Cumberland County Multi-Hazard Mitigation Plan Update

Base Plan

August 22, 2022

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Section 1: Introduction

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1.1 Overview

On October 30, 2000, President William Jefferson Clinton signed the Disaster Mitigation Act of 2000, also known as "DMA 2000". DMA 2000 established a requirement that local and state governments must develop and adopt a federally approved hazard mitigation plan (HMP) to maintain eligibility for federal Hazard Mitigation Assistance (HMA) grants and programs. On February 26, 2002, the Federal Emergency Management Agency (FEMA) published an Interim Final Rule (IFR) that provided specific requirements for the content of an HMP and detailed descriptions of the planning process that states and localities are required to observe. In addition, DMA 2000 stipulated that HMPs for counties and municipalities must be updated and reapproved every five years.

Cumberland County and its fourteen municipalities completed their first HMP as a joint effort approved by the New Jersey Office of Emergency Management (NJOEM) and FEMA's Region II (RII) in 2011. This initial HMP was part of a multi-jurisdictional planning effort called the *Southern Delaware Valley Regional Hazard Mitigation Plan* (SDVR HMP) which covered participating jurisdictions within the four Counties of Camden, Gloucester, Salem, and Cumberland in southwestern New Jersey.

The same four counties initiated a joint project in April 2014 to update the SDVR HMP called the *Mitigation Plan for Four New Jersey Counties* (NJ4 HMP). The Cumberland County portion of the NJ4 HMP was approved by FEMA RII in May 2016 for the County and all its constituent municipalities.

In early 2021, Cumberland County undertook the next update of the project resulting in this document, the *Cumberland County Multi-Hazard Mitigation Plan Update* (CC HMPU). All fourteen municipalities participated and more than 200 individuals were directly involved in the planning process. There were also opportunities for participation by the public and interested parties.

The Cumberland County Office of Emergency Management led the plan update effort with the assistance of Stuart Wallace LLC, hazard mitigation planning consultants. The project was funded by a grant from FEMA. The non-federal share of the FEMA planning grant was covered by the participation of individuals representing the County and municipalities.

Important terms related to the CC HMPU include:

- *Hazards* cause loss of life or injuries, property damage, and economic hardship. The CC HMPU addresses a range of natural hazards including floods, high winds, severe winter weather, and dam or levee failures.
- *Hazard mitigation* reduces or eliminates risk of death, injury, or damage to private or public property potentially caused by hazards.
- *Hazard mitigation plans* evaluate potential risk factors and identify hazard mitigation measures to address identified risks.

- *Hazard mitigation measures* include:
  - Activities or programs such as improving public awareness about hazard risk and mitigation or enhancing available data regarding natural hazards.
  - Improving regulations and codes that lead to safer structures.
  - Construction projects that directly reduce potential impacts of hazards.

The CC HMPU includes:

1. *Base Plan* – with summary information common to all participating jurisdictions.
2. *Appendices* – identifying hazard priorities, critical facilities, and mitigation measures for each individual participating jurisdiction.

The *Base Plan* is organized in four sections:

Section 1: Introduction

Section 2: Planning Process

Section 3: Hazard Identification and Risk Assessment

Section 4: Mitigation Measures

Explanations are included in each Section regarding how IFR requirements are met by the content of the Base Plan.

Appendices for Cumberland County and fourteen individual municipalities have a similar organizational structure as the Base Plan but the components are designated as “Parts” per the following:

Part 1: Overview

Part 2: Participation

Part 3: Hazard Identification and Risk Assessment

Part 4: Mitigation Measures

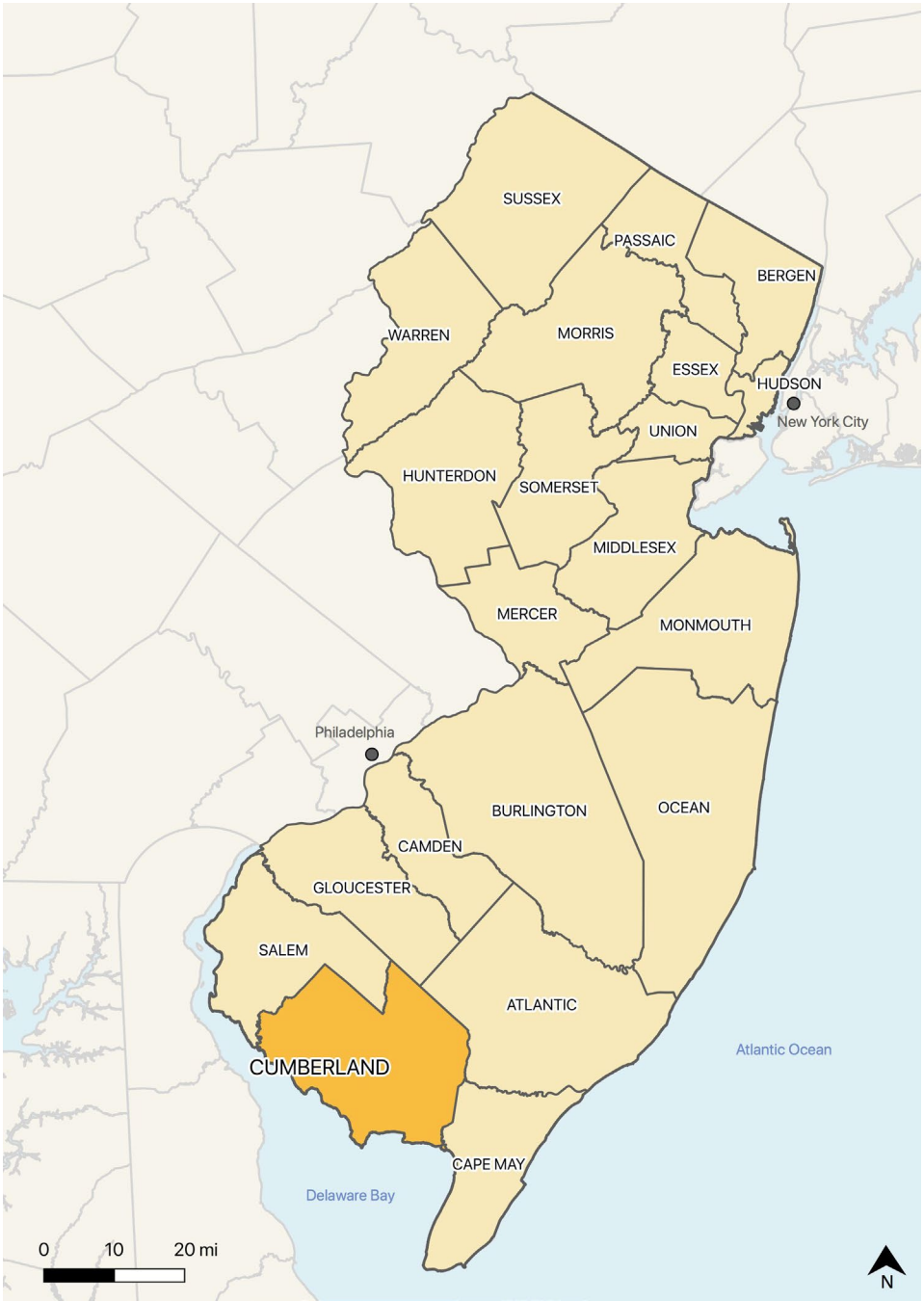
The organizational structure provides an actionable document for each of the participating jurisdictions.

