program	**Responsible Agency**	NJDEP
	Hazard:	All hazards
The Blue Acres Program purchases flood-prone properties. This land preservation 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. A secondary benefit of these laws and rules is that flood-prone properties are often purchased and not available for future development. Funding for Blue Acres is a combination of dedicated state funding from the cooperate business tax and federal grants. To date, the program has received five state funding appropriations from 2009-2019, ranging from $3 million to $12 million to effectuate buyouts in flood-prone areas. Most recently, the 3 Garden State Preservation Trust appropriation recommendation proposed Blue Acres receive an infusion of $10.5 million ($10 million for buyouts and $500,000 for administrative costs).		

Capability	Details	
Open Space and Farmland Preservation Programs	**Responsible Agency:**	Counties, New Jersey State Agriculture Development Committee, and the New Jersey Green Acres Program
	Hazard:	Flood, Severe Weather
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 Water Bank	**Responsible Agency:**	NJDEP, New Jersey Environmental Infrastructure Trust
	Hazard:	Flood, Severe Weather
The New Jersey Water Bank is a partnership between the NJDEP and the New Jersey Environmental Infrastructure Trust 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. The Water Bank finances projects by utilizing two funding sources. The Trust issues revenue bonds which are 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.		
NJDEP Dam Restoration and Inland Water Projects Loan Program	**Responsible Agency:**	NJDEP Dam Safety Program
	Hazard:	Flood, Dam Failure
The New Jersey Dam Restoration and Inland Water Projects Loan Program was established by the "Green Acres, Clean Water, Farmland and Historic Preservation Bond Act of 1992", Public Law 1992, c. 88. The purpose is to provide loans to dam owners for dam restoration or inland waters projects.		
Dam Restoration Loan Program	**Responsible Agency:**	NJDEP Dam Safety Program
	Hazard:	Dam failure
The New Jersey Dam Restoration Loan Program was established by the "Dam, Lake, Stream, Flood Control, Water Resources and Wastewater Treatment Project Bond Act of 2003", Public Law 2003, c. 162. The purpose is to provide loans to dam owners for dam restoration projects.		
New Jersey Redevelopment Authority	**Responsible Agency:**	New Jersey Redevelopment Authority
	Hazard:	All hazards
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	**Responsible Agency**	NJDCA
	Hazard:	All hazards
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.		

<table>
<tr><th>Capability</th><th colspan="2">Details</th></tr>
<tr><td rowspan="2">New Jersey Board of Public Utilities (BPU)</td><td>Responsible Agency:</td><td>BPU</td></tr>
<tr><td>Hazard:</td><td>All hazards</td></tr>
<tr><td colspan="3">The New Jersey 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 are used during response and recovery efforts in the event of emergency or disaster and is also used to analyze impact of mitigation plans and projects. BPU also provides technical assistance for the Energy Resiliency Program</td></tr>
<tr><td rowspan="2">Environmental Infrastructure Financing Program</td><td>Responsible Agency:</td><td>NJDEP</td></tr>
<tr><td>Hazard:</td><td>All hazards</td></tr>
<tr><td colspan="3">Qualified borrowers receive loans in two equal parts: Approximately one half to three quarters comes from a 0-percent interest State Revolving Fund maintained by the NJDEP. The other portion comes from proceeds of highly rated tax-exempt revenue bonds sold by the Trust. Combining these two funds results in a loan that is 50 to 75 percent lower than traditional loan rates.</td></tr>
<tr><td rowspan="2">New Jersey Small Cities Communities Development Block Grants</td><td>Responsible Agency:</td><td>NJDCA</td></tr>
<tr><td>Hazard:</td><td>All hazards</td></tr>
<tr><td colspan="3">The New Jersey Small Cities Communities 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. Information on the program is available on the website: https://www.nj.gov/dca/divisions/dhcr/offices/neighborhood.html.</td></tr>
<tr><td rowspan="2">New Jersey Conservation Foundation</td><td>Responsible Agency:</td><td>New Jersey Conservation Foundation</td></tr>
<tr><td>Hazard:</td><td>All hazards</td></tr>
<tr><td colspan="3">The New Jersey Conservation Foundation is a private, not-for-profit organization. Through acquisition and stewardship, the Foundation protects strategic lands, promotes strong land use policies, and forges partnerships to achieve conservation goals. Grants are used to help fund preservation activities. Information on the program is available on the website: https://www.njconservation.org/what-we-do/.</td></tr>
<tr><td rowspan="2">The New Jersey Infrastructure Bank</td><td>Responsible Agency:</td><td>NJDEP</td></tr>
<tr><td>Hazard:</td><td>All hazards</td></tr>
<tr><td colspan="3">The New Jersey Infrastructure Bank is an independent state financing authority responsible for providing and administering low interest rate loans to qualified municipalities, counties, regional authorities, and water purveyors in New Jersey. Two programs provide and administer low interest rate loans to qualified municipalities, counties, regional authorities, and water purveyors in New Jersey. Approximately $350 million is awarded annually.

1. New Jersey Environmental Infrastructure Trust for the purpose of financing water quality infrastructure projects that enhance ground and surface water resources, ensure the safety of drinking water supplies, protect the public health, and make possible responsible and sustainable economic development.

2. The New Jersey Transportation Infrastructure Bank is an independent state financing authority responsible for providing and administering low interest rate loans to qualified municipalities, counties, and regional authorities in New Jersey for the purpose of financing transportation quality infrastructure projects.

The New Jersey Infrastructure Bank provides principal forgiveness opportunities and better financing packages for those projects that implement climate change resilience measures.

Information on the program is available on the website: https://www.njib.gov/.</td></tr>
</table>

TETRA TECH

Capability	Details	
Drinking Water State Revolving Fund	**Responsible Agency:**	NJDEP
	Hazard:	Drought
The Drinking Water State Revolving Fund program assists water systems in financing the cost of infrastructure through the use of federal and New Jersey Infrastructure Trust funds. Additionally, the Water Supply program provides operator licensing and training support as well as financial assistance through the Fund. Information on the program is available on the website: https://www.state.nj.us/dep/watersupply/dws_loans.html.		
New Jersey Department of Transportation (NJDOT) Local Aid and Economic Development	**Responsible Agency:**	NJDOT
	Hazard:	All hazards
NJDOT is committed to advancing projects that enhance safety, renew the aging infrastructure and the state's economy and support new transportation opportunities. The Transportation Trust Fund provides the opportunity for state assistance to local governments for the funding of road, bridge, and other transportation projects. Annually, the Transportation Trust Fund provides $400 million in state aid to municipalities and counties for local transportation improvements. In addition, several programs which provide funding to counties and municipalities are funded with federal monies available through the Transportation Equity Act for the 21st Century (TEA 21) legislation. Information on the program is available on the website: https://www.state.nj.us/transportation/business/localaid/funding.shtm.		
Environmental Aid Act (NJSA 13:1H – 1 to 7) Office of Environmental Services Matching Grants Program for Local Environmental Agencies (N.J.A.C.7:5)	**Responsible Agency:**	NJDEP Office of Environmental Services
	Hazard:	Natural hazards
State aid may be granted by the department 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 shall be a report on environmental conditions within 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 department may provide technical assistance in addition to (or in lieu of) state aid to any local environmental agency for the purpose indicated in this act. The purpose of the funding dedicated under this act is to assist local environmental commissions and soil conservation districts with funding for a variety of local environmental projects, including community education projects; 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; and 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 (NJDEP n.d.). Projects funded by this grant are reported online. Examples of mitigation projects that have been funded in the past include Waterways Beach Monitoring and Management Strategy, Dune Project, Beach Protection and Storm Drainage Plan, Beach Storm Water Drainage Analysis, Stream Corridor/Greenway Protection Plan, Shoreline Bioengineering Demonstration and Outreach Project, Stream, and the Pamphlet/Education Project.		
Sewage Infrastructure Improvement Act Grants (N.J.A.C.7:22)	**Responsible Agency:**	NJDEP
	Hazard:	Flood
New Jersey Sewage Infrastructure Improvement Act establishes comprehensive requirements for NJDEP and municipalities/authorities to address combined sewer overflows and stormwater management. NJDEP issues permits and provides below-market interest rate loans through the Environmental Infrastructure Financing Program to municipalities for capital improvements that improve water quality. To prioritize wastewater projects under the Environmental Infrastructure Financing Program, projects are ranked to address higher state priorities or high-water quality problems or improvements.		

Capability	Details	
Water Pollution Control Quality Act (NJSA 58:10A-1 to 60) **Water Quality Management Planning Rules (N.J.A.C.7:15)**	**Responsible Agency:**	NJDEP
	Hazard:	Flood
This Act phased out the Construction Grants Program and required states to establish a State Revolving Fund Loan Program. The last year in which construction grants were made available for new projects in New Jersey was 1989. Grant awards are available currently to cover increased allowable costs for projects that previously received a construction grant. The rules serve two basic functions: (1) to establish the Department's general regulatory framework for water quality planning and (2) to supplement other Department rules pertaining to wastewater management. This Act is implemented through a number of regulations and programs throughout NJDEP, including but not limited to Freshwater Wetlands Protection Act (NJAC 7:7A), Stormwater Management (NJAC 7:8), Water Pollution Control (NJAC 7:9), Surface Water Quality Standards (NJAC 7:9B), Safe Drinking Water Act (NJAC 7:10), Flood Hazard Control Act (NJAC 7:13), Pollutant Discharge Elimination System (NJAC 7:14A), and Water Quality Management (NJAC 7:15). Through these rules, NJDEP regulates development location and intensity of uses, protects floodplain capacity and riparian buffers, funds restoration of lakes and streams, and funds infrastructure improvements that primarily provide environmental health. Secondarily, the rules allow NJDEP to provide mitigation in the form of reduced losses due to infrastructure failure. Wastewater Management Plans (WMP) are integral components of area-wide Water Quality Management Plans. WMPs are the vehicle through which the continuing planning process integrates local and regional planning into the area-wide Water Quality Management Plans.		
New Jersey Department of Environmental Protection: WRM, Municipal Finance and Construction Element New Jersey Environmental Infrastructure Financing Program	**Responsible Agency:**	NJDEP
	Hazard:	Drought, Flood
The New Jersey Environmental Infrastructure Financing Program is a revolving loan program for the construction of drinking water facilities, wastewater treatment facilities, sludge management systems, combined sewer overflow abatement, stormwater, and other non-point source management projects. The program also offers funding to publicly and privately-owned drinking water systems for the construction or upgrade of drinking water facilities, transmission and distribution systems, storage facilities, and source development. The Program also offers a disaster relief fund that will be able to provide short-term or bridge loans to entities that are in need of an upfront cash flow (NJDEP 2017).		
New Jersey Turnpike Authority: Capital Program	**Responsible Agency:**	New Jersey Turnpike Authority
	Hazard:	Wildfire, Severe Storm
The New Jersey Turnpike Authority (Authority) is dedicated to the safe and efficient movement of people and goods over two of the busiest toll roads in the United States – the New Jersey Turnpike and the Garden State Parkway. The Authority's highways are a critical link in the transportation network of the Northeast Corridor. Under the current 10-year, $7 billion capital program adopted in 2008, the Authority has expanded capacity, repaired 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. Under this capital program, the following projects have been advanced addressing hazard mitigation: Bridge Security Program, Forest Fire Prevention, Roadside Weather Information System (RWIS), Coastal Evacuation. 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.		
New Jersey Department of Transportation (NJDOT): Local Aid and Economic Development	**Responsible Agency:**	NJDOT
	Hazard:	Flood
NJDOT is committed to advancing transportation projects that enhance safety, renew aging infrastructure, and support new transportation opportunities at the county and municipal level. The Transportation Trust Fund and the Safe, Accountable, Flexible, Efficient Transportation Equity Act (SAFE-TEA) legislation provide the opportunity for funding assistance to local governments for road, bridge, and other transportation projects. NJDOT has established several local aid programs that provide financial support to counties and municipalities for capital improvements to transportation infrastructure.		

Capability	Details	
Coastal Engineering and Restoration Projects	**Responsible Agency:**	NJDEP
	Hazard:	Coastal erosion, floods
Funding for coastal engineering and restoration projects is available from a variety of state funding sources, including: • Coastal Engineering • Coastal and Land Use Enforcement • Dam Safety • Flood Control • Land Resource Protection • Resilience Engineering and Construction • Tidelands		

5.3.3 County

Table 5-7 summarizes the fiscal capabilities available to Burlington County, at the county level. For a discussion of fiscal capabilities at the municipal level, refer to the jurisdictional annexes in Volume II.

Table 5-7. Pre- and Post-Disaster Funding Capabilities – County

Capability	Details	
Burlington County Municipal Park Development Program	**Responsible Agency:**	Burlington County Department of Resource Conservation
	Hazard:	All Hazards
The Burlington County Municipal Park Development Program was created to assist its partner municipalities in the development and improvement of parks for outdoor passive and active recreation and in their efforts to preserve open space and farmland. Through this program, the County Commissioners will offer grants to build or improve municipal parks, to offset the local cost share required by the county's Farmland Preservation Program, or to provide additional financial assistance for acquisition of locally important open space in conjunction with the County's Local Open Space Preservation Program.		
Farmland Preservation Program	**Responsible Agency:**	Burlington County Agriculture Development Board
	Hazard:	All Hazards
The Farmland Preservation Program is committed to preserving a permanent agricultural land base and maintaining an environment that supports a viable agricultural industry. Over 28,000 acres of farmland have been preserved to date through this County program.		
Open Space Preservation Program/Trail Development Program	**Responsible Agency:**	Burlington County Department of Resource Conservation
	Hazard:	All Hazards
The Open Space Preservation Program/Trail Development Program is responsible for acquisition of the land that will become part of the County Parks System and developing that land for public enjoyment.		

5.4 PLAN INTEGRATION

Hazard mitigation is a sustained action taken to reduce or eliminate the long-term risk to human life and property from hazards. Integrating hazard mitigation into a community's existing plans, policies, codes, and programs leads to development patterns that do not increase risk from known hazards or leads to redevelopment that reduces risk from known hazards. The Burlington County Planning Partnership was tasked with identifying how hazard mitigation is integrated into existing planning mechanisms. The jurisdictional annexes in Volume II detail how this is done for each participating municipality and the County. During this process, many municipalities recognized the importance and benefits of incorporating hazard mitigation into future municipal planning and regulatory processes and have added new mitigation actions to support this effort.

The Planning Partners will continue to incorporate mitigation planning as an integral component of daily government operations. Planning Partnership representatives will continue to work with local government officials to integrate the newly adopted hazard mitigation goals and actions into the general operations of government and partner organizations. Further, the sample adoption resolution presented in Appendix A (Plan Adoption) includes a resolution item stating the intent of the local governing body to incorporate mitigation planning as an integral component of government and partner operations. By doing so, the Planning Partnership anticipates that:

- Hazard mitigation planning will be formally recognized as an integral part of overall planning and emergency management efforts.
- The Hazard Mitigation Plan, master 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.

Section 7 (Plan Maintenance) provides for additional information on the implementation of the hazard mitigation plan through integration into existing programs.

SECTION 6. MITIGATION STRATEGY

6.1 INTRODUCTION

This section presents mitigation actions for the Planning Partnership to reduce potential exposure and losses identified as concerns in the risk assessment. The Planning Partnership reviewed the risk assessment to develop the mitigation actions presented herein.

Hazard mitigation reduces the potential impacts of, and costs associated with, emergency and disaster-related events. Mitigation actions address a range of impacts, including impacts on the population, property, the economy, and the environment.

Mitigation actions can include activities such as: revisions to land-use planning, training and education, and structural and nonstructural safety measures.

6.2 BACKGROUND AND PAST MITIGATION ACCOMPLISHMENTS

In accordance with federal requirements, a discussion regarding past mitigation activities and an overview of past efforts is provided as a foundation for understanding the mitigation goals, objectives, and activities outlined in this HMP. The Planning Partnership, through previous and ongoing hazard mitigation activities, has demonstrated that it is proactive in protecting its physical assets and citizens against losses from natural and human-caused hazards. Examples of previous and ongoing actions, projects and capabilities include the following:

- Burlington County led the development of a 2019 HMP update and facilitated the 2024 Update, which included the participation of all municipal governments in the Planning Area. The current planning process represents the regulatory five-year local plan update process.
- All municipalities in Burlington County, except the Borough of Fieldsboro, participate in the National Flood Insurance Program (NFIP), which requires the adoption of FEMA floodplain mapping and certain minimum construction standards for building within the floodplain.
- Currently, two municipalities in Burlington County are participating in NFIP Community Rating System (CRS) program and have floodplain management programs that exceed NFIP requirements.
- Many municipalities in Burlington County have adopted regulatory standards regarding land use and zoning that exceed minimum requirements and provide the communities with greater capability to manage development without increasing hazard risk and vulnerability.
- Municipalities have participated on a limited basis in available mitigation grant funding opportunities to implement mitigation projects.
- The County and its municipalities have implemented mitigation actions to protect critical facilities and infrastructure throughout the Planning Area. These actions and others were identified in the County and municipal mitigation strategies in the 2019 HMP.

- NJOEM supports Burlington County communities reducing their risk and increasing their resilience. NJOEM provides a comprehensive program to support local jurisdictions as they assess the risks they face, plan to mitigate them, and fund those plans to implement mitigation projects that reduce risk across the Planning Area.
- In 2020, the County and municipalities worked to mitigate the impacts of the coronavirus pandemic through education of the public, enforcement of local and state social distancing and masking measures, and establishment of best practices to slow the spread of COVID-19.

These past and ongoing activities have contributed to the Planning Partnership's understanding of its hazard preparedness and future mitigation activity needs, costs, and benefits. These efforts provide an ongoing foundation for the Planning Partnership to use in developing this HMP update.

6.3 GENERAL MITIGATION PLANNING APPROACH

The overall approach used to update the County and local hazard mitigation strategies was based on FEMA and State of New Jersey regulations and guidance for local mitigation plan development, including:

- DMA 2000 implementing regulations, specifically 44 CFR 201.6 (local mitigation planning)
- FEMA Local Mitigation Planning Policy Guide, April 19, 2023
- FEMA Local Mitigation Planning Handbook, May 2023
- FEMA Local Mitigation Plan Review Guide, October 1, 2011
- FEMA Integrating Hazard Mitigation into Local Planning, March 1, 2013
- FEMA Plan Integration: Linking Local Planning Efforts, July 2015
- FEMA Mitigation Planning How-To Guide #3, Identifying Mitigation Actions and Implementing Strategies (FEMA 386-3), February 2013
- FEMA Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards, January 2013

The mitigation strategy update approach included the following steps:

- Problem and solutions identification (see Section 6.4)
- Update of mitigation goals and objectives (see Section 6.5)
- Mitigation strategy development and update (see Section 6.6), including:
    - Review of the 2019 HMP mitigation actions
    - Identification of mitigation techniques
    - 2024 HMP mitigation action plan
    - Mitigation best practices
    - Mitigation strategy evaluation and prioritization
    - Benefit/cost review

6.4 PROBLEM AND SOLUTIONS IDENTIFICATION

A problem and solutions identification exercise was completed by the participating jurisdictions. Participants were asked to fill out at least one problem and solution for each of the hazards of concern for the 2024 HMP update. Jurisdictions were asked to begin the exercise by identifying a problem caused by each of the hazards. Next, a range of potential solutions to that problem were identified. To conclude the discussion of each ranked hazard, participants were asked about anticipated costs, benefits, funding sources, and project feasibility. The results were reviewed and discussed with the contracted consultant and used to help identify capabilities and potential mitigation actions.