1.2 Context

1.2.1 Geography

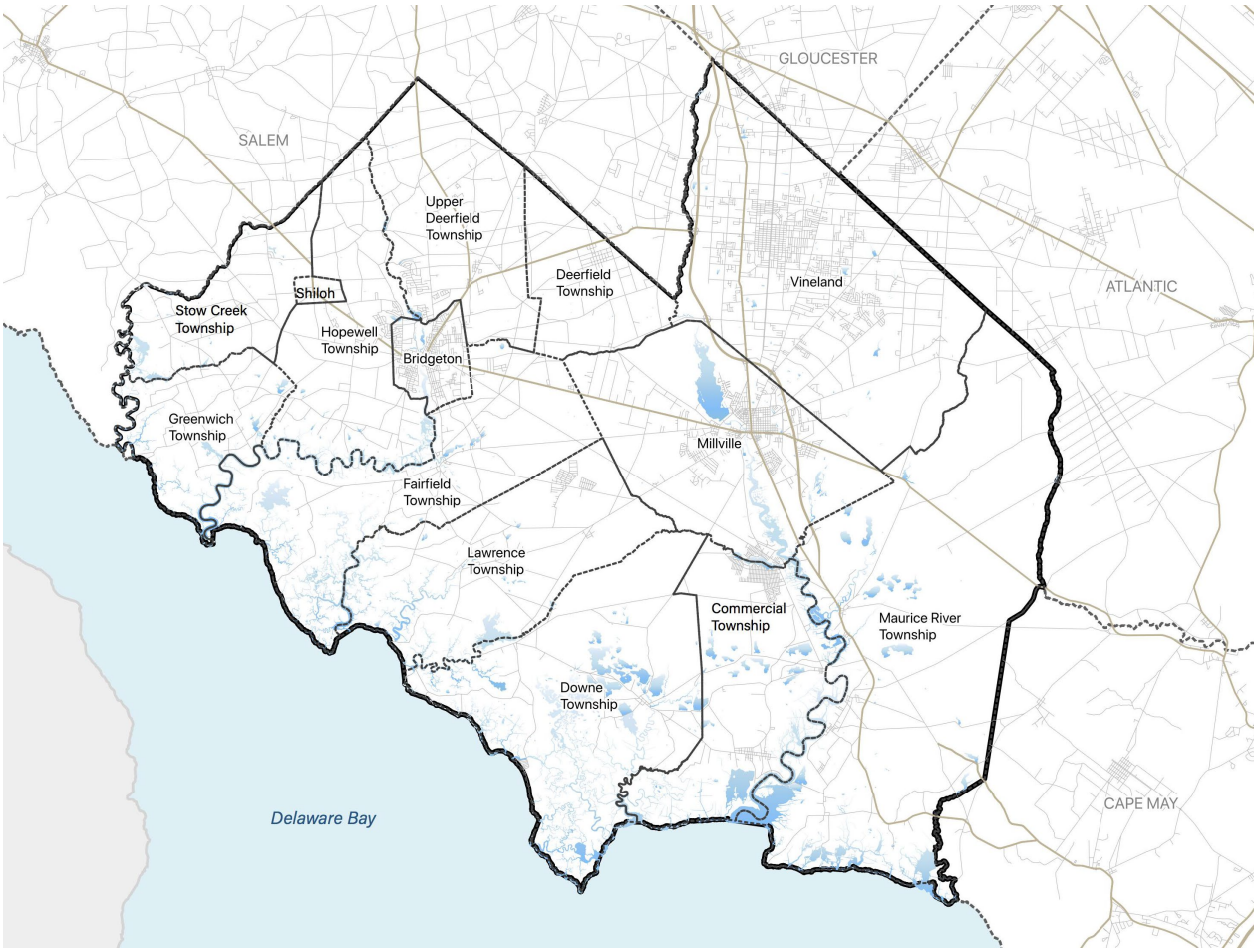
Cumberland County is located in southern New Jersey (See Figure BP.1-1), in an area sometimes referred to as the “Southern Delaware Valley Region.”

Figure BP.1-1: Cumberland County Location Map



The County includes a diverse community mix with three incorporated cities and one borough amid more sparsely settled agricultural and bayshore incorporated townships (See Figure BP.1-2).

Figure BP.1-2: Cumberland County Incorporated Municipalities



Major water bodies include the Delaware Bay which transitions from south to north into the Delaware River. The Delaware is considered tidal along the entire boundary of the County and large expanses of the bay shore in Cumberland County is considered important marshland. This includes part of an area designated by the New Jersey Department of Environmental Protection (NJDEP) as a Natural Heritage Priority Site.

Other key water features include the Maurice and Cohansey Rivers and Union Lake in Millville City and several smaller water courses run inland including Stow Creek and Lower Alloway Creek. Much of eastern Cumberland County (in Maurice River Township) is also considered part of the New Jersey Pinelands National Reserve, a unique combination of vegetation under conservation management.

The land is generally flat to gently rolling; the highest point in the County is only 140 feet above sea level at several points in Upper Deerfield Township in the northern end of the County. Major ground transportation routes that connect Cumberland County with neighboring counties and communities include New Jersey Route 49 running northwest to southeast and NJ Routes 47, 55, and 77 running roughly north to south.

1.2.2 Demographics

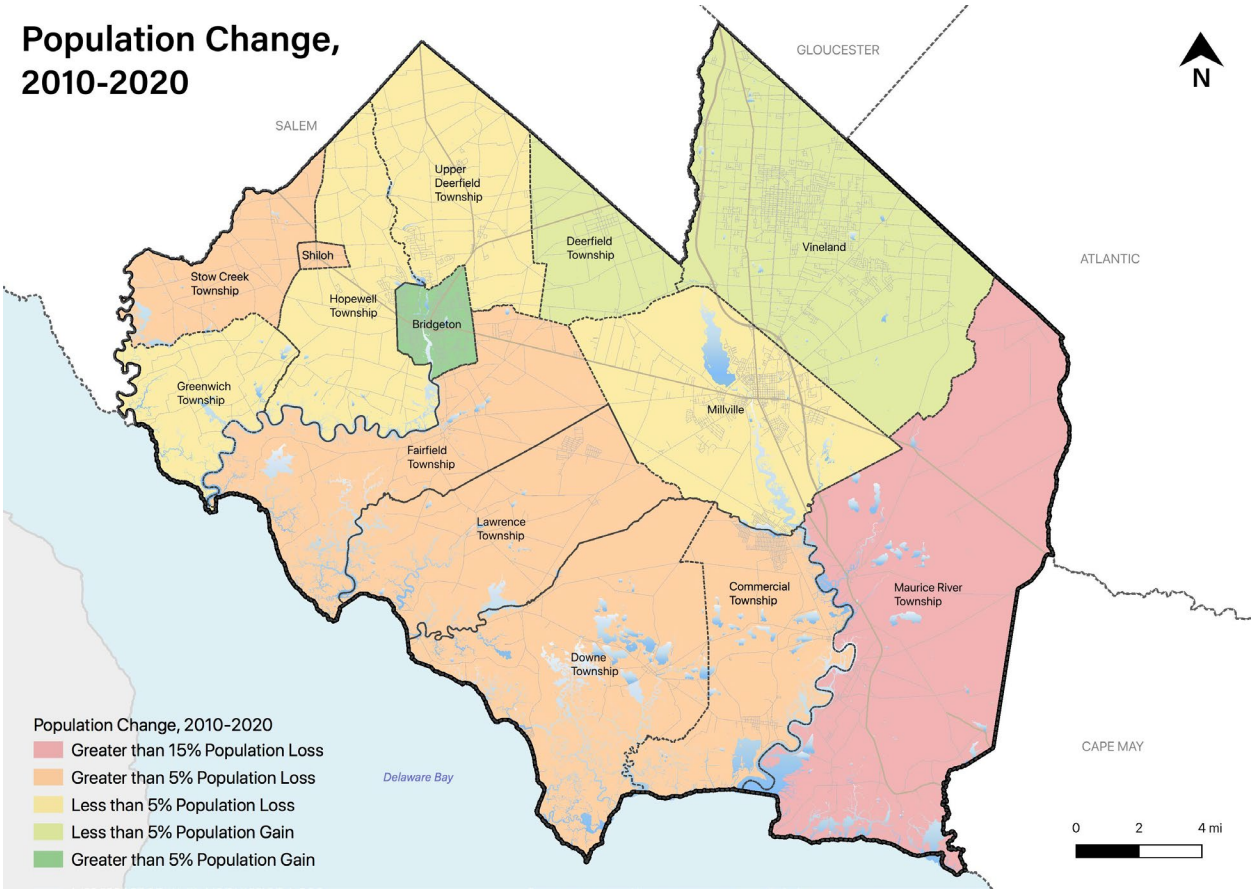
Table BP.1-1 is a compilation of demographic information for the county.

Table BP.1-1: Cumberland County Demographics
(Source: Census 2020 ACS 5-Year Data Estimate Profiles)

	Cumberland County	New Jersey[1]
2020 Population	150,085	Rank = 16th
Percent Change (2010 to 2020)	-4.34%	+1.06%
Land Area (square miles)	483.70	Rank = 4th
Population Density (per square mile)	310.29	Rank = 17th

A key observation is the overall decrease in the County's population since 2010 (minus 4.34%) which differs from the overall increase in the State's population of plus 1.06% during the same period. Per Figure BP.1-3, population change was not uniform throughout the County.

Figure BP.1-3: Population Change, 2010 - 2020



[1] Where "Rank" is indicated, this is relative to the total of 21 counties in New Jersey.

Demographic and economic conditions in Cumberland County can be viewed in terms of what is referred to as *social vulnerability*. The concept of social vulnerability is based on the premise that certain factors can impact the ability of individuals, households, and communities to prepare for, and recover from, disasters. One way in which social vulnerability is measured is through the Social Vulnerability Index which uses 15 different census variables to estimate the relative vulnerability of each census tract. The Center for Disease Control (CDC) and the Agency for Toxic Substances and Disease Registry (ATSDR) have created the CDC/ATSDR Social Vulnerability Index (CDC/ATSDR SVI) and made the index available for public use. This data can be used to make decisions around the allocation of resources, including mitigation dollars, based upon where there are likely to be concentrations of greater need. Although the social vulnerability index is unable to account for individual characteristics that may make some families and communities more or less resilient, it is still a very useful tool for comparing relative levels of potential need and establishing related policies.