6.5 UPDATE OF MITIGATION GOALS AND OBJECTIVES

This section documents the efforts to update the hazard mitigation goals and objectives established to reduce or avoid long-term vulnerabilities to the identified hazards.

FEMA defines **Goals** as general guidelines that explain what should be achieved. Goals are usually broad, long-term, policy statements, and represent a global vision.

FEMA defines **Objectives** as strategies or implementation steps to attain mitigation goals. Unlike goals, objectives are specific and measurable, where feasible.

FEMA defines **Mitigation Actions** as specific actions that help to achieve the mitigation goals and objectives.

According to CFR 201.6(c)(3)(i): "The hazard mitigation strategy shall include a description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards." Further, FEMA mitigation planning guidance recommends establishing objectives to better tie mitigation goals to specific mitigation strategies (e.g., projects, activities, and initiatives).

The goals established in the 2019 Burlington County HMP were presented to the Steering Committee and Planning Partnership for review at the beginning of the planning process. This review was made with consideration of the hazard events and losses since the 2019 plan, the updated hazard profiles and vulnerability assessment, and the goals and objectives established in the updated 2019 State of New Jersey HMP and proposed in the draft of the 2024 State of New Jersey HMP.

The Steering Committee met on August 22, 2023, to review the 2019 goals and objectives and provided input on updated goals and objectives. These updates were presented to the Planning Partnership during the August 29, 2023, Planning Partnership Kick-Off meeting. As a result of these efforts, Table 6-1 presents the Planning Partnership's 2019 goals and the 2024 updated goals; Table 6-2 presents the 2019 HMP objectives and the updated 2024 objectives.

Table 6-1. Burlington County 2019 and 2024 Hazard Mitigation Plan Goals

2019 HMP Goals	2024 HMP Update Goals
1. Protect Life 2. Protect Property 3. Promote a Sustainable Economy 4. Protect the Environment 5. Increase Public Awareness 6. Support Continuity of Operations	1. Protect Life 2. Protect Property 3. Increase public preparedness and awareness 4. Develop and maintain an understanding of increased risk from climate change impacts to natural hazards 5. Enhance mitigation capabilities to reduce hazard vulnerabilities 6. Support continuity of operations pre-, during, and post-hazard events 7. Reduce the risk of natural hazards for socially vulnerable populations

Table 6-2. Burlington County 2019 and 2024 Hazard Mitigation Plan Objectives

2019 HMP Objectives	2024 HMP Update Objectives
1. Promote disaster-resistant development. 2. Build and support local capacity to enable the public to prepare for, respond to, and recover from disasters. 3. Reduce the possibility of damages to emergency facilities from natural hazards. 4. Reduce the possibility of damage and losses due to natural hazards affecting the county and its municipalities. 5. Educate the public on the risk from natural and man-made hazards and increase their awareness of preparation, mitigation, response, and recovery activities. 6. Increase communications before, during, and after natural hazard events. 7. Retrofit, acquire, or relocate vulnerable property in high hazard areas including those known to be subject to repetitive damages. 8. Utilize the best available information on hazard exposure and vulnerability to support appropriate land use decisions within Burlington County. 9. Increase local government official awareness regarding funding opportunities for mitigation and participating/contributing to future plan updates	1. Promote disaster-resistant development. 2. Build and support local capacity to enable the public to prepare for, respond to, and recover from disasters. 3. Reduce the possibility of damages to critical facilities from natural hazards. 4. Reduce the possibility of damage and losses due to natural hazards affecting the county and its municipalities. 5. Educate the public on the risk from natural and man-made hazards and increase their awareness of preparation, mitigation, response, and recovery activities. 6. Increase communications before, during, and after natural hazard events. 7. Retrofit, acquire, or relocate vulnerable property in high hazard areas including those known to be subject to repetitive damages. 8. Utilize the best available information on hazard exposure and vulnerability to support appropriate land use decisions within Burlington County. 9. Increase local government official awareness regarding funding opportunities for mitigation and participating/contributing to future plan updates. 10. Identify, and provide additional resources to, vulnerable and marginalized populations that have reduced capacity to respond to hazards compared with the general population. 11. Ensure dam infrastructure is maintained. 12. Support the identification and access to funding to repair/rehabilitate/replace dams. 13. Ensure Emergency Action Plans are developed and updated. 14. Acquire and maintain detailed data regarding critical facilities and lifelines such that these sites can be prioritized and risk-assessed for possible mitigation actions. 15. Support increased participation in the National Flood Insurance Program and Community Rating System. 16. Promote sustainable and equitable land development practices that direct future development away from hazard-prone areas. 17. Encourage and support multi-jurisdictional mitigation projects that leverage funding and support from multiple levels of government and community organizations. 18. Strengthen inter-jurisdiction and inter-agency communication, coordination, and partnerships to foster hazard mitigation actions and/or projects. 19. Encourage the establishment of policies to help ensure the prioritization and implementation of mitigation actions and/or projects designed to benefit essential facilities, services, and infrastructure.

6.6 MITIGATION STRATEGY DEVELOPMENT AND UPDATE

As required by FEMA, the County and participating municipalities completed a comprehensive evaluation of the mitigation strategies and actions from the 2019 HMP and reported on the status of each. Their update may be found in each jurisdictional annex (see Volume II). In addition, the County and participating municipalities were provided the opportunity to include new strategies or actions to include in the 2024 HMP Update. New actions were prioritized to ensure they are cost-effective, environmentally sound, and technically feasible using the methodology outlined below.

6.6.1 Review of the 2019 HMP Mitigation Action Plans

To evaluate progress on local mitigation actions, the planning consultant met with each participant to discuss the status of the mitigation actions identified in the 2019 plan. For each action, jurisdictions were asked to provide the status of each action (*No Progress, In Progress, Ongoing Capability, Discontinue, or Completed*) and provide review comments on each. Jurisdictions were requested to quantify the extent of progress and provide reasons for the level of progress or why actions were being discontinued. Each jurisdictional annex in Volume II provides a table identifying the jurisdiction's prior mitigation strategy, the status of those actions and initiatives, and their disposition within their updated strategy.

Local mitigation actions identified as *Complete*, and those actions identified as *Discontinued*, were removed from the updated strategies. Local mitigation actions identified as an *Ongoing Capability* were incorporated into the capability assessment of each jurisdictional annex. Those actions identified as *No Progress* or *In Progress* that remain a priority for the jurisdiction, have been carried forward into the updated mitigation strategy. Actions identified as *Ongoing Capabilities* which are fully integrated into the normal operational and administrative framework of the community have been identified within the capabilities section of each annex and removed from the updated mitigation strategy.

At the August 2023 Planning Partnership kick-off meeting and during subsequent local-level planning meetings (phone, email), all participating jurisdictions were requested to identify mitigation activities completed, ongoing, and potential/proposed. As new potential mitigation actions, projects, or initiatives became evident during the plan update process, including as part of the risk assessment update and as identified through the public and stakeholder outreach process detailed in Section 2 (Planning Process), jurisdictions were made aware of these either through direct communication (local meetings, email, phone), at Steering Committee and Planning Partnership meetings, or via their draft jurisdictional annexes.

Throughout the planning process, the planning consultant worked directly with each community (phone, email) to assist with the development and update of their annex and include mitigation strategies, focusing on identifying well-defined, implementable projects with a careful consideration of benefits (risk reduction, losses avoided), costs, and possible funding sources (including mitigation grant programs).

6.6.2 Identification and Analysis of Mitigation Techniques

Concerted efforts were made to assure that municipalities develop updated mitigation strategies that included activities and initiatives covering the range of mitigation action types described in recent FEMA planning guidance (FEMA "Local Mitigation Planning Handbook" May 2023), specifically:

- **Local Plans and Regulations**—These actions include government authorities, policies, or codes that influence the way land and buildings are being developed and built.
- **Structure and Infrastructure Projects**—These actions involve modifying existing structures and infrastructure to protect them from a hazard or remove them from a hazard area. This could apply to public or private structures as well as critical facilities and infrastructure. This could apply to public or private structures as well as critical facilities and infrastructure.
- **Natural Systems Protection**—This type of action can include green infrastructure and low impact
- development, nature-based solutions, Engineering with Nature and bioengineering to incorporate natural features or processes into the built environment.
- **Education and Awareness Programs**—These types of actions keep residents informed about potential natural disasters. Many of these types of actions are eligible for funding through the FEMA HMA program. These actions may also include participation in national programs, such as the National Flood Insurance Program and Community Rating System, StormReady (NOAA), and Firewise (NFPA) Communities.

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 (PR)—**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 (PP)—**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 (PI)**—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 (NR)**—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 (SP)**—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 (ES)**—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 Lifeline Facilities

Planning partner mitigation actions that address vulnerable lifeline 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 lifeline facilities.

Accounting for Climate Change

As discussed in the hazard profiles in this HMP, the long-term effects of climate change are anticipated to exacerbate the impacts of weather-related hazards (e.g., flood, severe weather, severe winter weather, 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.

6.6.3 2024 HMP Mitigation Action Plan

To help support the selection of an appropriate, risk-based mitigation strategy, each annex provides a summary of hazard vulnerabilities identified during the plan update process, either directly by municipal representatives, through the capability assessment, and through the hazard profiling and vulnerability assessment process.

In October 2023, the Planning Partnership participated in a mitigation strategy development workshop, supplemented by emails and phone calls between jurisdictions and the contract consultant, 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 were intended to provide a detailed description of the problem area, including its impacts on the municipality/jurisdiction; past damages; loss of service; etc. An effort was made to include the street address of the property/project location, adjacent streets, water bodies, and well-known structures as well as a brief description of existing conditions (topography, terrain, hydrology) of the site. These problem statements formed a bridge between the hazard risk assessment which quantifies impacts to each community with the development of actionable mitigation strategies.

As discussed in the hazard profiles in Section 4.3, the long-term effects of climate change are anticipated to exacerbate the impacts of weather-related hazards including flood, hurricanes and tropical storm, nor'easter, severe weather, severe winter weather, and wildfire. By way of addressing these climate change-sensitive hazards within their local mitigation strategies and integration actions, communities are working to evaluate and recognize these long-term implications and potential impacts, and to incorporate in planning and capital improvement updates.

To assist with the development of mitigation actions, municipalities were provided with the following:

- 2024 HMP goals and objectives
- 2019 HMP mitigation strategies
- Risk and capability assessment results
- Problem and solutions exercise
- Mitigation catalog
- Stakeholder and public input (e.g., citizen and stakeholder survey results)
- FEMA resources

A strong effort has been made to better focus local mitigation strategies on clearly defined, readily implementable projects and initiatives that meet the definition or characteristics of mitigation. Broadly defined mitigation actions were eliminated from the updated strategy unless accompanied by discrete actions, projects, or initiatives. Certain continuous or ongoing strategies that represent programs that are fully integrated into the normal operational and administrative framework of the community have been identified within the capabilities section of each annex and removed from the updated mitigation strategy.

Overall, a comprehensive range of specific mitigation initiatives were considered by each plan participant to pursue in the future to reduce the effects of hazards. Some of these initiatives may be previous actions carried forward for this plan update. These initiatives are dependent upon available funding (grants and local match availability) and may be modified or omitted at any time based on the occurrence of new hazard events and changes in municipal priorities.

Throughout the course of the plan update process, additional regional and county-level mitigation actions were identified by the following processes:

- Review of the results and findings of the updated risk assessment,
- Review of available regional and County plans reports and studies,
- Direct input from County departments and other county and regional agencies, and
- Input received through the public and stakeholder outreach process.

The 2024 Mitigation Action Plan includes the following information for each action:

- **Action Name**—Each action in the action plan has a short action name to allow for quick identification.
- **Action Number**—The action plan assigns a numeric identifier to each action for tracking and progress reporting.
- **Lead Agency**—The action plan identifies the lead agency (and department/bureau if applicable) responsible for implementation of the action.

- **Supporting Agencies**—The action plan identifies any supporting agencies and/or departments (if applicable) that will partner with the lead agency to complete the action or phases of the action.
- **Hazard(s) of Concern**—The action plan includes a list of hazards addressed by the mitigation action.
- **Description of the Problem**—The action plan provides a problem statement for context as to why the action is needed. The problem connects the risk assessment, capability assessment, or both to the mitigation action.
- **Description of the Solution**—The action plan describes the mitigation strategies used within each action and how the action will be implemented, including phases and responsibilities.
- **Estimated Costs**—The action plan lists estimated costs to implement each action.
- **Potential Funding Sources**—The action plan lists options for funding the action, including annual budgets, state grants, and federal funding opportunities.
- **Implementation Timeline**—The action plan provides general project implementation timing.
- **Goals Met**—The action plan lists the HMP goals that the action supports.
- **Benefits**—The action plan discusses the overall benefits resulting from the implemented action.
- **Impact on Socially Vulnerable Populations**—The action plan identifies if and how the action reduces risk for underserved communities and/or socially vulnerable populations.
- **Impact on Future Development**—The action plan identifies if and how the action will reduce risk in areas that are under development pressures.
- **Impact on Critical Facilities/Lifelines**—The action plan identifies if and how the action reduces risk for critical facilities/community lifelines.
- **Impact on Capabilities**—The action plan identifies if and how the action supports or improves hazard mitigation capabilities.
- **Climate Change Considerations**—The action plan identifies if and how the action addresses anticipated changes to hazards as a result of climate change or how the action is able to adapt to changes in risk over time.
- **Mitigation Category**—The action plan categorizes each action by FEMA mitigation category:

    - Local Plans and Regulations (LPR)—These actions include government authorities, policies or codes that influence the way land and buildings are being developed and built.
    - Structure and Infrastructure Project (SIP)—These actions involve modifying existing structures and infrastructure to protect them from a hazard or remove them from a hazard area. This could apply to public or private structures as well as critical facilities and infrastructure. This type of action also involves projects to construct structures to reduce the impact of hazards.
    - Natural Systems Protection (NSP)—These are actions that minimize damage and losses, and also preserve or restore the functions of natural systems.
    - Education and Awareness Programs (EAP)—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 StormReady and Firewise Communities.

- **CRS Category**—The action plan categorizes each action by Community Rating System mitigation category:
    - Preventative Measures (PR)—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 (PP)—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 (PI)—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 (NR)—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 (SP)—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 (ES)—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.
- **Priority**—The action plan identifies if the action is a low, medium, or high priority for implementation.
- **Alternatives**—The action plan identifies and evaluates three potential alternative approaches to solving the problem, including the impact of a "no action" approach.

6.6.4 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 Planning Area, in compliance with 44 CFR Section 201.6(c)(3)(ii). One catalog was developed for each natural hazard of concern evaluated in this plan (see Appendix F, Mitigation Strategy Supplementary Data). The catalogs present alternatives that are categorized in two ways:

- By who would have responsibility for implementation:
  - Individuals—personal scale
  - Businesses—corporate scale
  - Government—government scale
- By what each of the alternatives would do:
  - Manipulate the hazard
  - Reduce exposure to the hazard
  - Reduce vulnerability to the hazard
  - Build local capacity to respond to or be prepared for the hazard

The alternatives presented include actions that will mitigate current risk from hazards and actions that will help reduce risk from changes in the impacts of these hazards resulting from climate change. Hazard mitigation actions recommended in this plan were selected from among the alternatives presented in the catalog, as well as other resources made available to all jurisdictions (i.e., FEMA's Mitigation Ideas). The catalog provides 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 catalog was to provide a list of what could be considered to reduce risk from natural hazards within the Planning Area. Actions in the catalog that are not included for the partnership's action plan were not selected for one or more of the following reasons:

- The action is not feasible,
- The action is already being implemented,
- There is an apparently more cost-effective alternative, and/or
- The action does not have public or political support.

6.6.5 Mitigation Strategy Evaluation and Prioritization

44 CFR Section 201(c)(3)(iii) requires an action plan describing how the actions identified will be prioritized. FEMA planning guidance (March 2013) identifies a modified STAPLEE (Social, Technical, Administrative, Political, Legal, Economic, and Environmental) mitigation action evaluation methodology that uses a set of 10 evaluation criteria suited to the purposes of hazard mitigation strategy evaluation. This method provides a systematic approach that considers the opportunities and constraints of implementing a particular mitigation action.

Based on this guidance, the Steering Committee has adopted and applied an action evaluation and prioritization methodology which includes an expanded set of 14 criteria to include the consideration of cost-effectiveness, availability of funding, anticipated timeline, and if the action addresses multiple hazards.

The 14 evaluation/prioritization criteria used in the 2024 update process are:

- **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? Developing 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 entity have the authority to implement the action?
- **Fiscal**—Can the action be funded under existing program budgets (i.e., is this initiative currently budgeted for)? Or would it require a new budget authorization or funding from another source such as grants?
- **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 the SVI index and other appropriate measures of social vulnerability.
- **Administrative**—Does the entity 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 project align with the entity's capabilities?
- **Hazards of Concern**—Does the action address one or more of the entity's high-ranked hazards?
- **Climate Change—**Does the action incorporate climate change projections? Is the action designed to withstand/address long-term conditions? Is the action consistent with climate resilience goals?
- **Timeline**—Can the action be completed in less than five years (within the HMP planning horizon)?
- **Community Lifelines**—Does this project benefit community lifelines?
- **Other Local Objectives**—Does the action advance other entity objectives, such as capital improvements, economic development, environmental quality, or open-space preservation? Does it support the policies of other plans and programs?

Specifically, for each mitigation action, the jurisdictions were asked to assign a numeric rank (-1, 0, or 1) for each of the 14 evaluation criteria, defined as follows:

- 1 = Highly effective or feasible
- 0 = Neutral
- -1 = Ineffective or not feasible

Further, jurisdictions were asked to provide a summary of the rationale behind the numeric rankings assigned, as applicable. The numerical results were totaled to assist each jurisdiction in selecting mitigation actions for the updated plan.

As step one in the prioritization process, actions that had a numerical value between 0 and 6 were initially prioritized as low; actions with numerical values between 7 and 10 were initially categorized as medium; and actions with numerical values between 11 and 14 were initially categorized as high. As step two, jurisdictions were then asked to consider the benefits and costs, as well as the desired timeline for implementation and project completion timeline when finalizing each action's priority as high/medium/low. These attributes are included in the mitigation strategy table and for FEMA-eligible projects in the mitigation worksheets (see jurisdictional annexes in Volume II).

For the plan update there has been an effort to develop more clearly defined and action-oriented mitigation strategies. These local strategies include projects and initiatives that are seen by the community as the most effective approaches to advance their local mitigation goals and objectives within their capabilities. In addition, each jurisdiction was asked to develop problem statements. With this process, participating jurisdictions were able to develop action-oriented and achievable mitigation strategies.

6.6.6 Benefit/Cost Review

44 CFR Section 201(c)(3)(iii) requires the prioritization of the action plan to emphasize the extent to which benefits are maximized according to a cost/benefit review of the proposed projects and their associated costs. Stated otherwise, cost-effectiveness is one of the criteria that must be applied during the evaluation and prioritization of all actions comprising the overall mitigation strategy.

The benefit/cost review applied in for the evaluation and prioritization of projects and initiatives in this HMP update process was qualitative; that is, it does not include the level of detail required by FEMA for project grant eligibility under the Hazard Mitigation Grant Program (HMGP), Flood Mitigation Assistance (FMA) and Pre-Disaster Mitigation (PDM) grant programs. For all actions identified in the local strategies, jurisdictions have identified both the costs and benefits associated with project, action, or initiative.

- **Costs** are the total cost for the action or project, and may include administrative costs, construction costs (including engineering, design and permitting), and maintenance costs.
- **Benefits** are the savings from losses avoided attributed to the implementation of the project, and may 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 value for project costs and associated benefits. Having defined costs and benefits allows a direct comparison of benefits versus costs, and a quantitative evaluation of project cost-effectiveness. Often, however, numerical costs and/or benefits have not been identified or may be impossible to quantitatively assess.

For the purposes of this planning process, jurisdictions were tasked with evaluating project cost-effectiveness with both costs and benefits assigned to "High," "Medium," and "Low" ratings. Where quantitative estimates of costs and benefits were available, ratings/ranges were defined as:

- Low = < $10,000
- Medium = $10,000 to $100,000
- High = > $100,000

Where quantitative estimates of costs and/or benefits were not available, qualitative ratings using the definitions listed in Table 6-3 were used.

Table 6-3. 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-beneficial and are prioritized accordingly.

For some of the Burlington 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.

SECTION 7. PLAN MAINTENANCE

This section details the formal process that will ensure that the HMP remains an active and relevant document and that the Planning Partnership maintains their 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 section describes how public participation will be integrated throughout the plan maintenance and implementation process. It explains how the mitigation strategies outlined in this plan update will be incorporated into existing planning mechanisms and programs, such as comprehensive land use planning processes, capital improvement planning, and building code enforcement and implementation. The plan's format allows sections to be reviewed and updated when new data become available, resulting in a plan that will remain current and relevant.

The plan maintenance matrix shown in Table 7-1 provides a synopsis of responsibilities for plan monitoring, evaluation, and update, which are discussed in further detail in the sections below. An HMP Coordinator is assigned to manage the maintenance and update of the plan during its performance period, which is the five-year period between adoption of this update and approval of the next update. The timeline for implementing this plan over the performance period is shown in Figure 7-1.

Table 7-1. Plan Maintenance Matrix

Task	Approach	Timeline	Lead Responsibility	Support Responsibility
Monitoring	Preparation of status updates and action implementation tracking as part of submission for Annual Progress Report	August or upon major update to Master Plan or major disaster	Jurisdictional points of contact identified in Volume II	Jurisdictional implementation lead identified in Volume II
Integration	In order for integration of mitigation action principles to become an organic part of the ongoing county and municipal activities, the County will incorporate the distribution of the safe growth worksheet for annual review and update by all participating jurisdictions.	August 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
Evaluation	Review the status of previous actions as submitted by the monitoring task lead and support to assess the effectiveness of the plan; compile and finalize the Annual Progress Report	Finalized progress report completed by January 31st of each year	Steering Committee; Plan Maintenance element	Jurisdictional points of contacts identified in Volume II
Update	Reconvene the planning partners, at a minimum, every 5 years to guide a comprehensive update to review and revise the plan.	Every 5 years or upon major update to Master Plan or major disaster	HMP Coordinator	Jurisdictional points of contacts identified in Volume II

Figure 7-1. Plan Maintenance Timeline

7.1 MONITORING, EVALUATING, AND UPDATING THE PLAN

The HMP Coordinator will chair the Planning Partnership and be the prime point of contact for questions regarding the plan and its implementation, as well as to coordinate incorporation of additional information into the plan.

The Planning Partnership shall fulfill the monitoring, evaluation, and updating responsibilities identified in this section which is comprised of a representative from each participating jurisdiction. Each jurisdiction is expected to maintain a representative on the Planning Partnership throughout the plan performance period (five years from the date of plan adoption). 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.

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

Currently, the designated Burlington County HMP Coordinator is:

Kristen Carr, Deputy Emergency Management Coordinator
Burlington County Office of Emergency Management
*(*609*)* 738-5139 | krcarr@co.burlington.nj.us

7.1.1 Monitoring

The Planning Partnership will be responsible for monitoring progress on, and evaluating the effectiveness of, the plan, and documenting annual progress. Each year, beginning one year after plan development, the Burlington County and local Planning Partnership representatives will collect and process information from the departments, agencies, and organizations involved in implementing mitigation projects or activities identified in their jurisdictional annexes (Volume II of this plan), by contacting the lead agencies responsible for initiating and/or overseeing the mitigation projects.

In the first year of the performance period, this will be accomplished by utilizing an online performance progress reporting system, the BATool℠ which will enable municipal and county representatives to directly access mitigation initiatives to easily update the status of each project, document successes or obstacles to implementation, add or delete projects to maintain mitigation project implementation. It is anticipated that all participating partners will be prompted by the tool to update progress annually, providing an incentive for participants to refresh their mitigation strategies and to continue implementation of projects. It is expected that this reporting system will support the submittal of an increased number of project grant fund applications due to the functionality of the system which facilitates the sorting and prioritization of projects.

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

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

Plan monitoring for years two through four of the plan performance period will be similarly addressed via the BATool^{SM} or manually.

7.1.2 Integration Process of the HMP into Municipal Planning Mechanisms

Hazard mitigation is sustained action taken to reduce or eliminate the long-term risk to human life and property from natural hazards. Integrating hazard mitigation into a community's existing plans, policies, codes, and programs leads to development patterns that do not increase risk from known hazards or leads to redevelopment that reduces risk from known hazards. The Burlington County HMP Planning Partnership was tasked with identifying how hazard mitigation is integrated into existing planning, regulatory, and programmatic mechanisms. The jurisdictional annexes in Volume II describe how this is done for each participating municipality. During this process, many municipalities recognized the importance and benefits of incorporating hazard mitigation into future municipal planning and regulatory processes.

The Planning Partnership representatives will incorporate mitigation planning as an integral component of daily government operations. They will work with local government officials to integrate the newly adopted hazard mitigation goals and actions into the general operations of government and partner organizations. Further, the sample adoption resolution (Appendix A) 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 planning and emergency management efforts.
- The HMP, master plans, emergency management/operations plans and other relevant planning mechanisms will become mutually supportive documents that work in concert to meet the goals and needs of County residents.

During the HMP annual review process, each participating municipality will be asked to document how they are utilizing and incorporating the Burlington County HMP 2024 update into their day-to-day operations and planning and regulatory processes. Additionally, the County will identify additional policies, programs, practices, and procedures that could be modified to accommodate hazard mitigation actions and include these findings and recommendations in the Annual HMP Progress Report.

The checklist shown in Table 7-2, adapted from FEMA's Local Mitigation Handbook (2013; Appendix A, Worksheet 4.2), will help a community analyze how hazard mitigation is integrated into local plans, ordinances, regulations, ordinances, and policies. Completing the checklist will help the County identify areas that integrate hazard mitigation currently and where to make improvements and reduce vulnerability to future development. In this manner, the integration of mitigation into municipal activities will evolve into an ongoing culture within the County.

Table 7-2. Safe Growth Checklist

Planning Mechanisms	Do you Do This?		Notes: How is it being done or how will this be utilized in the future?
	Yes	No	
Operating, Municipal and Capital Improvement Program Budgets			
When constructing upcoming budgets, hazard mitigation actions will be funded as budget allows. Construction projects will be evaluated to see if they meet the hazard mitigation goals.			
Annually, during adoption process, the municipality will review mitigation actions when allocating funding.			
Do budgets limit expenditures on projects that would encourage development in areas vulnerable to natural hazards?			
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 County HMP?			
Human Resource Manual			
Do any job descriptions specifically include identifying and/or implementing mitigation projects/actions or other efforts to reduce natural hazard risk?			
Building and Zoning Ordinances			
Prior to, zoning changes, or development permitting, the municipality will review the hazard mitigation plan 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 it contain natural overlay zones that set conditions			
Does the ordinance require developers to take additional actions to mitigate natural hazard risk?			
Do rezoning procedures recognize natural hazard areas as limits on zoning changes that allow greater intensity or density of use?			
Do the ordinances prohibit development within, of 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 subdivision regulations restrict the subdivision of land within or adjacent to natural hazard areas?			
Do the regulations provide for conservation subdivisions or cluster subdivisions to conserve environmental resources?			

Planning Mechanisms	Do you Do This?		Notes: How is it being done or how will this be utilized in the future?
	Yes	No	
Do the regulations allow density transfers where hazard areas exist?			
Master Plan			
Are the goals and policies of the plan related to those of the County HMP?			
Does the future land use map clearly identify natural hazard areas?			
Do the land use policies discourage development or redevelopment with natural hazard areas?			
Does the plan provide adequate space for expected future growth in areas located outside natural hazard areas?			
Land Use			
Does the future land use map clearly identify natural hazard areas?			
Do the land use policies discourage development or redevelopment with natural hazard areas?			
Does the plan provide adequate space for expected future growth in areas located outside natural hazard areas?			
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 that is located outside protective ecosystems?			
Grant Applications			
Data and maps will be used as supporting documentation in grant applications.			
Municipal Ordinances			
When updating municipal ordinances, hazard mitigation will be a priority			
Economic Development			
Local economic development group will consider information regarding identified hazard areas when assisting new businesses in finding a location.			
Public Education and Outreach			
Does the municipality have any public outreach mechanisms / programs in place to inform citizens on natural hazards, risk, and ways to protect themselves during such events?			

7.1.3 Evaluating

The evaluation of the mitigation plan is an assessment of whether the planning process and actions have been effective, if the HMP goals are being achieved, and whether changes are needed. The HMP will be evaluated on an annual basis to determine the effectiveness of the programs, and to reflect changes that could affect mitigation priorities or available funding.

The status of the HMP will be discussed and documented at an annual plan review meeting of the Planning Partnership, to be held either in person or via teleconference approximately one year from the date of local adoption of this update, and successively thereafter. At least two weeks before the annual plan review meeting, the Burlington County HMP Coordinator will advise Planning Partnership members of the meeting date, agenda, and expectations of the members.

The Burlington County HMP Coordinator will be responsible for calling and coordinating the annual plan review meeting and soliciting input regarding progress toward meeting plan goals and objectives. 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, such as technical, political, legal or coordination issues with other agencies are presents.
- Outcomes have occurred as expected.
- Changes in County resources impacted plan implementation (e.g., funding, personnel, and equipment)
- New agencies/departments/staff should be included, including 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
- Under/over spending
- Achievement of the goals and objectives
- Resource allocation
- Timeframes
- Budgets
- Lead/support agency commitment
- Resources
- Feasibility

Finally, the Planning Partnership will evaluate how other programs and policies have conflicted or augmented planned or implemented measures, and shall identify policies, programs, practices, and procedures that could be modified to accommodate hazard mitigation actions ("Implementation of Mitigation Plan through Existing Programs" subsection later in this section discusses this process). Other programs and policies can include those that address:

- Economic development
- Environmental preservation
- Historic preservation
- Redevelopment
- Health and/or safety
- Recreation
- Land use/zoning
- Public education and outreach
- Transportation

The Planning Partnership should refer to the evaluation forms, Worksheets #2 and #4 in the FEMA 386-4 guidance document, to assist in the evaluation process (see Appendix F – Plan Maintenance). Further, the Planning Partnership should refer to any process and plan review deliverables developed by the County as a part of the plan review processes established for prior or existing local HMPs within the County.

The Burlington County HMP Coordinator shall be responsible for preparing an Annual HMP Progress Report for each year of the performance period, based on the information provided by the local Planning Partnership members, information presented at the annual Planning Partnership meeting, and other information as appropriate and relevant. 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 on an annual basis, the Planning Partnership will be able to assess which projects are completed, which are no longer feasible, and what projects should require additional funding.

The Annual HMP Progress Report shall be posted on the Burlington County HMP website to keep the public appraised of the plan's implementation (located at https://co.burlington.nj.us/462/All-Hazards-Mitigation-Plan). Additionally, the website provides details on the HMP update planning process. Communities in the CRS program can use this report to meet annual CRS recertification requirements. To meet this recertification timeline, the Planning Partnership will strive to complete the review process and prepare an Annual HMP Progress Report by January 31st of each year.

The HMP will also be evaluated and revised following any major disasters, 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 damages or if data listed in the hazard profiles (Section 4.3 of this plan) has been collected to facilitate the risk assessment. This is an opportunity to increase the community's disaster resistance and build a better and stronger community.

7.1.4 Updating

To facilitate the update process, the Burlington County HMP Coordinator, with support of the Planning Partnership, shall use the second annual meeting to develop and commence the implementation of a detailed plan update program. The Burlington County HMP Coordinator shall invite representatives from New Jersey Office of Emergency Management to this meeting to provide guidance on plan update procedures. This program shall, at a minimum, establish who shall be responsible for managing and completing the plan update effort, what needs to be included in the updated plan, and a detailed timeline with milestones to assure that the update is completed according to regulatory requirements.

At this meeting, the Planning Partnership shall determine what resources will be needed to complete the update. The Burlington County HMP Coordinator shall be responsible for assuring that needed resources are secured.

Following each five-year update of the mitigation plan, the updated plan will be distributed for public comment. After all comments are addressed, the HMP will be revised and submitted to the New Jersey Office of Emergency Management and FEMA for review and approval.

7.1.5 Grant Monitoring and Coordination

Burlington County recognizes the importance of having an annual coordination period that helps each planning partner become aware of upcoming mitigation grant opportunities and identifies multi-jurisdiction projects to pursue. Grant monitoring will be the responsibility of each municipal partner as part of their annual progress reporting. The Burlington County HMP Coordinator will keep the planning partners apprised of FEMA Hazard Mitigation Assistance grant openings and assist in developing letters of intent for grant opportunities when practicable.

Burlington 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 Partnership during open windows for grant applications. As part of grant monitoring and coordination, Burlington 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.

Grant monitoring and coordination will be integrated into the annual progress report or as needed based on the availability of non-HMA or post-disaster funding opportunities.

7.2 IMPLEMENTATION OF MITIGATION PLAN THROUGH EXISTING PROGRAMS

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

Section 5 (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 within the County. Within each jurisdictional annex in Volume II, the County and each participating jurisdiction identified how each capability reduces risk and how they are integrating hazard risk management into their existing planning, regulatory, and operational/administrative framework. If they are currently not showing this, they indicate how they intend to promote this integration.

It is the intention of Planning Partnership representatives to continue to incorporate mitigation planning as an integral component of daily government operations. The Planning Partnership representatives will work with local government officials to integrate the newly adopted hazard mitigation goals and actions into the general operations of government and partner organizations. Further, the sample adoption resolution (Appendix A [Adoption Resolutions]) 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 Steering Committee anticipates that:

- Hazard mitigation planning will be formally recognized as an integral part of overall emergency management efforts.
- The HMP, master plans, emergency management/operations 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 hazard mitigation plan include the following:

- Continuity of government/operations 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
- Flood Hazard Management Plans
- Resiliency plans
- Community Development Block Grant-Disaster Recovery action plans
- Public information/education plans

Some action items do not need to be implemented through regulation. Instead, these items can be implemented through the creation of new educational programs, continued interagency coordination, or improved public participation.

During the annual plan evaluation process, the Planning Partnership representatives will identify additional policies, programs, practices, and procedures that could be modified to accommodate hazard mitigation actions and include these findings and recommendations in the Annual HMP Progress Report.

7.3 CONTINUED PUBLIC INVOLVEMENT

Burlington County and participating jurisdictions are committed to the continued involvement of the public in the hazard mitigation process. This HMP update will be posted on the Burlington County Division of Emergency Management webpage (https://co.burlington.nj.us/462/All-Hazards-Mitigation-Plan).

In addition, public outreach and dissemination of the HMP will include:

- Links to the plan on municipal websites of each jurisdiction with capability
- Continued utilization of existing social media outlets (Facebook, Twitter) to inform the public of natural hazard events, such as floods and severe storms and education of the public via the jurisdictional websites on how these applications can be used in an emergency situation
- Development of annual articles or workshops on hazards to educate the public and keep them aware of the dangers of specific hazard events

The Steering Committee representatives and the Burlington County HMP Coordinator will be responsible for receiving, tracking, and filing public comments regarding this HMP. The public will have an opportunity to comment on the plan via the hazard mitigation website at any time. The HMP Coordinator will maintain this website, posting new information and maintaining an active link to collect public comments.

The public can also provide input at the annual review meeting for the HMP and during the next five-year plan update. The Burlington County 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. Additional meetings might also be held as deemed necessary by the planning group. The purpose of these meetings would be to provide the public an opportunity to express concerns, opinions, and ideas about the mitigation plan.

The Steering Committee representatives shall be responsible to assure that:

- Public comment and input on the plan, and hazard mitigation in general, are recorded and addressed, as appropriate.
- Copies of the latest approved plan (or draft in the case that the five-year update effort is underway) are available for review, along with instructions to facilitate public input and comment on the HMP.
- Appropriate links to the Burlington County Hazard Mitigation Plan webpage are included on municipal websites.
- Public notices are made as appropriate to inform the public of the availability of the plan, particularly during HMP update cycles.

The Burlington County HMP Coordinator shall be responsible to assure that:

- Public and stakeholder comment and input on the plan, and hazard mitigation in general, are recorded and addressed, as appropriate.
- Copies of the latest approved plan are available for review at appropriate Burlington County facilities along with instructions to facilitate public input and comment on the plan.
- Public notices, including media releases, are made as appropriate to inform the public of the availability of the plan, particularly during plan update cycles.

REFERENCES

SECTION 1 – INTRODUCTION

None

SECTION 2 – PLANNING PROCESS

None

SECTION 3 – COMMUNITY PROFILE

American Community Survey. 2022. *Philadelphia-Camden-Wilmington, PA-NJ-DE-MD Metro Area.* Accessed September 29, 2023. https://www.bing.com/search?q=Philadelphia-Camden-Wilmington+Metropolitan+Statistical+Area+population&qs=n&sp=-1&ghc=1&lq=1&pq=philadelphia-camden-wilmington+metropolitan+statistical+area+population&sc=1-71&sk=&cvid=437CCF5377124CBA8E35AE23032A2D6B&ghsh=0.