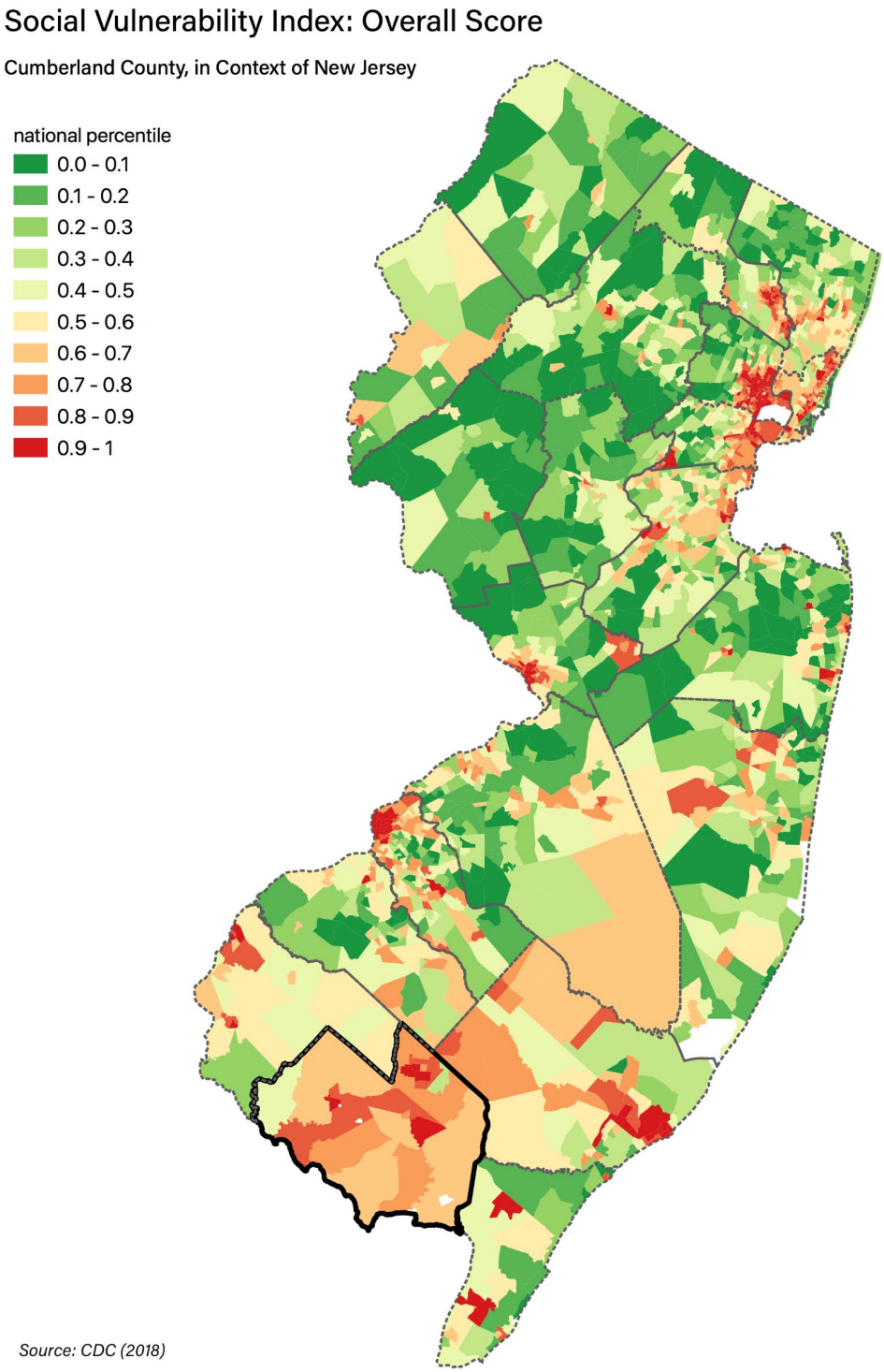
Communities with high social vulnerability have been shown to have a more difficult time with disaster recovery, as well as a more difficult time accessing resources and grants, including those for hazard mitigation. Hazard mitigation dollars are often concentrated in wealthier communities, where higher value infrastructure and homes are able to meet benefit-cost requirements and where families can afford to pay the non-federal match. Similarly, residents of less wealthy areas often find it more difficult to access recovery dollars, and often exhibit less trust in government and emergency management. Taking social vulnerability into account in planning is an important step in reducing disparities and inequities following disasters.

The CDC/ATSDR SVI 2018 data is broken down into four themes, based on the fifteen social factors, which are then utilized to generate a score. The closer the score is to “1”, the higher the social vulnerability. Table BP.1-2 identifies these themes and the related census data points they consider.

Table BP.1-2: CDC/ATSDR SVI Themes

Theme	Social Factor
Socioeconomic Status – percent of individuals:	▪ With low income ▪ Living below poverty levels ▪ Without a high school diploma ▪ Unemployed
Household Composition & Disability – percent of individuals:	▪ Aged 65 or older ▪ Aged 17 or younger ▪ Older than age 5 with a disability ▪ Living in a single-parent households
Minority Status & Language – percent of individuals who:	▪ Identify as a minority ▪ Speak English “less than well”
Housing Type & Transportation – percent of individuals who:	▪ Live in multi-unit structures ▪ Live in mobile homes ▪ Live in crowded conditions ▪ Do not have access to a vehicle ▪ Live in group quarters

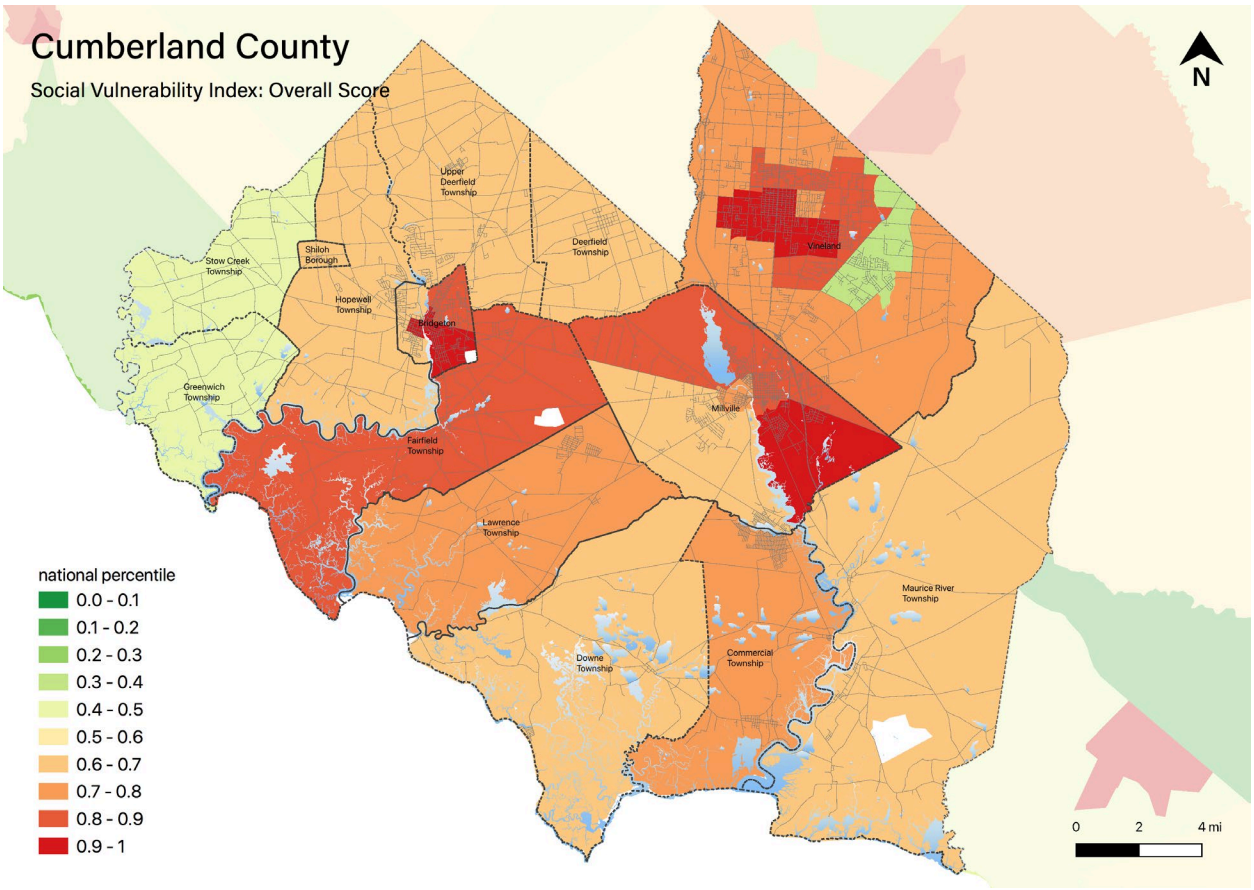
Figure BP.1-4: Social Vulnerability for New Jersey