American Water. 2023. *ABOUT US.* February 21. Accessed September 29, 2023. https://www.amwater.com/corp/about-us/.

Burlington County. 2019. "Burlington County Hazard Mitigation Plan." http://co.burlington.nj.us/1861/2019-Hazard-Mitigation-Plan---Final.

—. 2023. *Burlington County Profile.* https://www.co.burlington.nj.us/691/County-Profile#:~:text=There%20are%2040%20political%20subdivisions,is%20located%20in%20Mount%20Holly.

—. n.d. *County Parks.* Accessed September 29, 2023. http://www.co.burlington.nj.us/919/County-Parks.

Burlington County Department of Resource Conservation. 2017. *Burlington County Wastewater Management Plan.* June 30. Accessed January 5, 2024. https://www.co.burlington.nj.us/DocumentCenter/View/6756/Burlington-County-WWMP-051117?bidId=.

Burlington County Parks. 2023. *County Park Facilities.* http://www.co.burlington.nj.us/919/County-Parks.

Burlington County Resource Conservation. 2022. "Burlington County Farmland Preservation." *Burlington County Comprehensive Farmland Preservation Plan.* http://www.co.burlington.nj.us/1952/2022-Comprehensive-Farmland-Plan-Update.

CDC. 2020. *Disability Inclusion.* September 16. Accessed September 19, 2023. https://www.cdc.gov/ncbddd/disabilityandhealth/disability-inclusion.html.

TETRA TECH

Dalton, Richard. 2003. "Physiographic Provinces of New Jersey." *New Jersey Geological Survey Information Circular.* https://www.nj.gov/dep/njgs/enviroed/infocirc/provinces.pdf.

Delaware River Basin Commission. 2023. *Basin Information.* https://www.state.nj.us/drbc/basin/.

DVRPC. 2013. *Regional, County, and Municipal Population Forecasts, 2010-2040.* https://www.dvrpc.org/products/adr018-a.

FEMA. 2023. *Community Lifelines.* July 27. https://www.fema.gov/emergency-managers/practitioners/lifelines.

—. 2022. *Disaster Declarations for States and Counties.* Accessed 2022. https://www.fema.gov/data-visualization/disaster-declarations-states-and-counties.

—. 2019. *Flood insurance Study - Burlington County.* August 28. Accessed August 25, 2023. https://map1.msc.fema.gov/data/34/S/PDF/34005CV001B.pdf?LOC=f82215e4aa1c2088d90f1d02c906e295.

FEMA. 1997. *Multi Hazard Identification and Risk Assessment.* Technical, FEMA. http://www.fema.gov/library/viewRecord.do?id=2214.

JC NERR. 2017. *About Us.* https://jcnerr.org/about.html.

Joint Base MDL. n.d. *Joint Base McGuire-Dix-Lakehurst.* Accessed January 5, 2024. https://www.jbmdl.jb.mil/About-Us/About-Us/.

Lucey, et al. 2001. "The Mullica River Basin." *A Report to the Pinelands Commission on the Status of the Landscape and Selected Acquatic and Wetland Resources.* https://www.nj.gov/pinelands/infor/reports/Mullica%20River%20Basin%20Report.pdf.

New Jersey Department of Environmental Protection. n.d *C.*

New Jersey Pinelands Commission. 2018. https://www.nj.gov/pinelands/home/maps/maps/documents/Municipalities%20in%20the%20Pinelands.pdf.

—. 2018. *Long Term Economic Long Term Economic 2017 Annual Report.* June. Accessed September 29, 2023. https://www.nj.gov/pinelands/landuse/current/economic/LTEM%20%202017%20Report%20(Complete).pdf.

—. 2022. "Pinelands Comprehensive Management Plan." *State of New Jersey Pinelands Commission.* https://www.nj.gov/pinelands/cmp/#:~:text=The%20New%20Jersey%20Pinelands%20Commission,in%20the%20state%20Pinelands%20Area.

NJDEP Compliance and Enforcement. 2018. *Toxic Catastrophe Prevention act (TCPA) Program.* https://www.nj.gov/dep/enforcement/tcpa.html.

NJDEP. 2012. *New Jersey Department of Environmental Protection (NJDEP).* https://www.nj.gov/dep/gis/digidownload/metadata/lulc12/anderson2012.html#:~:text=The%20Level%20II%20categories%20of,associated%20with%20confined%20feeding%20operations.

—. 2021. *Watershed Management Areas in New Jersey.* https://gisdata-njdep.opendata.arcgis.com/datasets/de7aafe4a0604076a50f2a6885aff277/explore?location=40.081064%2C-74.754578%2C8.28.

ONJSC. 1983. *Rutgers New Jersey Agricultural Experiement Station.* https://climate.rutgers.edu/stateclim/?target=NJCoverview.

State of New Jersey. 2012. *About Aqua New Jersey.* January 26. Accessed September 29, 2023. https://www.nj.gov/rpa/case/water/about_aqua_new_jersey.html#:~:text=Company%3A%20Aqua%20New%20Jersey%2C%20Inc.%20Summary%3A%20Aqua%20New,Burlington%2C%20Monmouth%2C%20Ocean%2C%20Camden%2C%20Gloucester%20and%20Sussex%20counties.

—. 2006. "State of New Jersey Department of Agriculture." *New Jersey Agricultural Smart Growth Plan.* https://www.nj.gov/agriculture/pdf/smartgrowthplan.pdf.

U.S. Census Bureau. 2020. *New Jersey: 2020 Core Based Statistical Areas and Counties.* Accessed September 29, 2023. https://www2.census.gov/programs-surveys/metro-micro/reference-maps/2020/state-maps/34_NewJersey_2020.pdf.

—. 2023. *QuickFacts.* Accessed January 4, 2024. https://www.census.gov/quickfacts/fact/table/burlingtoncountynewjersey/HSG860222#HSG860222.

U.S. Census. 2021. *New Jersey Population Topped 9 Million in Last Decade.* August 25. Accessed January 4, 2024. https://www.census.gov/library/stories/state-by-state/new-jersey-population-change-between-census-decade.html.

United For ALICE. 2024. *About Us.* https://www.unitedforalice.org/meet-alice.

US Census Bureau. 2023. *Poverty Thresholds.* July 13. Accessed September 19, 2023. https://www.census.gov/data/tables/time-series/demo/income-poverty/historical-poverty-thresholds.html.

US EPA. 2023. *2021 TRI Factsheet: County - Burlington, NJ.* https://enviro.epa.gov/triexplorer/tri_factsheet.factsheet?pzip=&pstate=NJ&pcity=&pcounty=Burlington&pyear=2021&pParent=TRI&pDataSet=TRIQ1.

USACE. 2023. *National Inventory of Dams.* Accessed August 30, 2023. https://nid.sec.usace.army.mil/#/dams/search/sy=@countyState:Burlington,%20New%20Jersey&viewType=map&resultsType=dams&advanced=false&hideList=false&eventSystem=false.

—. 2024. *National Levee Database.* February 7. https://levees.sec.usace.army.mil/#/levees/search/in=@county%20state:Burlington,%20New%20Jersey&sy=@NAME:burlington%20county,%20nj&viewType=map&resultsType=systems&advanced=true&hideList=false&eventSystem=false.

USDA. 2019. *2017 Census of Agriculture: County Profile.* May 24. Accessed August 28, 2023. https://www.nass.usda.gov/Publications/AgCensus/2017/Online_Resources/County_Profiles/New_Jersey/cp34005.pdf.

Zampella, Robert A., and John F. Bunnel. 2000. "The Distribution of Anurans in Two River Systems of a Coastal Plain Watershed." *Journal of Herpetology*, June: 34(2):210. https://www.researchgate.net/publication/273232369_The_Distribution_of_Anurans_in_Two_River_Systems_of_a_Coastal_Plain_Watershed.

SECTION 4.1 – IDENTIFICATION OF HAZARDS OF CONCERN

None

SECTION 4.2 – METHODOLOGY AND TOOLS

None

SECTION 4.3.1 – DAM FAILURE

Association of State Dam Safety Officials. 2021. *Dam Failures and Incidents.* Accessed 2023. https://damsafety.org/dam-failures.

—. 2023. *Dams 101.* https://damsafety.org/dams101.

Burlington County. 2019. *2019 Hazard Mitigation Plan.* Accessed August 30, 2023.

CDC. 2020. *CDC updates, expands list of people at risk of severe COVID-19 illness.* June 25. Accessed August 25, 2023. https://www.cdc.gov/media/releases/2020/p0625-update-expands-covid-19.html.

FEMA. 2023. *Disaster Declarations for States and Counties.* Accessed June 28, 2023. https://www.fema.gov/data-visualization/disaster-declarations-states-and-counties.

—. 2019. *Flood insurance Study - Burlington County.* August 28. Accessed August 25, 2023. https://map1.msc.fema.gov/data/34/S/PDF/34005CV001B.pdf?LOC=f82215e4aa1c2088d90f1d02c906e295.

—. 2013. *Living With Dams.* February. Accessed June 13, 2023. https://www.fema.gov/sites/default/files/2020-08/fema_living-with-dams_p-956.pdf.

—. 2018. *Risk Exposure and Residual Risk Related to Dams.* May. Accessed August 30, 2023. https://www.fema.gov/sites/default/files/2020-08/fact-sheet_risk-exposure-residual-risk-related-to-dams.pdf.

NJDEP. 2020. *2020 New Jersey Scientific Report on Climate Change.* June 30. Accessed August 25, 2023. https://www.nj.gov/dep/climatechange/docs/nj-scientific-report-2020.pdf.

—. 2023. *About Dam Safety.* May 30. Accessed August 30, 2023. https://dep.nj.gov/wlm/drec/dam-safety/.

—. 2020. *Burlington County Storm – July 2004.* June 23. Accessed August 30, 2023. https://www.nj.gov/dep/damsafety/storm200407.htm.

—. 2008. *Dam Safety Standards.* June 16. Accessed August 30, 2023. https://www.nj.gov/dep/damsafety/docs/standard.pdf.

—. 2017. *Guidelines for inspections of Existing Dams.* January. Accessed September 5, 2023. https://www.nj.gov/dep/damsafety/docs/vicguid2.pdf.

NJOEM. 2019. *2019 New Jersey State Hazard Mitigation Plan.* NJOEM.

NOAA. 2023. *Storm Events Database.* Accessed June 28, 2023. https://www.ncdc.noaa.gov/stormevents/choosedates.jsp?statefips=-999%2CALL.

Stanford University. 2018. *NPDP Dam Incident Database.* December 22. Accessed August 30, 2023. https://npdp.stanford.edu/dam_incidents.

State of New Jersey. 2017. *Population and Labor Force Projections.* May 11. Accessed September 8, 2023. https://www.nj.gov/labor/labormarketinformation/demographics/population-labor-projections/index.shtml.

USACE. 2021. *Dam Safety Program.* https://www.usace.army.mil/Missions/Civil-Works/Dam-Safety-Program/.

—. 2022. *Ice Jam Database.* August. Accessed August 25, 2022. https://icejam.sec.usace.army.mil/ords/f?p=101:7::::::.

—. 2023. *National Inventory of Dams.* Accessed August 30, 2023. https://nid.sec.usace.army.mil/#/dams/search/sy=@countyState:Burlington,%20New%20Jersey&viewType=map&resultsType=dams&advanced=false&hideList=false&eventSystem=false.

—. 2014. *SAFETY OF DAMS – POLICY AND PROCEDURES.* March 31. Accessed August 30, 2023. https://www.publications.usace.army.mil/Portals/76/Users/182/86/2486/ER_1110-2-1156.pdf?ver=2020-01-29-103920-173.

USBR. 2003. *Probabilistic Extreme Flood Hydrographs That Use PaleoFlood Data for Dam Safety Applications.* June. Accessed August 4, 2023. https://www.usbr.gov/ssle/damsafety/TechDev/DSOTechDev/DSO-03-03.pdf.

USDA. 2023. *Disaster Designation Information.* Accessed June 28, 2023. https://www.fsa.usda.gov/programs-and-services/disaster-assistance-program/disaster-designation-information/index.

USGS. 2011. *Summary Flooding New Jersey Caused Hurricane Irene.* October 20. Accessed September 5, 2023. https://www.usgs.gov/news/summary-flooding-new-jersey-caused-hurricane-irene-august-27-30-2011.

SECTION 4.3.2 – DISEASE OUTBREAK

Baker, R.E., A.S. Mahmud, I.F. Miller, M. Rajeev, F. Rasambainarivo, B.L. Rice, S. Takashi, et al. 2021. "Infectious disease in an era of global change." *Nature Reviews Microbiology*, October 13: 193-205. https://www.nature.com/articles/s41579-021-00639-z.

Behler McArthur, Donna. 2019. "https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7096727/." *Nurs Clin North Am*, June: 297-311. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7195975/.

Burlington County. 2019. *Burlington County Mosquito Control Fact Sheet .* August 19. Accessed August 30, 2023. https://www.co.burlington.nj.us/DocumentCenter/View/1574/Burlington-County-Mosquito-Control-Fact-Sheet.

—. n.d. *Mosquito Control.* Accessed August 30, 2023. https://www.co.burlington.nj.us/469/Mosquito-Control.

CDC. 2020. *CDC updates, expands list of people at risk of severe COVID-19 illness.* June 25. Accessed August 25, 2023. https://www.cdc.gov/media/releases/2020/p0625-update-expands-covid-19.html.

—. 2021. *COVID-19.* Accessed 2021. https://www.cdc.gov/coronavirus/2019-ncov/.

—. 2023. *Historic Data (1999-2022).* June 13. Accessed August 25, 2023. https://www.cdc.gov/westnile/statsmaps/historic-data.html.

—. 2022. *Lyme Disease.* January 19. Accessed August 5, 2023. https://www.cdc.gov/lyme/.

—. 2022. *Lyme disease vaccine.* August 11. Accessed September 5, 2023. https://www.cdc.gov/lyme/prev/vaccine.html.

—. 2020. *Mosquitoes in the United States.* March 5. Accessed August 25, 2023. https://www.cdc.gov/mosquitoes/about/mosquitoes-in-the-us.html.

—. 2020. *Pandemic Influenza.* May 12. https://www.cdc.gov/flu/pandemic-resources/index.htm.

—. 2016. *Pandemic Severity Assessment Framework (PSAF).* November 03. Accessed October 13, 2022. https://www.cdc.gov/flu/pandemic-resources/national-strategy/severity-assessment-framework.html.

—. 2018. *Past Pandemics.* August 10. Accessed August 25, 2023. https://www.cdc.gov/flu/pandemic-resources/basics/past-pandemics.html.

—. 2013. *West Nile Virus (WNV) Fact Sheet.* August 20. Accessed August 25, 2023. https://www.cdc.gov/westnile/resources/pdfs/wnvFactsheet_508.pdf#:~:text=About%201%20in%20150%20people%20infected%20with%20WNV,several%20weeks%2C%20and%20neurological%20effects%20may%20be%20permanent.

—. 2023. *West Nile Virus.* August 18. Accessed August 25, 2023. https://www.cdc.gov/westnile/index.html.

—. 2013. *West Nile Virus in the United States.* June 14. Accessed 2021. https://www.cdc.gov/westnile/resources/pdfs/wnvguidelines.pdf.

CISA. n.d. *Critical Infrastructure Sectors.* Accessed August 25, 2023. https://www.cisa.gov/topics/critical-infrastructure-security-and-resilience/critical-infrastructure-sectors.

Columbia University. 2021. *Epidemic, Endemic, Pandemic: What are the Differences?* February 19. Accessed August 5, 2023. https://www.publichealth.columbia.edu/news/epidemic-endemic-pandemic-what-are-differences.

FEMA. 2023. *Disaster Declarations for States and Counties.* Accessed 2023. https://www.fema.gov/data-visualization/disaster-declarations-states-and-counties.

Homeland Security Council. 2006. *National Strategy for Pandemic Influenza: Implementation Plan.* May. Accessed August 25, 2023. https://www.cdc.gov/flu/pandemic-resources/pdf/pandemic-influenza-implementation.pdf.

Jordan, Rob. 2019. "How does climate change affect disease?" *Stanford Earth Matters magazine*, March 15. https://earth.stanford.edu/news/how-does-climate-change-affect-disease#:~:text=Mordecai%E2%80%99s%20research%20has%20found%20that%20warmer%20temperatures%20increase,mosquitoes%20are%20adapted%20to%20a%20range%20of%20temperatures.

Juliano, S.A., and L.P. Lounibos. 2005. "Ecology of invasive mosquitoes: effects on resident species and on human health." *National Library of Medicine*, May: 558-574.

National Geographic. 2022. *The Many Effects of Flooding.* September 8. Accessed August 25, 20232. https://education.nationalgeographic.org/resource/many-effects-flooding/.

New Jersey Department of Labor and Workforce Development. 2021. *Economic Brief: Measuring the Impacts of COVID-19 on the New Jersey Economy One Year Later.* September. Accessed September 5, 2023. https://www.nj.gov/labor/labormarketinformation/assets/PDFs/pub/econbrief/NJ%20Economic%20Report%202021.pdf.

NJDEP. 2020. *2020 New Jersey Scientific Report on Climate Change.* June 30. Accessed August 25, 2023. https://www.nj.gov/dep/climatechange/docs/nj-scientific-report-2020.pdf.

—. 2020. *PESTICIDE PRODUCT REGISTRATION, GENERAL REQUIREMENTS, PROHIBITED AND RESTRICTED USE PESTICIDES.* July 7. Accessed August 25, 2023. https://www.nj.gov/dep/enforcement/pcp/regulations/Subchapter%202%20as%20of%20April%206%202020.pdf#:~:text=No%20person%20shall%20hold%2C%20use%2C%20distribute%2C%20sell%2C%20or,unless%20it%20is%20currently%20registered%20with%20the%20Department.

NJDOH. 2023. *Influenza and Respiratory Illness Surveillance Reports.* May 24. Accessed August 25, 2023. https://www.nj.gov/health/cd/statistics/flu-stats/.

—. 2012. *Lyme Disease.* August. Accessed August 25, 2023. https://nj.gov/health/cd/documents/faq/lyme_faq.pdf#:~:text=Lyme%20disease%20is%20spread%20to%20people%20by%20the,small%20mammals%2C%20such%20as%20deer%20and%20meadow%20voles.

—. 2023. *New Jersey COVID-19 Dashboard.* August 25. Accessed August 25, 2023. https://covid19.nj.gov/forms/datadashboard.

—. 2022. *Reportable Disease Statistics.* November 17. Accessed August 25, 2023. https://www.nj.gov/health/cd/statistics/reportable-disease-stats/.

—. 2023. *Seasonal Influenza.* July 11. Accessed August 25, 2023. https://www.nj.gov/health/cd/topics/flu.shtml.

—. 2023. *Vector-Borne Diseases in New Jersey.* August 23. Accessed August 25, 2023. https://dashboards.doh.nj.gov/views/public_dashboard/HumanCases?%3Aembed=y&%3AisGuestRedirectFromVizportal=y.

—. 2023. *West Nile Virus.* July 31. Accessed August 25, 2023. https://www.nj.gov/health/cd/topics/westnile.shtml.

State of New Jersey. 2017. *Population and Labor Force Projections.* May 11. Accessed September 8, 2023. https://www.nj.gov/labor/labormarketinformation/demographics/population-labor-projections/index.shtml.

Steere, Allen, Jenifer Coburn, and Lisa Glickstein. 2004. "The emergence of Lyme disease." *The Journal of Clinical Investigation* 1093-1011.

TickCheck. 2023. *TickCheck.* Accessed August 25, 2023. https://www.tickcheck.com/stats/county/new-jersey/burlington-county/lyme.

WHO. 2022. *Coronavirus Disease (COVID-19).* https://www.who.int/health-topics/coronavirus#tab=tab_1.

World Health Organization. 2009. *Pandemic Influenza Preparedness and Response.* Geneva: World Health Organization.

SECTION 4.3.3 – DROUGHT

CDC. 2021. *CDC Social Vulnerability Index.* https://svi.cdc.gov/map.html.

—. 2020. *CDC updates, expands list of people at risk of severe COVID-19 illness.* June 25. Accessed August 25, 2023. https://www.cdc.gov/media/releases/2020/p0625-update-expands-covid-19.html.

—. 2021. *Health Impacts of Drought.* March 21. https://www.cdc.gov/nceh/drought/implications.htm.

—. 2020. *Heat Stress.* August 31. Accessed September 8, 2023. https://www.cdc.gov/niosh/topics/heatstress/default.html.

—. 2018. *Sun Exposure.* June 1. Accessed September 8, 2023. https://www.cdc.gov/niosh/topics/sunexposure/default.html.

—. 2018. *SVI Interactive Map.* Accessed 2022. https://svi.cdc.gov/map.html.

Cornell University. 2021. *How Cliamte Change is Affecting Your Farm?* March 29. http://climatesmartfarming.org/changing-climate/.

FAO. 2019. *Proactive drought management.* November. Accessed August 28, 2023. https://www.fao.org/climate-smart-agriculture/knowledge/practices/drought/en/.

FEMA. 2023. *Disaster Declarations for States and Counties.* Accessed June 28, 2023. https://www.fema.gov/data-visualization/disaster-declarations-states-and-counties.

Fourth National Climate Assessment. 2017. *Northeast.* https://nca2018.globalchange.gov/chapter/18/.

Hoffman and Domber. 2003. *Development of Streamflow and Ground-water Drought Indicators for New Jersey.* New Jersey Department of Environmental Protection. Land Use Management. http://www.state.nj.us/dep/njgs/pricelst/ofreport/ofr04-2.pd.

IPCC. 2016. *Food Security Chapter 5 "Drought".* https://www.ipcc.ch/srccl/.

National Drought Mitigation Center. 2022. "Types of Drought." Accessed 2022. https://drought.unl.edu/Education/DroughtIn-depth/TypesofDrought.aspx.

NC State University. 2013. *Temperatures Moderate and Drought Abates in April.* May 10. https://climate.ncsu.edu/blog/2013/05/climate-summary-april-2013/.

NCAR. 2023. *Palmer Drought Severity Index (PDSI).* August 19. Accessed August 28, 2023. https://climatedataguide.ucar.edu/climate-data/palmer-drought-severity-index-pdsi.

NDMC. 2023. *Drought Impact Reporter Dashboard.* September 7. Accessed September 8, 2023. https://www.arcgis.com/apps/dashboards/46afe627bb60422f85944d70069c09cf.

—. n.d. *Types of Drought.* Accessed August 28, 2023. https://drought.unl.edu/Education/DroughtIn-depth/TypesofDrought.aspx.

NIDIS. 2019. *Fire.* April 5. Accessed August 28, 2023. https://www.drought.gov/drought/data-maps-tools/fire.

—. 2023. *Historical Data and Conditions.* Accessed August 30, 2023. https://www.drought.gov/historical-information?state=new-jersey&countyFips=34005&dataset=1&selectedDateUSDM=20210608&selectedDateSpi=20200101&dateRangeUSDM=2020-2022&dateRangeSpi=2018-2023.

—. n.d. *Monitoring Drought.* Accessed August 28, 2023. https://www.drought.gov/what-is-drought/monitoring-drought.

NJ Department of Environmental Protection. 2017. *NJ Water Supply Plan.* NJDEP. https://www.state.nj.us/dep/watersupply/pdf/wsp.pdf.

NJDEP. 2022. *2018/2020 New Jersey Integrated Water Quality Assessment Report.* September 1. Accessed August 28, 2023. https://www.state.nj.us/dep/wms/bears/assessment-report20182020.html#:~:text=New%20Jersey%27s%20surface%20waters%20provide%20much%20of%20the,economy%2C%20and%20quality%20of%20life%20for%20our%20residents.

—. 2020. *2020 New Jersey Scientific Report on Climate Change.* June 30. Accessed August 25, 2023. https://www.nj.gov/dep/climatechange/docs/nj-scientific-report-2020.pdf.

—. 2021. *New Jersey Drinking Water Watch .* https://www9.state.nj.us/DEP_WaterWatch_public/NJMap.jsp.

—. 2021. *New Jersey Drought Information.* https://www.nj.gov/dep/drought/faq.html.

NJDEP. 2017. *New Jersey Water Supply Plan.* Trenton: NJDEP. https://www.nj.gov/dep/watersupply/pdf/wsp.pdf.

—. 2017. *NEW JERSEY WATER SUPPLY PLAN.* October 5. Accessed September 8, 2023. https://www.nj.gov/dep/watersupply/pdf/wsp.pdf.

—. 2023. *Surface Water Quality Standards.* August 7. Accessed August 30, 2023. https://www.state.nj.us/dep/wms/bears/swqs-overview.htm#:~:text=Surface%20waters%20are%20classified%20based,other%20freshwaters%20except%20Pinelands%20waters).

NJOEM. 2019. *2019 New Jersey State Hazard Mitigation Plan.* NJOEM.

NOAA . 2012. *Location of US Climate Divisions.* Earth System Research Laboratory. Physical Sciences Division. http://www.esrl.noaa.gov/psd/data/usclimdivs/data/map.html.

NOAA. 2023. *Climate Change: Global Temperature.* National Oceanic and Atmospheric Administration. https://www.climate.gov/news-features/understanding-climate/climate-change-global-temperature.

—. 2023. *Storm Events Database.* Accessed August 30, 2023. https://www.ncdc.noaa.gov/stormevents/listevents.jsp?eventType=%28Z%29+Drought&beginDate_mm=01&beginDate_dd=01&beginDate_yyyy=1950&endDate_mm=05&endDate_dd=31&endDate_yyyy=2023&county=BURLINGTON%3A5&hailfilter=0.00&tornfilter=0&windfilter=000&sort=DT&subm.

—. 2021. *What is meant by the term drought?* March 12. https://www.weather.gov/bmx/kidscorner_drought.

State of New Jersey. 2017. *Population and Labor Force Projections.* May 11. Accessed September 8, 2023. https://www.nj.gov/labor/labormarketinformation/demographics/population-labor-projections/index.shtml.

University of Nebraka, Lincoln. . 2013. *Comparison of Major Drought Indices: Palmer Drought Severity Index.* http://drought.unl.edu/Planning/Monitoring/ComparisonofIndicesIntro/PDSI.aspx.

US EPA. 2023. *Safe Drinking Water Search for the State of New Jersey.* Accessed August 28, 2023. https://enviro.epa.gov/envirofacts/sdwis/search/results?q=N4Ig7glgJg5gpgFwMIEMA2aQC4Bm6DOcANCGgPYDGSZUc2IAcgFIglgoJwBOAygJ75OAWwCSUHnBRcKACwBq6eqxAAHMioCuaDhDIA7APIqE%2BBZiwBtEAFYADLeUBmR-eUBGe65IfPD777cQAF0ScioOOBgyLj56QQjldk5eAWEJKVlsUHUEXT106RkAFT4VOiw.

USDA. 2019. *2017 Census of Agriculture: County Profile.* May 24. Accessed August 28, 2023. https://www.nass.usda.gov/Publications/AgCensus/2017/Online_Resources/County_Profiles/New_Jersey/cp34005.pdf.

—. 2023. *Disaster Designation Information.* Accessed June 28, 2023. https://www.fsa.usda.gov/programs-and-services/disaster-assistance-program/disaster-designation-information/index.

SECTION 4.3.4 – EARTHQUAKE

Anil Agrawal, Huabei Liu, Roy Imbsen, Xin Zong, Nazhat Aboobaker. 2012. *Seismic Design Considerations.* Technical , Region 2 Transportation Research Center , City College of New York (CUNY), New York, NY: NJDOT, 1-604. Accessed April 30, 2021. https://www.nj.gov/transportation/business/research/reports/FHWA-NJ-2010-006.pdf.

FEMA. 2001. *Defining an Earthquake.* Washington DC: FEMA. http://www.fema.gov/media-library-data/20130726-1504-20490-4864/fema_159_units.pdf.

—. 2023. *Disaster Declarations for States and Counties.* Accessed June 28, 2023. https://www.fema.gov/data-visualization/disaster-declarations-states-and-counties.

—. 2022. *Hazus Earthquake Model User Guidance.* April. Accessed August 28, 2023. https://www.fema.gov/sites/default/files/documents/fema-hazus-5.1-earthquake-model-user-guidance.pdf.

—. 2021. *National Earthquake Hazards Reduction Program.* https://www.fema.gov/emergency-managers/risk-management/earthquake/nehrp#:~:text=The%20program%20develops%20strategies%2C%20tools,resilience%20among%20at%2Drisk%20communities.

NJDEP. 2020. *2020 New Jersey Scientific Report on Climate Change.* June 30. Accessed August 25, 2023. https://www.nj.gov/dep/climatechange/docs/nj-scientific-report-2020.pdf.

—. 2021. *Division of Water Supply and Geoscience.* https://www.nj.gov/dep/njgs/enviroed/hazus.htm.

—. 2009. *Physiographic provinces of New Jersey and location of the Ramapo Fault.* Accessed August 28, 2023. https://www.state.nj.us/dep/njgs/enviroed/physiog.htm.

NJGWS. 2019. *Earthquakes Epicentered In New Jersey.* April 24. Accessed August 28, 2023. https://www.state.nj.us/dep/njgs/geodata/dgs04-1.htm.

NJOEM. 2019. *2019 New Jersey State Hazard Mitigation Plan.* NJOEM.

NJOEM. 2019. *New Jersey State Hazard Mitigation Plan.* Trenton: NJOEM.

Shedlock, K. and Pakiser, L. 1997. *Earthquakes.* United States Geological Survey. http://pubs.usgs.gov/gip/earthq1/.

State of New Jersey. 2017. *Population and Labor Force Projections.* May 11. Accessed September 8, 2023. https://www.nj.gov/labor/labormarketinformation/demographics/population-labor-projections/index.shtml.

Stover, C.W. and Coffman, J.L. 1993. "Seismicity of the United States, 1569-1989 (Revised)." http://www.rosemonteis.us/files/references/stover-coffman-1993.pdf.

US SAR Task Force. n.d. *Tsunamis.* http://www.ussartf.org/tsunamis.htm.

USDA. n.d. *Disaster Designation Information.* Accessed November 28, 2023. https://www.fsa.usda.gov/programs-and-services/disaster-assistance-program/disaster-designation-information/index.

USGS. 2023. *Earthquake Catalog.* Accessed August 28, 2023. https://earthquake.usgs.gov/earthquakes/eventpage/us7000ebfb/dyfi/intensity.

—. 2012. *Earthquake Glossary- seiche.* http://earthquake.usgs.gov/learn/glossary/?term=seiche.

—. 2012. *Moment magnitude, Richter scale - what are the different magnitude scales, and why are there so many?* December 13. Accessed September 14, 2023. https://www.usgs.gov/faqs/moment-magnitude-richter-scale-what-are-different-magnitude-scales-and-why-are-there-so-many.

—. 2021. *The Modified Mercalli Intensity Scale.* https://www.usgs.gov/natural-hazards/earthquake-hazards/science/modified-mercalli-intensity-scale?qt-science_center_objects=0#qt-science_center_objects.

—. 2021. *USGS Earthquake Hazard Program.* https://earthquake.usgs.gov/.

—. n.d. *What are the Effects of Earthquakes?* Accessed August 28, 2023. https://www.usgs.gov/programs/earthquake-hazards/what-are-effects-earthquakes.

Volkert, R., R. Witte. 2015. *Geological History and Virtual Field Trip of the New Jersey Highlands.* State of New Jersey DEP. http://www.state.nj.us/dep/njgs/enviroed/freedwn/HighlandsVFT.pdf.

SECTION 4.3.5 – EXTREME TEMPERATURE

AARP. 2022. American Association of Retired Persons. https://www.aarp.org/health/conditions-treatments/info-2022/heat-wave-dangers.html.

2022. *Academy of Nutrition and Dietetics.* https://www.eatright.org/fitness/physical-activity/exercise-nutrition/exercise-safely-in-hot-weather.

CDC. 2017. Centers for Disease Control and Prevention. https://www.cdc.gov/disasters/extremeheat/medical.html.

—. 2005. *Extreme Cold.* March 22. Accessed September 1, 2023. https://www.cdc.gov/disasters/winter/pdf/extreme-cold-guide.pdf.

—. 2016. *Extreme Heat.* https://www.cdc.gov/disasters/extremeheat/index.html.

—. 2022. *Extreme Heat.* June 17. Accessed September 1, 2023. https://www.cdc.gov/disasters/extremeheat/index.html.

—. 2021. *Health Impacts of Drought.* March 21. https://www.cdc.gov/nceh/drought/implications.htm.

—. 2022. *Heat Stress – Heat Related Illness.* May 13. https://www.cdc.gov/niosh/topics/heatstress/heatrelillness.html#exhaustion.

—. 2012. "Natural Disasters and Severe Weather." *Center for Disease Control and Protection.* December 03. Accessed August 27, 2023. https://www.cdc.gov/disasters/winter/guide.html.

—. 2022. *Pregnant Women.* Centers for Disease Control and Prevention. https://www.cdc.gov/disasters/extremeheat/heat_and_pregnant_women.html#:~:text=Why%20are%20pregnant%20women%20more,body%20and%20the%20developing%20baby.

—. 2018. *SVI Interactive Map.* Accessed 2022. https://svi.cdc.gov/map.html.

Columbia University. 2023. *Columbia University Irving Medical Center.* https://www.cuimc.columbia.edu/news/heat-stroke-kids-what-watch-and-know#:~:text=%E2%80%9CHeatstroke%20is%20a%20serious%20medical,cannot%20take%20care%20of%20themselves.

Cornell University. 2021. *How Cliamte Change is Affecting Your Farm?* March 29. http://climatesmartfarming.org/changing-climate/.

EPA. 2019. *Heat Island Effect.* US EPA. https://www.epa.gov/heat-islands.

FAO. 2019. *Proactive drought management.* November. Accessed August 28, 2023. https://www.fao.org/climate-smart-agriculture/knowledge/practices/drought/en/.

FEMA. 2023. *Disaster Declarations for States and Counties.* Accessed June 28, 2023. https://www.fema.gov/data-visualization/disaster-declarations-states-and-counties.

IPCC. 2016. *Food Security Chapter 5 "Drought".* https://www.ipcc.ch/srccl/.

Meehl, G., Tebaldi, C. 2004. *More Intense, More Frequent, and Longer Lasting Heat Waves in the 21st Century.* NA.

2023. *National Geographic.* https://education.nationalgeographic.org/resource/urban-heat-island/.

NC State University. 2013. *Temperatures Moderate and Drought Abates in April.* May 10. https://climate.ncsu.edu/blog/2013/05/climate-summary-april-2013/.

NIDIS. 2019. *Fire.* April 5. Accessed August 28, 2023. https://www.drought.gov/drought/data-maps-tools/fire.

NJ Department of Environmental Protection. 2017. *NJ Water Supply Plan.* NJDEP. https://www.state.nj.us/dep/watersupply/pdf/wsp.pdf.

NJDEP. 2020. *2020 New Jersey Scientific Report on Climate Change.* June 30. Accessed August 25, 2023. https://www.nj.gov/dep/climatechange/docs/nj-scientific-report-2020.pdf.

—. 2021. *New Jersey Drinking Water Watch .* https://www9.state.nj.us/DEP_WaterWatch_public/NJMap.jsp.

NJDEP. 2021. *New Jersey Drought Information.* Division of Water Supply and Geoscience, New Jersey Drought Information. https://www.nj.gov/dep/drought/faq.html .

NJDEP. 2017. *New Jersey Water Supply Plan.* Trenton: NJDEP. https://www.nj.gov/dep/watersupply/pdf/wsp.pdf.

NOAA. 2009. *Naionanl Weather Service, Heat Wave.* June 25. Accessed August 30, 2022. https://w1.weather.gov/glossary/index.php?word=heat+wave.

—. 2023. *Storm Events Database.* Accessed June 28, 2023. https://www.ncdc.noaa.gov/stormevents/choosedates.jsp?statefips=-999%2CALL.

NWS. n.d. *Cold Weather Safety.* Accessed August 27, 2023. https://www.weather.gov/safety/cold.

—. 2023. *Heat Forecast Tools.* July 18. Accessed August 27, 2023. https://www.weather.gov/safety/heat-index.

—. 2021. *NWS Heat Forcasting Tools.* 06 2. Accessed 2021. https://www.weather.gov/safety/heat-index.

—. 2022. *Stay Safe in the Extreme Cold.* February 8. Accessed August 27, 2023. https://www.weather.gov/dlh/extremecold.

—. 2021. *Wind Chill Chart.* 06 01. Accessed 2021. https://www.weather.gov/safety/cold-wind-chill-chart.

—. 2019. *Wind Chill Chart.* August 1. Accessed aUGUST 27, 2023. https://www.weather.gov/safety/cold-wind-chill-chart.

ONJSC. 2021. *Historical monthly summary tables.* http://climate.rutgers.edu/stateclim_v1/monthlydata/index.php.

OSHA. 2023. *Heat Illness at Work.* Occupational Health and Safety Administration. https://www.osha.gov/heat-exposure#:~:text=Workers%20suffering%20from%20heat%20stroke,Related%20Illnesses%20and%20First%20Aid.

Rutgers University. 2019. *New Jersey Climate Publication.* https://climate.rutgers.edu/stateclim_v1/njclimoverview.html.

State of New Jersey. 2021. *Energy Resilience Bank.* https://www.state.nj.us/bpu/about/divisions/opp/erb.html.

—. 2017. *Population and Labor Force Projections.* May 11. Accessed September 8, 2023. https://www.nj.gov/labor/labormarketinformation/demographics/population-labor-projections/index.shtml.

2020. *US Census Bureau.* https://www.census.gov/quickfacts/fact/table/NJ/PST045222.