Generally, the greatest concentrations of high social vulnerability tracts are found primarily across the south, as well as some areas of the west of the United States. Within New Jersey, as well as in much of the northeast, census tracts with high social vulnerability are interspersed amongst tracts with much lower social vulnerability. Per Figure BP.1-4, Cumberland County has the highest concentration of high social vulnerability census tracts within the state.

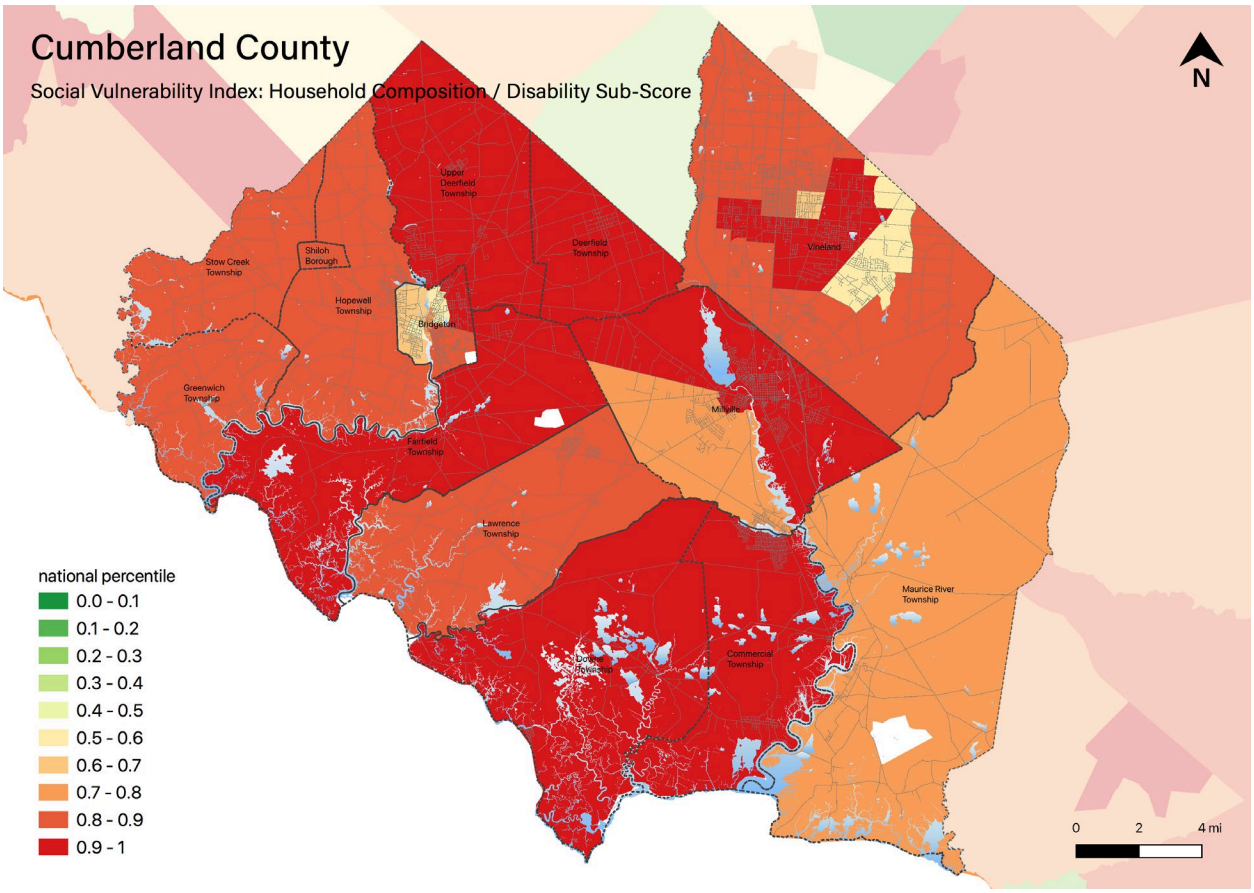
As shown in Figure BP.1-5, the highest overall social vulnerability scores are found in the Cities of Vineland, Millville, and Bridgeton and Fairfield Township, where many census tracts are above 0.8. This is equivalent to being in the top 80th percentile of vulnerability for the nation.