US Census Bureau. 2021. *American Community Survey.* https://www.census.gov/programs-surveys/ahs/data/interactive/ahstablecreator.html?s_areas=00000&s_year=2021&s_tablename=TABLE3&s_bygroup1=1&s_bygroup2=1&s_filtergroup1=1&s_filtergroup2=1.

US Census. 2022. *Redefining Urban Areas following the 2020 Census.* December 22. Accessed August 27, 2023. https://www.census.gov/newsroom/blogs/random-samplings/2022/12/redefining-urban-areas-following-2020-census.html.

US EPA. 2023. *Learn About Heat Islands.* August 28. Accessed September 14, 2023. https://www.epa.gov/heatislands/learn-about-heat-islands.

—. 2023. *Safe Drinking Water Search for the State of New Jersey.* Accessed August 28, 2023. https://enviro.epa.gov/envirofacts/sdwis/search/results?q=N4Ig7glgJg5gpgFwMIEMA2aQC4Bm6DOcANCGgPYDGSZUc2IAcgFIglgoJwBOAygJ75OAWwCSUHnBRcKACwBq6eqxAAHMioCuaDhDIA7APIqE%2BBZiwBtEAFYADLeUBmR-eUBGe65IfPD777cQAF0ScioOOBgyLj56QQjldk5eAWEJKVlsUHUEXT106RkAFT4VOiw.

USDA. 2019. *2017 Census of Agriculture: County Profile.* May 24. Accessed August 28, 2023. https://www.nass.usda.gov/Publications/AgCensus/2017/Online_Resources/County_Profiles/New_Jersey/cp34005.pdf.

—. 2023. *Disaster Designation Information.* Accessed June 28, 2023. https://www.fsa.usda.gov/programs-and-services/disaster-assistance-program/disaster-designation-information/index.

USGS. 2020. *Drought, FIre and Extreme Weather.* https://www.usgs.gov/ecosystems/climate-adaptation-science-centers/science/drought-fire-and-extreme-weather.

SECTION 4.3.6 – FLOOD

American Community Survey. 2020. *American Community Survey 5-year Estimates 2020.*

Andrew, Rick. 2021. *Flooding's Impact on Public Water Supplies, Sanitation.* December 09. Accessed February 21, 2023. https://www.waterworld.com/water-utility-management/article/14211783/floodings-impact-on-public-water-supplies.

CDC. 2020. *CDC updates, expands list of people at risk of severe COVID-19 illness.* June 25. Accessed August 25, 2023. https://www.cdc.gov/media/releases/2020/p0625-update-expands-covid-19.html.

—. 2020. *Mold After a Disaster.* July 28. Accessed June 13, 2023. https://www.cdc.gov/disasters/mold/index.html.

—. 2020. *SVI Interactive Map.* Accessed 2023. https://svi.cdc.gov/map.html.

—. 2017. *What You Can Do to Prepare.* December 13. https://www.cdc.gov/climateandhealth/pubs/CoastalFloodingClimateChangeandYourHealth-508.pdf.

Center for Disaster Resilience. 2016. *The Growing Threat of Urban FLooding: A National Challenge.* https://cdr.umd.edu/sites/cdr.umd.edu/files/resource_documents/COMPRESSEDurban-flooding-report-online-compressed-0319.pdf.

EPA. 2022. *Climate Change Indicators.* August 01. https://www.epa.gov/climate-indicators/climate-change-indicators-coastal-flooding#:~:text=Rising%20sea%20level%20inundates%20low,vulnerable%20to%20damage%20from%20storms.

FEMA. 2023. *Coastal Flooding.* March. https://hazards.fema.gov/nri/coastal-flooding.

—. 2023. *Disaster Declarations for States and Counties.* Accessed June 28, 2023. https://www.fema.gov/data-visualization/disaster-declarations-states-and-counties.

—. 2019. *Flood insurance Study - Burlington County.* August 28. Accessed August 25, 2023. https://map1.msc.fema.gov/data/34/S/PDF/34005CV001B.pdf?LOC=f82215e4aa1c2088d90f1d02c906e295.

—. 2020. *Flood Zones.* https://www.fema.gov/glossary/flood-zones.

—. 2020. *Flood Zones.* July 8. Accessed July 7, 2023. https://www.fema.gov/glossary/flood-zones.

—. 2022. *Floodwater After a Disaster or Emergency.* October 04. Accessed June 13, 2023. https://www.cdc.gov/disasters/floods/floodsafety.html.

—. 2019. *Guidance for Flood Risk Analysis and Mapping.* November. Accessed July 7, 2023. https://www.fema.gov/sites/default/files/2020-02/FloodwayAnalysis_and_Mapping_Nov_2019.pdf.

FEMA. 2018. *Ice-Jam Analyses and Mapping.* Guidance for Flood Risk , FEMA. https://www.fema.gov/sites/default/files/2020-02/Ice_Jam_Guidance_Feb_2018.pdf.

—. 2022. "Local Mitigation Planning Policy Guide." *FEMA Mitigation Planning Policy Updates.* April 19. https://www.fema.gov/sites/default/files/documents/fema_local-mitigation-planning-policy-guide_042022.pdf.

—. 2019. *Riverine Flooding.* Accessed January 03, 2023. https://hazards.fema.gov/nri/riverine-flooding.

—. 2007. *Types of Floods and Floodplains.* jULY 12. Accessed aUGUST 6, 2023. https://training.fema.gov/hiedu/docs/fmc/chapter%202%20-%20types%20of%20floods%20and%20floodplains.pdf#:~:text=If%20local%20drainage%20conditions%20are%20inadequate%20to%20accommodate,in%20certain%20areas%20may%20cause%20localized%20flooding%20problems.

Harris, T. 2008. *How Floods Work.* http://science.howstuffworks.com/flood.htm.

NASA Earth Observatory. 2020. *Taking a Measure of Sea Level Rise: Ocean Altimetry.* November 6. Accessed October 30, 2022. https://earthobservatory.nasa.gov/images/147435/taking-a-measure-of-sea-level-rise-ocean-altimetry.

NASA. 2020. *Sea Level 101, Part Two: All Sea Level is 'Local'.* July 14. Accessed October 30, 2022. https://climate.nasa.gov/ask-nasa-climate/3002/sea-level-101-part-two-all-sea-level-is-local/.

National Geographic. 2023. *Erosion.* July 18. Accessed August 25, 2023. https://education.nationalgeographic.org/resource/erosion/.

—. 2022. *The Many Effects of Flooding.* September 8. Accessed August 25, 2023. https://education.nationalgeographic.org/resource/many-effects-flooding/.

NESEC. 2021. *Ice Jams.* Accessed August 6, 2023. https://nesec.org/ice-jams/.

NHC. n.d. *Storm Surge Overview.* Accessed September 1, 2023. https://www.nhc.noaa.gov/surge/.

—. n.d. *Storm Surge Watch/Warning Graphic.* Accessed 2023. https://www.nhc.noaa.gov/surge/warning/.

NJDEP. 2020. *2020 New Jersey Scientific Report on Climate Change.* June 30. Accessed August 25, 2023. https://www.nj.gov/dep/climatechange/docs/nj-scientific-report-2020.pdf.

NOAA . 2022. *Tides & Currents.* Accessed October 30, 2022. https://tidesandcurrents.noaa.gov/.

NOAA. 2023. *NOAA SciJinks- Storm Surge.* July 7. Accessed July 31, 2023. https://scijinks.gov/storm-surge/.

—. 2023. *Storm Events Database.* Accessed June 28, 2023. https://www.ncdc.noaa.gov/stormevents/choosedates.jsp?statefips=-999%2CALL.

—. 2023. *What is storm surge?* January 20. Accessed August 4, 2023. https://oceanservice.noaa.gov/facts/stormsurge-stormtide.html.

NWS. 2023. *Advanced Hydrologic Prediction Service.* Accessed August 25, 2023. https://water.weather.gov/ahps2/index.php?wfo=phi.

—. 2009. *Flash Flood.* http://w1.weather.gov/glossary/index.php?word=flash+flood.

—. 2019. *Flood Related Hazards.* September 16. Accessed January 03, 2023. https://www.weather.gov/safety/flood-hazards.

—. 2011. *Flood Safety.* http://www.erh.noaa.gov/car/WCM/Awareness_Campaigns_files/flood_part_1.htm.

—. 2014. *Floods.* September 24. Accessed December 08, 2022. https://www.weather.gov/pbz/floods#:~:text=Flash%20flooding%20occurs%20within%206%20hours%20of%20the,river%20basins%20with%20too%20much%20water%2C%20too%20quickly.

—. 2017. *Watch/Warning/Advisory Definitions.* December 1. Accessed August 4, 2023. https://www.weather.gov/lwx/warningsdefined.

Rokaya, P. 2018. *Trends in the Timing and Magnitude of Ice-Jam Floods in Canada.* https://www.nature.com/articles/s41598-018-24057-z.

State of New Jersey. 2017. *Population and Labor Force Projections.* May 11. Accessed September 8, 2023. https://www.nj.gov/labor/labormarketinformation/demographics/population-labor-projections/index.shtml.

Stroosnijder, Leo. 2005. "Measurement of erosion: Is it possible?" *CATENA* 162-173. https://www.sciencedirect.com/science/article/abs/pii/S0341816205001268.

US DHS. 2019. *Base Flood Elevation (BFE).* August 28. Accessed July 7, 2023. https://www.ready.gov/faq/base-flood-elevation-bfe.

US EPA. 2023. *Climate Change Indicators: Heavy Precipitation.* July 21. Accessed August 4, 2023. https://www.epa.gov/climate-indicators/climate-change-indicators-heavy-precipitation.

—. 2009. *Extreme Events: Abrupt Climate Change.* http://www.epa.gov/climatechange/effects/extreme.html>. U.S. Forest Services. 2020 On-Line Address: http://www.fs.fed.us/.

USACE. 2022. *Ice Jam Database.* August. Accessed August 25, 2022. https://icejam.sec.usace.army.mil/ords/f?p=101:7::::::.

USDA. 2023. *Disaster Designation Information.* Accessed June 28, 2023. https://www.fsa.usda.gov/programs-and-services/disaster-assistance-program/disaster-designation-information/index.

USGS. 2016. *Effects of Urban Development on Floods.* November 29. Accessed August 6, 2023. https://pubs.usgs.gov/fs/fs07603/#:~:text=The%20changes%20in%20land%20use%20associated%20with%20urban,and%20frequency%20of%20floods%20increase%20in%20nearby%20streams.

—. 2016. *Ground Water and the Rural Homeowner.* November 30. Accessed August 6, 2023. https://pubs.usgs.gov/gip/gw_ruralhomeowner/#:~:text=In%20addition%20to%20seasonal%20fluctuations%20in%20ground-water%20storage%2C,years%20of%20above-normal%20precipitation%20causes%20a%20corresponding%20rise.

—. 2023. *WaterWatch.* Accessed August 25, 2023. https://waterwatch.usgs.gov/index.php?r=nj&id=ww_current.

SECTION 4.3.7 – SEVERE WEATHER

American Community Survey. 2020. *American Community Survey 5-year Estimates 2020.*

CDC. 2016. *Extreme Heat.* https://www.cdc.gov/disasters/extremeheat/index.html.

—. 2012. "Natural Disasters and Severe Weather." *Center for Disease Control and Protection.* December 03. Accessed August 27, 2023. https://www.cdc.gov/disasters/winter/guide.html.

EPA. 2019. *Heat Island Effect.* US EPA. https://www.epa.gov/heat-islands.

FEMA. 2023. *Disaster Declarations for States and Counties.* Accessed June 28, 2023. https://www.fema.gov/data-visualization/disaster-declarations-states-and-counties.

—. 2022. *Hazus Earthquake Model User Guidance.* April. Accessed August 28, 2023. https://www.fema.gov/sites/default/files/documents/fema-hazus-5.1-earthquake-model-user-guidance.pdf.

—. 2019. *National Risk Index.* Accessed August 16, 2023. https://hazards.fema.gov/nri/map.

Hazwoper OSHA. 2020. *Protecting Workers in Bad Weather Conditions.* November 6. Accessed September 14, 2023. https://hazwoper-osha.com/blog-post/protecting-workers-in-bad-weather-conditions.

Meehl, G., Tebaldi, C. 2004. *More Intense, More Frequent, and Longer Lasting Heat Waves in the 21st Century.* NA.

National Oceanic and Atmospheric Administration. 2023. *Storm Events Database.* Accessed June 28, 2023. https://www.ncdc.noaa.gov/stormevents/choosedates.jsp?statefips=-999%2CALL.

NFPA. 2013. *Lightning Fires and Lightning Strikes.* June. Accessed August 27, 2023. https://www.nfpa.org/-/media/Files/News-and-Research/Fire-statistics-and-reports/US-Fire-Problem/Fire-causes/oslightning.ashx?la=en#:~:text=During%202007-2011%2C%20U.S.%20local%20fire%20departments%20responded%20to,%24451%20million%20in%20direct%20propert.

NHC. n.d. *Storm Surge Watch/Warning Graphic.* Accessed 2023. https://www.nhc.noaa.gov/surge/warning/.

—. n.d. *Tropical Cyclone Climatology.* https://www.nhc.noaa.gov/climo/?text#overview.

NIST. 2011. *Double Jeopardy: Building Codes May Underestimate Risks Due to Multiple Hazards.* September 13. Accessed August 16, 2023. https://www.nist.gov/news-events/news/2011/09/double-jeopardy-building-codes-may-underestimate-risks-due-multiple-hazards.

NJDEP. 2020. *2020 New Jersey Scientific Report on Climate Change.* June 30. Accessed August 25, 2023. https://www.nj.gov/dep/climatechange/docs/nj-scientific-report-2020.pdf.

NOAA. 2020. *Hurricanes.* May 1. https://www.noaa.gov/education/resource-collections/weather-atmosphere/hurricanes.

—. 2009. *National Weather Service, Heat Wave.* June 25. Accessed August 30, 2022. https://w1.weather.gov/glossary/index.php?word=heat+wave.

NOAA NHC. 2023. *Historical Hurricane Tracks.* September 11. https://coast.noaa.gov/hurricanes/#map=4/32/-80.

—. 2010. *NHC Issuance Criteria Changes for Tropical Cyclone Watches/Warnings.* Accessed November 15, 2021. https://www.nhc.noaa.gov/watchwarn_changes.shtml#:~:text=Hurricane%20Watch%3A%20An%20announcement%20that,within%20the%20specified%20coastal%20area.&text=Hurricane%20Warning%3A%20An%20announcement%20that,within%20the%20specified%20coastal%20area.

NOAA. 2014. *NOAA Knows..Lightning.* Accessed 18 May, 2023. https://www.weather.gov/media/owlie/lightning3_050714.pdf#:~:text=ightning%20is%20one%20of%20the%20most%20underrated%20severe,people%20and%20injure%20hundreds%20of%20others%20each%20year.

—. 2023. *NOAA SciJinks- Storm Surge.* July 7. Accessed July 31, 2023. https://scijinks.gov/storm-surge/.

—. 2020. *Saffir-Simpson Hurricane Wind Scale.* Accessed May 8, 2023. https://www.nhc.noaa.gov/aboutsshws.php.

—. n.d. *Severe Weather 101.* Accessed 2023. https://www.nssl.noaa.gov/education/svrwx101/thunderstorms/.

—. n.d. *Severe Weather 101- Lightning.* Accessed 2022. https://www.nssl.noaa.gov/education/svrwx101/lightning/.

—. n.d. *SPC Products.* Accessed August 27, 2023. https://www.spc.noaa.gov/misc/about.html.

—. 2023. *Storm Events Database.* Accessed June 28, 2023. https://www.ncdc.noaa.gov/stormevents/choosedates.jsp?statefips=-999%2CALL.

—. 2023. *Thunderstorms.* April 14. Accessed September 14, 2023. https://www.noaa.gov/jetstream/thunderstorms.

—. 2011. *Tornadoes 101.* Accessed 2023. https://www.noaa.gov/stories/tornadoes-101.

—. 2023. *Types of Damaging Winds.* January 4. Accessed September 14, 2023. https://www.nssl.noaa.gov/education/svrwx101/wind/types/.

NSSL. 2021. *Severe Weather 101 - Hail Basics.* Accessed 2021. https://www.nssl.noaa.gov/education/svrwx101/hail/.

—. 2021. *Severe Weather 101 - Hail Basics.* Accessed 2021. https://www.nssl.noaa.gov/education/svrwx101/hail/.

NWS. 2012. "Air Pressure and Wind." November 9. Accessed 2021. https://www.weather.gov/media/zhu/ZHU_Training_Page/winds/pressure_winds/pressure_winds.pdf.

—. n.d. *Cold Weather Safety.* Accessed August 27, 2023. https://www.weather.gov/safety/cold.

—. 2015. *Explanation of EF-Scale Ratings.* July 30. Accessed August 27, 2023. https://www.weather.gov/hun/efscale_explanation.

—. 2019. *Hail Safety Rules.* October 7. Accessed August 27, 2023. https://www.bing.com/search?q=an+extreme+event+can+carry+hail+stones+traveling+at+speeds+greater+than+100+miles+per+hour&qs=n&form=QBRE&sp=-1&lq=1&pq=while+hailstorms+are+not+frequently+known+to+cause+major+injuries+or+damage+in+new+jersey%2C+an+extreme+e.

—. 2023. *Heat Forecast Tools.* July 18. Accessed August 27, 2023. https://www.weather.gov/safety/heat-index.

—. n.d. *Hurricane Facts.* Accessed August 16, 2023. https://www.weather.gov/source/zhu/ZHU_Training_Page/tropical_stuff/hurricane_anatomy/hurricane_anatomy.html#:~:text=Hurricanes%20are%20warm%20core%20storms.%20heat%20hurricanes%20generate,will%20continue%20to%20rise%20and%20condense%20water%20vapor.

—. 2021. *National Weather Service Glossary.* Accessed 2021. https://forecast.weather.gov/glossary.php.

—. 2021. *NWS Heat Forcasting Tools.* 06 2. Accessed 2021. https://www.weather.gov/safety/heat-index.

—. 2022. *Stay Safe in the Extreme Cold.* February 8. Accessed August 27, 2023. https://www.weather.gov/dlh/extremecold.

—. 2022. *Storm Prediction Center Severe Risk .* https://www.weather.gov/media/ewx/iwt/SPC_WPC_Differences.pdf.

—. 2023. *Summer Infographics.* May 9. Accessed August 27, 2023. https://www.weather.gov/wrn/summer-infographics.

—. 2010. *Thunderstorms, Tornadoes, Lightning...Nature's Most Violent Storms.* June 25. Accessed 2021. https://www.weather.gov/media/owlie/ttl6-10.pdf.

—. 2023. *WFO ILN Weather Product Criteria.* Accessed 2023. https://www.weather.gov/iln/criteria.

—. 2012. *WFO PHI Weather Product Criteria.* September 17. Accessed August 27, 2023. https://www.weather.gov/phi/criteria.