Figure BP.1-5: Social Vulnerability for Cumberland County



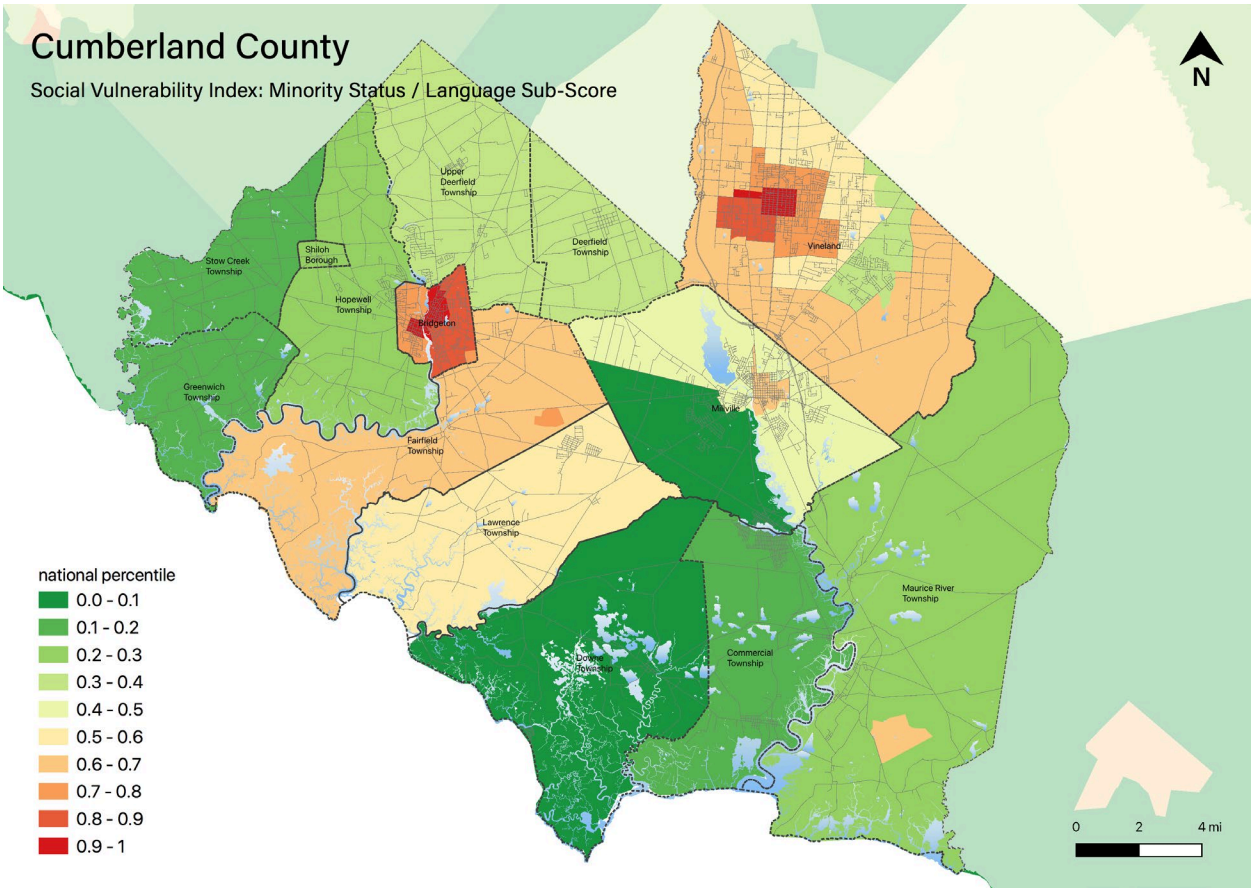
At the County level, per Figure BP.1-6, looking across the categories, the highest social vulnerability is found with regards to the Household Composition & Disability category, with almost the entire county scoring above 0.6. This indicates that preparedness and mitigation efforts might need to target youth, the elderly, single-parent homes, and persons with access and functional needs. Although none of these variables is determinative of vulnerability, there is a significant correlation between the intersection of these variables and higher vulnerability.

Figure BP.1-6: Household Composition & Disability for Cumberland County



The levels of social vulnerability for Minority Status & Language as depicted in Figure BP.1-6, on the other hand, are much lower with the exception of a few isolated census tracts in the Cities of Bridgeton and Vineland. Social vulnerability scores for the remaining two categories largely mirror the overall score.

Figure BP.1-7: Minority Status & Language for Cumberland County



Relevant index scores for individual municipalities are noted in their respective Appendices.

Cumberland County is also considered part of the Philadelphia Metropolitan Statistical Area, which exerts an economic influence on the area. However, while a few discrete areas have experienced growth and development, much of the built assets in the region have not changed dramatically for several decades. For example, according to the 2010 US Census, almost two-thirds of the housing stock was built between 1940 and 1990 with less than 20% in recent years.

Finally, it is worth mentioning the “Ocean 1” project, a proposed wind farm off the shores of southern New Jersey, which may provide potential for economic growth due to jobs and economic activity for support facilities to be built in Lower Alloways Creek Township in Salem County over the next 8 to 10 years.

1.3 Hazards and Risk

Cumberland County has experienced the impact of natural hazards on many occasions. For example, since the 1960's, southern New Jersey has received 24 Presidential disaster declarations and six emergency declarations. In the five years since the NJ4 HMP was approved in 2016, the County has experienced three of these hazard events including two natural disasters and the Covid-19 pandemic.

The NJ4 HMP Hazard Identification and Risk Assessment (HIRA) focused on twelve natural hazards, eleven of which were retained for the CC HMPU:

- Coastal Erosion and Sea Level Rise
- Dam Failure
- Drought
- Earthquake
- Extreme Temperature
- Flood
- High Wind
- Levee Failure
- Severe Weather-Summer
- Severe Weather-Winter
- Wildfire

The twelfth NJ4 HMP hazard, Geologic Hazards, was determined to be insignificant for Cumberland County and was deleted from the list of natural hazards for the CC HMPU.

For each of these hazards, Section 3 of the Base Plan includes:

- Description
- Location and Extent
- Previous Occurrences and Future Probability
- Community Vulnerability

In addition, Section 3 explains steps involved in the Critical Facility Hazard Exposure Assessment and proposed follow-up efforts to identify mitigation measures for all participating jurisdictions. The NJ4 HMP focused on identification of critical facilities relative to the identified hazards at the municipal level. The intent was to make sure important emergency functions and facilities with vulnerable populations are prepared for potential natural hazards. The CC HMPU has built on this work by updating the critical facility inventories which are included in Part 3 of each of the participating jurisdictions' Appendices. Implementation of the CC HMPU will continue that effort with on-going field evaluations of these critical facilities to identify any additional vulnerabilities and appropriate mitigation measures.

The Base Plan HIRA and related information in the Appendices indicate the following observations regarding hazards and risk in Cumberland County:

- All of the participating jurisdictions are exposed to earthquake, extreme temperatures, high winds, and severe weather in both summer and winter.
- Municipalities located along the Delaware Bay (and some of its tributaries) are at greatest risk from coastal erosion and sea level rise, flooding, and storm surge. Due to projections of continuing sea level rise, these municipalities are, and will increasingly be, vulnerable to periodic inundation.
- Dams are located in or near all 14 municipalities in Cumberland County. However, only four of these dams are classified as “High Hazard” dams by NJDEP and all four have undergone some level of renovation and rehabilitation in recent years.
- Levees are located in 7 municipalities in Cumberland County, all but one of which are in the coastal communities along the Delaware Bay. The highest number of levees is in Lawrence Township although most are privately owned and intended to protect agricultural lands.
- As of October 2021, Cumberland County had 69 Repetitive (Flood) Loss (RL) designated properties, which accounts for only a fraction of the total RL in the State of New Jersey. In addition, there were no properties designated as Severe Repetitive Loss (SRL).
- Property owners in Cumberland County have 438 active National Flood Insurance Program (NFIP) flood insurance policies. This provides coverage for less than one-quarter of the 2,432 buildings with a value of $209,840,477, located within the 1 % Annual Chance Flood Zone in Cumberland County municipalities. These numbers represent about 4% of total buildings and 2% of the total building value in the County. The levels of potentially underinsured properties is even more dramatic when considering buildings within 500 feet of the 1 % Annual Chance Flood Zone, where more than 11,000 buildings are located with a total value of over $1.4 million, representing about 16% of the total building value in the County.
- Areas at greatest risk from wildfire, i.e., highest amount of land with potential wildfire fuel sources in proximity to developed areas, are predominately located in the eastern part of the County, specifically Vineland City and Maurice River Township.

Section 3 of the Base Plan also include descriptions of the process used to identify, prioritize, and assess risk from these natural hazards. In addition, Part 3 of the County and Municipal Appendices provide more detailed information from the municipal perspective regarding hazard priorities.

1.4 Mitigation Measures

Common goals are included in the Base Plan and the Appendices. The goals are broad policy statements representing desired long-term results:

Goal 1: **Improve education and outreach efforts**

Goal 2: **Improve data collection, use, and sharing**

Goal 3: **Improve capabilities and coordination**

Goal 4: **Plan and implement projects**

In addition, overarching strategy statements are included in Appendices that articulate objectives for each participating jurisdiction. Because risk and hazard mitigation issues across the County have common roots in predominant natural hazards and constraints on capabilities and resources, many of these strategy statements are similar. However, where community representatives participating in the planning process identified specific areas of interest, the strategy statements may have been refined.

Participating municipalities in the County have identified a total of one hundred and eighty (180) mitigation measures. This includes:

- One-hundred and eighteen (118) municipal mitigation measures, where the ability to pursue the measure is within the authority of the municipality.
- Sixty-two (62) multi-jurisdictional mitigation measures, where implementation of these measures, in the opinion of the Municipal Working Groups, requires participation or leadership from other levels of government, including county, state, and federal agencies.

Consistent with the identified goals, these hazard mitigation measures include:

- Commitments to improving public awareness about natural hazards
- Identifying and evaluating critical facilities and risk-prone areas
- Promoting regulations and codes that lead to safer structures
- Enhancing capabilities and coordination between and within different levels of government
- Implementing construction projects to directly reduce hazard impacts

Part 4 of the County and Municipal Appendices provide more detailed information about mitigation measure identification and implementation for each of the participating jurisdictions.

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Section 2:
Planning Process

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2.0 Interim Final Rule Requirements for the Planning Process

Requirement §201.6(c)(1): *[The plan shall document] the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how the public was involved.*

Requirement §201.6(a)(3): *Multi-jurisdictional plans (e.g., watershed plans) may be accepted, as appropriate, as long as each jurisdiction has participated in the process …*

Requirement §201.6(b): *An open public involvement process is essential to the development of an effective plan. 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.

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). For multi-jurisdictional plans, each jurisdiction requesting approval of the plan **must** document that it has been formally adopted.*

2.1 Planning Process Milestones

The *Cumberland County Multi-Hazard Mitigation Plan Update* (CC HMPU) is the result of updating Cumberland County's portion of the *Mitigation Plan for Four New Jersey Counties* (NJ4 HMP).

The following summarizes the CC HMPU planning process milestones:

1. Project Initiation and Kick-off Meetings
2. Data Acquisition / Preliminary Hazard Identification and Risk Assessment
3. Working Group Round 1 Meetings
4. Preliminary Draft Appendices Production and Review
5. Working Group Round 2 Meetings
6. Public Review Draft CC HMPU Base Plan and Appendices Production and Review
7. Draft CC HMPU Base Plan and Appendices Production and Review
8. Final CC HMPU Adoption and Approval

Milestone 1: Project Initiation and Kick-off Meeting

- Project Initiation Meeting was held representatives of the Cumberland County Office of Emergency Management (CC OEM), to confirm the overall approach, schedule, and responsibilities of all participants in the planning process.
- Project Kick-off Meeting was held with Municipal OEM Coordinators from all fourteen participating municipalities as part of a regular periodic Municipal OEM Coordinator Meeting to review the approach, schedule, and opportunities for municipalities to participate in the HMP update process.
- Project Website[1] was established for information updates and posting documents for review.

Milestone 2: Data Acquisition / Preliminary Hazard Identification and Risk Assessment

Beginning with the Project Initiation Meeting and continuing through interactions with the County and municipalities, relevant open source and available data were acquired and compiled regarding hazards, risk, capabilities, mitigation measures, and plan maintenance activities since the NJ4 HMP was approved.

This included data and information readily available from the County and municipalities as well as the State of New Jersey and FEMA. This work included producing Preliminary Hazard Identification and Risk Assessment information for use in the Round 1 County and Municipal Working Group Meetings (see Milestone 3 on the following page).

- Data Acquisition and Compilation
  - Problem areas and concerns as reported by Work Session participants.
  - Related plans and documents including recently updated Emergency Operations Plans (EOPs).
  - Critical facilities including municipal offices, emergency operations centers, police stations, fire stations, emergency medical services, schools, facilities with vulnerable populations, health care facilities, utility and transportation infrastructure, etc.
  - State of New Jersey data including relevant portions of the most current version of the New Jersey State Hazard Mitigation Plan (NJ SHMP).
  - FEMA data:
    - ✓ Risk Mapping, Assessment, and Planning, also known as Risk MAP, regulatory and non-regulatory products.
    - ✓ National Flood Insurance Program (NFIP) policies and claims data including Repetitive Loss and Severe Repetitive Loss Property Lists.
    - ✓ Information from disaster declarations since the NJ4 HMP approval date.
    - ✓ Hazard Mitigation Grant Program and Pre-Disaster Mitigation project grants.
  - Data from other federal and state agencies such as open-source information regarding hazard histories and impacts from the National Oceanic and Atmospheric Administration National Climatic Data Center and related databases.
- Preliminary Hazard Identification & Risk Assessment (HIRA) relied on information that was readily available and included:
  - Updates to the hazard identification, profiles, priorities, vulnerability assessments, loss estimates, and summary risk assessments for natural hazards carried over from the NJ4 HMP. This work included updating the hazard identification for all relevant natural hazards and assuring all relevant hazards were covered in appropriate portions of the CC HMPU.

- Use of appropriate methods and technology for vulnerability assessments and loss estimation including:
  - ✓ Calculated Priority Risk Index methodology for evaluating and ranking hazards on a regional basis. The methodology combines a hazard's probability of future occurrence, magnitude or severity of impact, typical warning time before an event occurs, and the duration of the event.
  - ✓ Participant input for determining priority hazards at the county and municipal levels.
- Development of individualized reports on a municipality-by-municipality basis identifying HIRA results for each community. These municipal HIRA reports provided improved linkages between risk assessments and resulting mitigation measures.
- Introducing social vulnerability implications into the discussion of risk and mitigation.