—. 2021. *Wind Chill Chart.* 06 01. Accessed 2021. https://www.weather.gov/safety/cold-wind-chill-chart.

ONJSC. 2021. *Historical monthly summary tables.* http://climate.rutgers.edu/stateclim_v1/monthlydata/index.php.

Rutgers University. 2019. *New Jersey Climate Publication.* Rutgers University. https://climate.rutgers.edu/stateclim_v1/njclimoverview.html.

State of New Jersey. 2019. *2019 New Jersey State Hazard Mitigation Plan.* Accessed August 27, 2023. https://www.nj.gov/njoem/mitigation/2019-mitigation-plan.shtml.

—. 2017. *Population and Labor Force Projections.* May 11. Accessed September 8, 2023. https://www.nj.gov/labor/labormarketinformation/demographics/population-labor-projections/index.shtml.

U.S. Climate Resilience Toolkit. 2016. *Changing Ecosystems and Infectious Diseases.* November 16. Accessed August 27, 2023. https://toolkit.climate.gov/topics/human-health/altered-risk-infectious-diseases.

University Corporation for Atmospheric Research . 2022. *Hurricanes.* Accessed 2023. https://scied.ucar.edu/learning-zone/storms/hurricanes.

—. 2023. *Where Thunderstorms Happen.* Accessed 2023. https://scied.ucar.edu/learning-zone/storms/where-thunderstorms-happen.

US Cennsus. 2022. *Redefining Urban Areas following the 2020 Census.* December 22. Accessed August 27, 2023. https://www.census.gov/newsroom/blogs/random-samplings/2022/12/redefining-urban-areas-following-2020-census.html.

US EPA. 2023. *Climate Change Indicators: Weather and Climate.* July 26. Accessed August 27, 2023. https://www.epa.gov/climate-indicators/weather-climate.

USDA. 2023. *Disaster Designation Information.* Accessed June 28, 2023. https://www.fsa.usda.gov/programs-and-services/disaster-assistance-program/disaster-designation-information/index.

SECTION 4.3.8 – SEVERE WINTER WEATHER

FEMA. 2023. *Disaster Declarations for States and Counties.* Accessed June 28, 2023. https://www.fema.gov/data-visualization/disaster-declarations-states-and-counties.

Lam, Linda. 2019. *Ground Blizzards: Why Blizzard Warnings Are Issued With Little or No Falling Snow.* January 23. https://weather.com/storms/winter/news/2019-01-23-ground-blizzard-warning-no-falling-snow.

MRCC. 2021. *Ice Storms .* https://mrcc.illinois.edu/living_wx/icestorms/index.html.

NASA. 2023. *The Effects of Climate Change.* August 23. Accessed August 27, 2023. https://climate.nasa.gov/effects/.

National Geographic. 2022. *Nor'easter.* May 20. Accessed August 27, 2023. https://education.nationalgeographic.org/resource/noreaster/.

NJDEP. 2020. *2020 New Jersey Scientific Report on Climate Change.* June 30. Accessed August 25, 2023. https://www.nj.gov/dep/climatechange/docs/nj-scientific-report-2020.pdf.

NOAA. 2017. *6 tools our meteorologists use to forecast the weather.* August 14. Accessed August 5, 2023. https://www.noaa.gov/stories/6-tools-our-meteorologists-use-to-forecast-weather.

—. n.d. *Glossary.* Accessed September 14, 2023. https://forecast.weather.gov/glossary.php?word=ice%20storm.

—. 2023. *NOAA SciJinks.* July 7. Accessed July 31, 2023. https://scijinks.gov/noreaster/.

—. n.d. *Regional Snowfall Index (RSI).* Accessed August 2022. https://www.ncei.noaa.gov/access/monitoring/rsi/.

—. 2023. *Severe Winter Weather.* January 4. Accessed August 27, 2023. https://www.nssl.noaa.gov/education/svrwx101/winter/types/.

—. 2023. *Storm Events Database.* Accessed June 28, 2023. https://www.ncdc.noaa.gov/stormevents/choosedates.jsp?statefips=-999%2CALL.

—. 2021. *The National Severe Storm Laboratory.* https://www.nssl.noaa.gov/research/winter/.

—. 2023. *Winter Weather Basics.* January 4. Accessed August 27, 2023. https://www.nssl.noaa.gov/education/svrwx101/winter/#:~:text=Most%20deaths%20from%20winter%20storms%20are%20not%20directly,threat%20to%20you%20depends%20on%20your%20specific%20situation.

NSIDC. 2013. *Introduction to Snow.* http://nsidc.org/cryosphere/snow/index.html.

—. n.d. *Snow.* Accessed August 27, 2023. https://nsidc.org/learn/parts-cryosphere/snow/why-snow-matters#:~:text=Faster%20snow%20cover%20retreat%20means%20earlier%20soil%20exposure%2C,runoff%20potentially%20leaves%20rivers%20drier%20in%20late%20summer.

NWS. 2019. *Ice Storms.* July 31. Accessed August 27, 2023. https://www.weather.gov/safety/winter-ice-frost.

—. 2021. *Safety - Winter Hazards.* https://www.weather.gov/apx/day_7_winter_awareness.

—. 2019. *Snow Storm Safety.* July 31. Accessed August 27, 2023. https://www.weather.gov/safety/winter-snow.

Rutgers University. 2021. *NJ Climate Review.* https://climate.rutgers.edu/stateclim_v1/njclimoverview.html.

Siebers, Tony. n.d. *Mid-Atlantic Winter Storm Patterns.* Accessed August 16, 2023. https://glenallenweather.com/alink/18snow/stormtypes.htm.

State of New Jersey. 2017. *Population and Labor Force Projections.* May 11. Accessed September 8, 2023. https://www.nj.gov/labor/labormarketinformation/demographics/population-labor-projections/index.shtml.

Sustainable Jersey Climate Change Adaptation Task Force. 2011. *New Jersey Climate Change Trends and Projections Summary.* November 10. Accessed August 27, 2023. https://www.sustainablejersey.com/fileadmin/media/Media___Publications/Publications/2011-09-26_SJ_CATF_CC_Impacts_Summary_final.pdf.

Tiwari, A., and J.W. Rachlin. 2018. "A Review of Road Salt Ecological Impacts." *Northeastern Naturalist* 123-142. https://www.jstor.org/stable/26453969.

USDA. 2023. *Disaster Designation Information.* Accessed June 28, 2023. https://www.fsa.usda.gov/programs-and-services/disaster-assistance-program/disaster-designation-information/index.

SECTION 4.3.9 – WILDFIRE

Burlington County. 2019. *Burlington County 2019 Hazard Mitigation Plan.* Accessed August 30, 2023.

CDC. 2020. *CDC updates, expands list of people at risk of severe COVID-19 illness.* June 25. Accessed August 25, 2023. https://www.cdc.gov/media/releases/2020/p0625-update-expands-covid-19.html.

FEMA. 2023. *Disaster Declarations for States and Counties.* Accessed June 28, 2023. https://www.fema.gov/data-visualization/disaster-declarations-states-and-counties.

—. 2021. *Flood Risks Increase After Fires.* March 22. Accessed August 30, 2023. https://www.fema.gov/fact-sheet/flood-risks-increase-after-fires.

—. 2020. *Flood Risks Increase After Fires.* November. Accessed August 30, 2023. https://www.fema.gov/sites/default/files/documents/fema_flood-after-fire_factsheet_nov20.pdf.

Harvard University. 2022. *A Deadly Mix: Wildfires and Urban Air Pollution Create Toxic Ozone.* February 25. Accessed August 30, 2023. https://sitn.hms.harvard.edu/flash/2022/a-deadly-mix-wildfires-and-urban-air-pollution-create-toxic-ozone/.

Insurance information Institute. 2022. *Wildfires by State.* Accessed August 30, 2023. https://www.iii.org/table-archive/23284.

National Geographic. 2014. *Climate Change May Spark More Lightning Strikes, Igniting Wildfires.* November 15. Accessed August 30, 2023. https://www.nationalgeographic.com/science/article/141113-climate-change-lightning-atmosphere-science.

—. 2022. *Wildfires.* May 20. Accessed September 14, 2023. https://education.nationalgeographic.org/resource/wildfires/.

New Jersey Forest Fire Service. 2023. *Area of Interest Summary: Burlington County.* New Jersey Forest Fire Service.

New Jersey Forest Fire Service. 2023. *Fire Statistics 2018-2022.* New Jersey Forest Fire Service.

New Jersey Forest Fire Service. 2023. *New Jersey Wildland Fire Agencies.* New Jersey Forest Fire Service.

NIDIS. 2023. *Wildfire Management.* Accessed August 30, 2023. https://www.drought.gov/sectors/wildfire-management.

NJ Pinelands Commission. 2018. *Municipalities in the Pinelands.* September. Accessed August 30, 2023. https://www.nj.gov/pinelands/home/maps/maps/documents/Municipalities%20in%20the%20Pinelands.pdf#:~:text=Municipalities%20in%20the%20Pinelands%20MIDDLESEX,MERCER%20MONMOUTH%20JACKSON%20NORTH%20P%20HANOVER.

NJ Pinelands Comsission. 2014. *Long Term Economic Monitoring Program 2013 Annual Report.* April. Accessed August 30, 2023. https://www.state.nj.us/pinelands/landuse/econ/LTEM_Annual_Report-2013.pdf.

NJDEP. 2020. *2020 New Jersey Scientific Report on Climate Change.* June 30. Accessed August 25, 2023. https://www.nj.gov/dep/climatechange/docs/nj-scientific-report-2020.pdf.

—. 2023. *NJ Fire Danger Dashboard: FIRE DANGER INDICES.* Accessed September 14, 2023. https://njdep.maps.arcgis.com/apps/dashboards/3d95a723235d4a5383ab9838a8884282.

NJFFS. 2023. *New Jersey Forest Fire Service.* June 16. Accessed August 30, 2023. https://www.nj.gov/dep/parksandforests/fire/.

—. 2020. *Our Organization.* October 16. Accessed August 30, 2023. https://www.nj.gov/dep/parksandforests/fire/about/organization.html.

NJOEM. 2019. *2019 New Jersey State Hazard Mitigation Plan.* NJOEM.

NOAA. 2020. *Fire fuels in high northern latitudes are becoming more flammable.* December 8. Accessed September 14, 2023. https://www.climate.gov/news-features/featured-images/fire-fuels-high-northern-latitudes-are-becoming-more-flammable.

—. 2023. *Storm Events Database.* Accessed June 28, 2023. https://www.ncdc.noaa.gov/stormevents/choosedates.jsp?statefips=-999%2CALL.

NPS. 2018. *New Jersey Pinelands National Reserve.* August 2. Accessed August 30, 2023. https://www.nps.gov/places/new-jersey-pinelands-national-reserve.htm.

—. 2023. *Understanding Fire Danger.* August 17. Accessed September 14, 2023. https://www.nps.gov/articles/understanding-fire-danger.htm.

—. 2022. *Wildfires, Prescribed Fires, and Fuels.* January 12. Accessed September 14, 2023. https://www.nps.gov/orgs/1965/wildfires-prescribed-fires-fuels.htm.

State of New Jersey. 2017. *Population and Labor Force Projections.* May 11. Accessed September 8, 2023. https://www.nj.gov/labor/labormarketinformation/demographics/population-labor-projections/index.shtml.

U.S. Department of the Interior. 2012. "Integrating and Coordinating Wildland Fire and Invasive Species Management Efforts." October 12. https://www.doi.gov/sites/doi.gov/files/nisc-wflcmemo-final-10-12-2022.pdf.

United Nations. 2021. *Wildfires – a growing concern for sustainable development.* August. Accessed August 30, 2023. https://www.un.org/development/desa/dpad/wp-content/uploads/sites/45/publication/PB_111.pdf#:~:text=Catastrophic%20wildfires%20kill%2C%20injure%20and%20displace%20wildlife%20and,their%20population%2C%20and%20pushing%20them%20towards%20becoming%20endangere.

US EPA. 2022. *Climate Change Indicators: Wildfires.* July. Accessed August 30, 2023. https://www.epa.gov/climate-indicators/climate-change-indicators-wildfires.

—. 2022. *Wildfires.* July 28. Accessed August 30, 2023. https://www.epa.gov/sites/default/files/2021-04/documents/wildfires_td.pdf#:~:text=Earlier%20spring%20melting%20and%20reduced%20snowpack%20result%20in,in%20not%20just%20severity%20but%20also%20season%20length.

USDA. 2023. *Disaster Designation Information.* Accessed June 28, 2023. https://www.fsa.usda.gov/programs-and-services/disaster-assistance-program/disaster-designation-information/index.

USFS. n.d. *National Fire Danger Rating System.* Accessed August 30, 2023. https://www.fs.usda.gov/detail/cibola/landmanagement/resourcemanagement/?cid=stelprdb5368839.

—. 2011. *Wildland Fire.* January. Accessed August 30, 2023. https://www.fs.usda.gov/ccrc/topics/wildfire.

USGS. 2023. *Water Quality After Wildfire.* April 11. Accessed August 30, 2023. https://www.usgs.gov/mission-areas/water-resources/science/water-quality-after-wildfire#:~:text=Wildfires%20pose%20a%20substantial%20risk%20to%20water%20supplies,nutrients%2C%20and%20metals%20to%20rivers%2C%20lakes%2C%20and%20reservoirs.

SECTION 4.4 – HAZARD RANKING

None

SECTION 5 – CAPABILITY ASSESSMENT

Burlington County. n.d. *About Us.* https://www.co.burlington.nj.us/1393/About-Us.

Burlington County Board of Social Services. 2023. *The Mission Statement.* https://bcbss.org/about/mission-statement/.

Burlington County. n.d. *Boards and Commissions.* https://co.burlington.nj.us/199/Boards-Commissions.

Burlington County Bridge Commission. 2019. *Mission Statement.* https://www.bcbridges.org/mission-statment/.

Burlington County. 2009. *Burlington County Board of Appeals.* http://co.burlington.nj.us/DocumentCenter/View/10548/Construction-Board-of-Appeals?bidId=.

—. n.d. *Finance & Administration.* https://co.burlington.nj.us/899/Finance-Administration.

—. n.d. *Growing a Business.* https://co.burlington.nj.us/1228/Growing-a-Business.

—. n.d. *Human Services.* https://www.co.burlington.nj.us/166/Human-Services.

—. n.d. *Human Services Advisory Council.* https://www.co.burlington.nj.us/444/Human-Services-Advisory-Council.

—. n.d. *Information Technology.* https://www.co.burlington.nj.us/510/Information-Technology.

Burlington County Library System. 2023. *About.* https://www.bcls.lib.nj.us/about.

Burlington County. n.d. *Minority and Equality Rights Task Force.* https://www.co.burlington.nj.us/1866/Minority-and-Equality-Rights-Task-Force.

—. n.d. *Office of the Sheriff.* https://co.burlington.nj.us/130/Sheriffs-Office.

—. n.d. *Public Safety.* https://www.co.burlington.nj.us/197/Public-Safety.

—. n.d. *Resource Conservation.* https://co.burlington.nj.us/165/Resource-Conservation.

—. n.d. *Solid Waste Advisory Council.* http://www.co.burlington.nj.us/1937/Solid-Waste-Advisory-Council.

DRBC. 2023. *About DRBC.* May 4. https://nj.gov/drbc/about/.

DVRPC. n.d. *About DVRPC.* https://www.dvrpc.org/about/.

FEMA. 2023. *Community Disaster Resilience Zones.* October 30. https://www.fema.gov/partnerships/community-disaster-resilience-zones.

—. 2023. *Community Rating System.* October. Accessed March 2023. https://www.fema.gov/floodplain-management/community-rating-system#participating.

—. 2022. *Disaster Declarations for States and Counties.* Accessed 2022. https://www.fema.gov/data-visualization/disaster-declarations-states-and-counties.

—. 2008. *Emergency Support Function #14 – Long-Term Community Recovery Annex.* https://www.fema.gov/pdf/emergency/nrf/nrf-esf-14.pdf#:~:text=Emergency%20Support%20Function%20%28ESF%29%20%2314%20%E2%80%93%20Long-Term%20Community,analyses%29%20for%20community%20recovery%20and%20recovery%20planning%20support.

—. 2022. *FEMA Fact Sheet – Understanding Risk Rating 2.0: Equity in Action.* February. https://agents.floodsmart.gov/sites/default/files/fema-Risk-Rating-2.0-Fact-Sheet-2022.pdf.

—. 2023. *FEMA Hazard Mitigation Grants: 404 and 406.* April 26. https://www.fema.gov/press-release/20230426/fema-hazard-mitigation-grants-404-and-406.

—. 2006. "Joint Field Office Activation and Operatio." *FEMA.gov.* April. https://www.fema.gov/pdf/emergency/nims/jfo_sop.pdf.

—. n.d. *Mapping Information Platform Studies Tracker.* Accessed May 15, 2023. https://www.arcgis.com/home/webmap/viewer.html?webmap=6331cc6b45734c4eabfde6102d5fc0b1&extent=-148.9197,13.1588,-46.0876,55.5312.

—. 2023. *National Dam Safety Program Strategic Plan.* June. https://www.fema.gov/sites/default/files/documents/fema_ndsp-strategic-plan-fy24-29.pdf#:~:text=The%20National%20Dam%20Safety%20Program%20%28NDSP%29%20is%20a,property%2C%20and%20the%20environment%20from%20dam%20related%20hazards.

—. 2020. *Participation in the NFIP.* July 08. Accessed April 10, 2023. https://www.fema.gov/glossary/participation-nfip.

—. 2023. *Safeguarding Tomorrow Revolving Loan Fund Program.* November 9. Accessed November 10, 2023. https://www.fema.gov/grants/mitigation/storm-rlf.

—. 2023. *Summary of FEMA Hazard Mitigation Assistance (HMA) Programs.* March 14. https://www.fema.gov/fact-sheet/summary-fema-hazard-mitigation-assistance-hma-programs.

HURREVAC. n.d. *A HURRICANE DECISION SUPPORT TOOL FOR GOVERNMENT EMERGENCY MANAGERS.* Accessed June 6, 2023. https://www.hurrevac.com/.

JC NERR. 2017. *About Us.* https://jcnerr.org/about.html.

Jersey, Sustainable. 2021. *Sustainable Jersey.* Accessed November 2021. https://www.sustainablejersey.com/.

National Flood Insurance Program. 2023. October. Accessed August 2023.

New Jersey Pinelands Commission. 2023. *New Jersey Pinelands Development Credit Program.* August 24. https://www.nj.gov/pinelands/infor/fact/PDCfacts.pdf.

NJ Spotlight News. 2023. *Federal flood insurance program needs reform, say NJ lawmakers.* July 10. https://www.njspotlightnews.org/video/federal-flood-insurance-program-needs-reform-say-nj-lawmakers/.

NJAFM. n.d. *NJ Assocaition for Floodplain Management.* Accessed June 23, 2023. https://www.njafm.org/.

NJDCA. n.d. *The New Jersey State Uniform Construction Code.* Accessed May 18, 2023. https://www.nj.gov/dca/divisions/codes/publications/pdf_ucc/UCC_gen_info.pdf#:~:text=The%20New%20Jersey%20State%20Uniform%20Construction%20Code%20What,and%20enforcement%20of%20those%20rules%20throughout%20the%20State.

NJDEP Bureau of Flood Engineering. 2023. *About the Bureau of Flood Engineering.* January 9. https://www.nj.gov/dep/floodcontrol/about.htm#:~:text=The%20goal%20of%20the%20National%20Flood%20Insurance%20Program,activities%20including%2C%20and%20also%20exceeding%2C%20minimum%20NFIP%20standards.

NJDEP Division of Land Resource Protection. 2022. *NJDEP Floodplain Management Section.* April 12. Accessed March 2023. https://www.nj.gov/dep/landuse/lu_bfm.html.

NJDEP. n.d. *Environmental Services Matching Grants Program for Local Environmental Agencies.* https://dspace.njstatelib.org/xmlui/bitstream/handle/10929/61989/snjac_T7_ch6_2005_Dec_19.pdf?sequence=1.

—. 2017. *Funding Water Infrastructure for New Jersey.* May. https://www.nj.gov/dep/dwq/pdf/NJEIFP_Funding_Booklet20170517.pdf#:~:text=The%20New%20Jersey%20Environmental%20Infrastructure%20Financing%20Program%20%28NJEIFP%29,and%20help%20ensure%20safe%20and%20adequate%20drinking%20water.

—. 2023. *Inland Flood Protection Rule.* September 18. https://dep.nj.gov/inland-flood-protection-rule/.

—. 2023. *Inland Flood Protection Rule.* June 6. https://dep.nj.gov/inland-flood-protection-rule/.

—. 2023. *National Flood Insurance Program.* June 7. https://dep.nj.gov/wlm/drec/flood-engineering/nfip/.

—. 2023. *New Jersey Climate Data.* May 17. https://nj.gov/dep/climatechange/data.html.

—. 2004. *New Jersey Stormwater Best Management Practices Manual.* February. https://dep.nj.gov/wp-content/uploads/stormwater/bmp/nj_swbmp_3-print.pdf.

NJDEP. 2021. *State of New Jersey Climate Change Resilience Strategy.* NJDEP.

—. 2021. *State of New Jersey Pinelands Commission.* Accessed November 2021. https://www.nj.gov/pinelands/index.shtml.

—. 2021. *State, Local and Nonprofit Open Space of New Jersey.* November 8. https://gisdata-njdep.opendata.arcgis.com/datasets/state-local-and-nonprofit-open-space-of-new-jersey/explore.

—. 2023. *Stormwater FAQs.* March 24. https://dep.nj.gov/stormwater/sw_rule_faqs/#municipalities-stormwater-review.

—. n.d. *What is the NJ Statewide Water Supply Plan?* https://dep.nj.gov/wp-content/uploads/water-supply-plan/what-is-the-nj-statewide-water-supply-plan-topic-paper-1.pdf#:~:text=The%20Statewide%20Water%20Supply%20Plan%20is%20a%20policy,and%20economy%20are%20addressed%20in%20a%20sustainable%20manner.

NOAA. 2023. *Coastal Zone Management Act.* May 13. https://coast.noaa.gov/czm/act/#:~:text=The%20National%20Coastal%20Zone%20Management%20Program%20aims%20to,coastal%20and%20estuarine%20lands%20or%20obtain%20conservation%20easements.

NWS. 2023. *National Weather Service.* June 23. https://www.weather.gov/.

—. n.d. *NWS StormReady Program.* Accessed June 23, 2023. https://www.weather.gov/stormready/.

Pinelands Commission. 2023. *About.* https://nj.gov/pinelands/about/.

Rutgers. 2023. *New Jersey Agricultural Experiement Station Cooperative Extension for Burlington County.* https://burlington.njaes.rutgers.edu/.

Sustainable Jersey. 2023. *Certification Overview.* https://www.sustainablejersey.com/certification/certification-overview/.

—. 2023. *Participating Municipalities and Approved Actions.* Accessed October 4, 2023. https://www.sustainablejersey.com/certification/search-participating-municipalities-approved-actions/.

USACE. n.d. *About Us.* Accessed May 10, 2023. https://www.usace.army.mil/About/.

—. n.d. *Cliamte Preparedness and Resilience.* Accessed May 15, 2023. https://www.usace.army.mil/corpsclimate/Climate_Preparedness_and_Resilience/.

—. 2023. *FACT SHEET - Inspection of Completed Works, N.* January 6. https://www.nan.usace.army.mil/Media/Fact-Sheets/Fact-Sheet-Article-View/Article/487444/fact-sheet-inspection-of-completed-works-nj/.

—. n.d. *Flood Plain Management Services.* Accessed 21 2023, June. https://www.nae.usace.army.mil/Missions/Public-Services/Flood-Plain-Management-Services/.

—. n.d. *Planning Assistance to States Program.* Accessed June 21, 2023. https://www.nao.usace.army.mil/Business-With-Us/Flood-Plain-

Management/PAS/#:~:text=Section%2022%20of%20the%20Water%20Resources%20Development%20Act,and%20conservation%20of%20water%20and%20related%20land%20resources.

—. n.d. *Rehabilitation and Inspection Program.* Accessed June 21, 2023. https://www.mvp.usace.army.mil/Missions/Emergency-Management/Rehabilitation-Inspection/.

USEPA. 2022. *319 Grant: Current Guidance.* October 5. https://www.epa.gov/nps/319-grant-current-guidance.

USGS. 2018. *High-Water Marks and Flooding.* June 6. https://www.usgs.gov/special-topics/water-science-school/science/high-water-marks-and-flooding.

—. 2023. *USGS Current Water Data for New Jersey.* May 15. https://waterdata.usgs.gov/nj/nwis/rt.

SECTION 6 – MITIGATION STRATEGY

FEMA. (2018, October). *Mitigation Planning and the Community Rating System Key Topics Bulletin.* Retrieved from https://www.fema.gov/sites/default/files/2020-06/fema-mitigation-planning-and-the-community-rating-system-key-topics-bulletin_10-1-2018.pdf

SECTION 7 – PLAN MAINTENANCE

None

ACRONYMS AND ABBREVIATIONS

A

AARP: American Association of Retired Persons

AASHTO: American Association of State Highway and Transportation Officials

ACS: American Community Survey

ADRC: Aging and Disability Resource Connection

AECOM: Architecture, Engineering, Construction, Operations and Management

AFB: Air Force Base

ALICE: Asset Limited, Income Constrained, Employed

AT&T: American Telephone and Telegraph Company

B

BATool^{SM}: Baseline Assessment Tool

BC: Burlington County

BCCHA: Burlington County Cultural and Heritage Affairs

BCA: Benefit Cost Analysis

BCADB: Burlington County Agriculture Development Board

BCEGS: Building Code Effectiveness Grading Schedule

BCHD: Burlington County Health Department

BCMC: Burlington County Mosquito Commission

BCPB: Burlington County Planning Board

BFE: Base Flood Elevation

BMP: Best Management Practices

BOCA: Building Officials Code Administration

BPU: Board of Public Utilities

BRFSS: Behavioral Risk Factor Surveillance System

BRIC: Building Resilient Infrastructure and Communities

C

CAC: Community Assistance Contacts

CAD: Computer Aided Dispatch

CAFRA: Coastal Area Facility Review Act

CAP: Compliance Assistance Program

CAP: Continuing Authorities Program

CAV: Community Assistance Visits

CBA: Construction Board of Appeals

CCRHVA: Climate Change-Related Hazard Vulnerability Assessment

CBRP: Community-Based Restoration Program

CDBG: Community Development Block Grant

CDBG-DR: Community Development Block Grant – Disaster Recovery

CDBG-MIT: Community Development Block Grant Mitigation

CDC: Center for Disease Control

CDF: Confined Disposal Facility

CDMS: Comprehensive Data Management System

CEDS: Comprehensive Economic Development Strategy

CELCP: Coastal and Estuarine Land Conservation Program

CERT: Community Emergency Response Team

CEO: Chief Executive Officer

CFM: Certified Floodplain Manager

CG: Cloud-to-Ground

CFR: Code of Federal Regulations

CRS: Community Rating System

CHIP: Community Health Improvement Plan

CHNA: Community Health Needs Assessment

CIP: Capital Improvements Program

CISA: Cybersecurity and Infrastructure Security Agency

CMP: Comprehensive Management Plan

COAD: Community Organizations Active in Disasters

COOP: Continuity of Operations Plan

COVID: Coronavirus Disease

CR: County Route

CRREL: Cold Regions Research and Engineering Laboratory

CRS: Community Rating System

CSD: Communications Support Division

CTP: Cooperation Technical Partners

CZM: Coastal Zone Management

D

DE: Delaware

DRWTP: Delaware River Water Treatment Plant

DEM: Digital Elevation Model

DEP: Department of Environmental Protection

DFE: Design Flood Elevation

DFIRM: Digital Flood Insurance Rate Map

DHS: Department of Homeland Security

DMA: Disaster Mitigation Act

DOT: Department of Transportation

DPW: Department of Public Works

DR: Major Disaster Declaration

DRBC: Delaware River Basin Commission

DVPRC: Delaware Valley Regional Planning Commission

DWSRF: Drinking Water State Revolving Fund

E

EAP: Education and Awareness Programs

EAP: Emergency Action Plan

EF Scale: Enhanced Fujita Tornado Intensity Scale

EM: Emergency Declaration

EMC: Emergency Management Coordinator

EMPG: Emergency Management Performance Grant

EMS: Emergency Medical Service

EMT: Emergency Medical Technician

EOC: Emergency Operations Center

EPA: Environmental Protection Agency

ERB: Energy Resilience Bank

ES: Emergency Services

ESF: Emergency Support Function

ETC: Etcetera

EWPP: Emergency Watershed Protection Program

F

FAO: Food and Agriculture Organization of the United Nations

FEMA: Federal Emergency Management Agency

FHACA: Flood Hazard Area Control Act

FHWA: Federal Highway Administration

FIMA: Federal Insurance and Mitigation Administration

FIRM: Flood Insurance Rate Map

FIS: Flood Insurance Study

FMA: Flood Mitigation Assistance

FPA: Floodplain Administrator

FPC: First Presbyterian Church

FTA: Federal Transit Authority

FY: Fiscal Year

G

GI: General Investigation

GIS: Geographic Information System

GPS: Global Positioning Station

GSCSNJ: Girl Scouts of Central and Southern New Jersey

GSP: Garden State Parkway

H

HAZMAT: Hazardous Materials

HAZUS: Hazards United States

HMA: Hazard Mitigation Assistance

HMGP: Hazard Mitigation Grant Program

HMP: Hazard Mitigation Plan

HR: Human Resources

HSGP: Homeland Security Grant Program

HUC: Hydraulic Unit Code

HUD: U.S. Department of Housing and Urban Development

HVAC: Heating, Ventilation, and Air Conditioning

I

IA: Individual Assistance

IBC: International Residential Code

IC: Intra-Cloud

ICS: Incident Command System

ID: Identification

IPAWS: Integrated Public Alert and Warning System

IPCC: Intergovernmental Panel on Climate Change

IRC: Internal Revenue Code

ISO: International Organization for Standardization

IT: Information Technology

ITS: Intelligent Transportation System

J

JCNERR: Jacques Cousteau National Estuarine Research Reserve

JCP&L: Jersey Central Power and Light

JBMDL: Joint Base McQuire-Dix-Lakehurst

K

KBDI: Keetch-Byram Drought Index

L

LAN: Local Area Network

LEED: Leadership in Energy and Environmental Design

LEPC: Local Emergency Planning Committee

LGEF: Local Government Emergency Fund

LLC: Limited Liability Company

LPR: Local Plans and Regulations

M

MD: Maryland

MERS: Middle East Respiratory Syndrome

MH: Multi-Hazard

MLUL: Municipal Land Use Law

MMI: Modified Mercalli Intensity

MOU: Memorandum of Understanding

MPH: Miles Per Hour

MRCC: Midwestern Regional Climate Center

MRP: Mean Return Period

MSA: Metropolitan Statistical Area

MSWMP: Municipal Stormwater Management Plan

MTA: Metropolitan Transit Authority

MUA: Municipal Utility Authority

N

N/A: Not Applicable

NA: Not Applicable

NAS: National Academy of Sciences

NASA: National Aeronautics and Space Administration

NCAR: National Center for Atmospheric Research

NCDC: National Climatic Data Center

NCEI: National Centers for Environmental Information

NEHRP: National Earthquake Hazard Reductions Program

NDMC: National Drought Mitigation Center

NDSP: National Dam Safety Program

NESEC: Northeast States Emergency Consortium

NFDRS: National ire Danger Rating System

NFIA: National Flood Insurance Act

NFIP: National Flood Insurance Program

NFPA: National Fire Prevention Association

NFPP: National Fish Passage Program

NGO: Non-Governmental Organization

NHC: National Hurricane Center

NIDIS: National Integrated Drought Information System

NJ: New Jersey

NJ Transit: New Jersey Transit

NJAW: New Jersey American Water

NJCEP: New Jersey Clean Energy Program

NJCF: New Jersey Conservation Foundation

NJDCA: New Jersey Department of Community Affairs

NJDEP: New Jersey Department of Environmental Protection

NJDOH: New Jersey Department of Health

NJDOT: New Jersey Department of Transportation

NJEAS: New Jersey Agricultural Experiment Station

NJEDA: New Jersey Economic Development Authority

NJEIFP: New Jersey Environmental Infrastructure Financing Program

NJEIT: New Jersey Environmental Infrastructure Trust

NJFHADF: New Jersey Flood Hazard Area Design Flood

NJFFS: New Jersey Forestry Fire Service

NJGS: New Jersey Geological Survey

NJGWS: New Jersey Geological and Water Survey

NJOEM: New Jersey Office of Emergency Management

NJOGIS: New Jersey Office of Geographic Information Systems

NJPDES: New Jersey Pollutant Discharge Elimination System

NJRA: New Jersey Redevelopment Authority

NJSA: New Jersey State Act

NJSEA: New Jersey Sports and Exposition Administration

NJTIB: New Jersey Infrastructure Bank

NJTP: New Jersey Turnpike

NJTPA: New Jersey Transportation Planning Authority

NJWB: New Jersey Water Bank

NLDN: National Lightning Detection Network

NOAA: National Oceanic and Atmospheric Administration

NP: Not Participating

NPDP: National Performance of Dams Program

NPL: National Priorities List

NPS: National Park Service

NR: Natural Resource Protection

NRI: National Resources Inventory

NRCS: Natural Resources Conservation Service

NSIDC: National Snow and Ice Data Center

NSP: Natural Systems Protection

NSSL: National Severe Storms Laboratory

NWIS: National Water Information System

NWS: National Weather Service

NY: New York

NYC: New York City

NYCEM: New York City Emergency Management

O

OEM: Office of Emergency Management

ONJSC: Office of the New Jersey State Climatologist

OSHA: Occupational Safety and Health Administration

P

PA: Public Assistance

PA: Pennsylvania

PAS: Planning Assistance to States

PATCO: Port Authority Transit Corporation

PCII: Protected Critical Infrastructure Information

PD: Police Department

PDC: Pinelands Development Credit

PDM: Pre-Disaster Mitigation

PDSI: Palmer Drought Severity Index

PE: Professional Engineer

PGA: Peak Ground Acceleration

PI: Public Information

PIO: Public Information Officer

PNR: Pinelands National Reserve

PP: Property Protection

PPD: Presidential Policy Directive

PPE: Personal Protective Equipment

PR: Preventative Measures

PSAF: Pandemic Severity Assessment Framework

PSE&G: Public Service Electric and Gas

PSGP: Port Security Grant Program

PSI: Pandemic Severity Index

Q

R

RCV: Replacement Cost Value

RIMS: Records Information Management System

RL: Repetitive Loss

RMC: Registered Municipal Clerk

RSI: Regional Snowfall Index

RSIS: Residential Site Improvement Standards

RSV: Replacement Cost Value

RWIS: Roadside Weather Information System

S

SAFE-TEA: Safe, Accountable, Flexible, Efficient Transportation Equity Act

SARS: Severe Acute Respiratory Syndrome

SAR: Search and Rescue

SBA: Small Business Administration

SFHA: Special Flood Hazard Area

SGIA: Smart Growth Implementation Assistance

SH: State Highway

SHMO: State Hazard Mitigation Officer

SHMP: State Hazard Mitigation Plan

SJHC: South Jersey Health Collaborative

SIP: Structure and Infrastructure Project

SLOSH: Sea, Lake, and Overland Surge from Hurricanes

SP: Structural Flood Control Projects

SPC: State Planning Commission

SPC: Storm Prediction Center

SRL: Severe Repetitive Loss

SSSSE: State Support Services Element

STAP: Scientific and Technical Advisory Panel

STAPLEE: Social, Technical, Administrative, Political, Legal, Economic, and Environmental

STORM RLF: Safeguarding Tomorrow through Ongoing Risk Mitigation Revolving Loan Fund

SVI: Social Vulnerability Index

SWCD: Soil and Water Conservation District

SWMP: Storm Water Management Program

SWOO: Strengths, Weaknesses, Obstacles, and Opportunities

SWPPP: Stormwater Pollution Prevention Plan

SWTP: Surface Water Treatment Plant

T

TAC: Transportation Advisory Committee

TBD: To Be Determined

TDR: Transfer Development Rights

TEA: Transportation Equity Act

THIRA: Threat & Hazard Identification and Risk Assessment

TIGER: Transportation Investment Generating Economic Recovery

TMP: Traffic Management Process

TRI: Toxics Release Inventory

TTF: Transportation Trust Fund

TV: Television

U

UA: Urbanized Area

UASI: Urban Areas Security Initiative

UC: Urban Cluster

UCC: Uniform Construction Codes

UCAR: University Corporation for Atmospheric Research

UHI: Urban Heat Index

US: United States

USA: United States of America

USACE: United States Army Corp of Engineers

USBR: United States Bureau of Reclamation

USC: United States Code

USDA: U.S. Department of Agriculture

USDM: United States Drought Monitor

USEPA: U.S. Environmental Protection Agency

USFS: United States Forest Service

USGCRP: U.S. Global Change Research Program

USGS: U.S. Geological Survey

USFS: United States Forest Service

V

VFD: Volunteer Fire Department

VH: Very High

VOAD: Volunteer Organizations Active in Disasters

W

WAN: Wide Area Network

WCT: Wind Chill Temperature

WFO: Weather Forecasting Office

WHO: World Health Organization

WIC: Women, Infants, and Children

WMA: Watershed Management Area

WMP: Wastewater Management Plans

WNV: West Nile Virus

WUI: Wildland Urban Interface

WWTP: Wastewater Treatment Plant

X

Y

Z

ZBA: Zoning Board of Adjustment

ZIP: Zone Improvement Plan