Milestone 3: Working Group Round 1 Meetings

Cumberland County and each of the fourteen participating municipalities formed a separate Working Group[2]. Individual virtual Meetings were conducted with each of these Working Groups during the months of July and August 2021.

The agenda for the first round of work sessions with Working Groups included discussions of:

- Public Participation – reiterating information shared during the Project Kick-off Meetings highlighting the advantages of broad participation by representatives of all concerned and interested parties within the community[3].
- Capability Assessments and Plan Integration – including questions about current capabilities for planning and implementing hazard mitigation and flood plain management as well as soliciting relevant plans and documents to review regarding potential integration as part of the HMP update process.
- Preliminary HIRA Information - to validate work-in-progress and identify additional hazard and risk information. The review of preliminary HIRA information also set the stage for discussions of updated goals and mitigation measures.
- Critical Facilities – to improve available data about critical facilities including identifying natural hazard vulnerabilities and appropriate mitigation measures.
- NJ4 HMP Mitigation Measures Implementation Status - compiling information about mitigation measures identified in the NJ4 HMP that have been or will be implemented since the NJ4 HMP was adopted and approved.
- Mitigation Measures - identifying actions, programs, or projects resulting from community experience during disasters since the NJ4 HMP was adopted.

Milestone 4: Preliminary Draft Appendices Production and Review

Preliminary HIRA information and input from the Round 1 Working Group Meetings was incorporated in the Preliminary Draft Appendices and the documents posted to the Project Website for review during the months of September and October 2021.

[2] See *Section 2.2: Working Group Participation* for information about how County and Municipal Working Groups were formed and functioned during the CC HMPU project.
[3] See *Section 2.3: Public Participation* for information about how County and Municipal Working Groups solicited public involvement during the CC HMPU project.

Milestone 5: Working Group Round 2 Meetings

A second round of virtual Working Group Meetings were conducted with the participating jurisdictions during the period from late October 2021 through early February 2022. The intent of the Round 2 Meetings was to confirm:

- Work-in-progress for Public Review Draft Base Plan and Appendices, based on Round 1 Work Sessions and the Preliminary Draft Appendices, were in line with Working Group and community input and priorities.
- Roles and responsibilities for implementation were accurately identified including the next step(s) in the implementation process.

Milestone 6: Public Review Draft Base Plan and Appendices

The results of the Round 2 Working Group Meetings was used to develop the *Public Review Draft Base Plan and Appendices* for all participating jurisdictions including:

- Revisions to the Preliminary HIRA Information - reflecting review comments and additional information received from the municipalities and other agencies.
- Critical Facilities – including improved inventory information based on Working Group input.
- Updates to Goals - as necessary and as determined by the Working Groups.
- Updates and additions to the Mitigation Measure Identification and Implementation documentation - including progress made in implementing the recommendations from the NJ4 HMP and new strategies identified as a result of the Round 1 Municipal Work Sessions. The update process:
  - Considered a full range of hazard mitigation project types.
  - Discussed alternatives for implementing measures that have been not seen progress since the NJ4 HMP approval.
  - Established priorities per Municipal Working Group preferences.
  - Focused on identifying mitigation measures that protect critical facilities from the most common hazards such as flooding but in all cases, sought to identify projects that optimized engineering feasibility, positive benefit cost ratios, and environmental impacts.
  - Included measures to address Repetitive Loss Properties as identified by the New Jersey Department of Environmental Protection (NJDEP).
  - Identified mitigation measures that will require multi-jurisdictional approaches for implementation both vertically with county and state agencies and horizontally through cooperative agreements with other municipalities.
  - Identified floodplain management programs as a priority for capability building and plan integration as part of implementation of the CC HMPU.
  - Identified funding options including alternatives to federal hazard mitigation programs focusing on available community resources (i.e., public-private partners) and other grant programs.

- Updates and additions to Plan Maintenance Provisions - ensured that maintenance processes are institutionalized to the extent possible in a way that matches capabilities and normal business activities at the county and municipal levels including:
  - The use of appropriate tools to monitor implementation progress and provide status reports with minimal effort.
  - Identify new candidates for and enhance existing relationships with partners for long-term maintenance of HIRA information and other HMP update information.

The Public Review Draft Base Plan and Appendices were distributed to the Working Groups for review via the Project Website. Working Groups provided public notice of the availability of the documents during this review period. In addition, the Working Groups either convened additional Working Group meetings or otherwise corresponded to compile review comments.

Milestone 7: Draft CC HMPU Base Plan and Appendices Production and Review

Working Group and public review comments were incorporated in the Draft Base Plan and Appendices and the documents provided to New Jersey Office of Emergency Management (NJOEM) and FEMA Region II representatives for review. After addressing NJOEM and FEMA review comments, the Draft Base Plan and Appendices were designated as “approvable pending adoption” (APA)

Milestone 8: Final CC HMPU Approval and Adoption

Following FEMA’s APA designation, the Final CC HMPU documents were prepared and distributed to the participating jurisdictions for adoption. Support for adoption of the Final HMP Update was provided including:

- Adoption Resolution templates designating responsible parties for on-going implementation of mitigation strategies and plan maintenance.
- Distributing the Final CC HMPU to all participants via the Project Website.

2.2 Working Group Participation

The need to mobilize a Working Group was identified from the beginning of the planning process starting with the Project Kick-off Meeting and continuing throughout the Working Group Meetings. Each participating jurisdiction made an effort to invite and incorporate the involvement of individuals, groups, and organizations from the community as part of their respective Working Groups.

The following was used as a list of potential members of the Municipal Working Groups:

- Elected Officials
- Municipal Office of Emergency Management (OEM) Coordinator
- Floodplain Administrator/Manager
- Land Use / Economic Development Planner
- Geographic Information Systems (GIS) / Information Technology (IT) Specialist
- Building Code / Construction Official
- Engineering, Public Works, and Transportation Department Directors / Supervisors
- Police, Fire, and Emergency Medical Services
- Business associations (e.g., Chamber of Commerce)
- Community / Faith-based organizations
- Environmental organizations (e.g., watershed or waterway-based non-profit advocacy groups)
- Non-governmental organizations (e.g., American Red Cross)
- Critical infrastructure and key resources (e.g., utilities)
- Major employers and businesses
- Healthcare institutions
- Education institutions including school boards and local trade schools, community colleges, universities, etc.

All of these positions, agencies, or organizations did not exist in every jurisdiction. In addition, some individuals assume multiple roles and may have several of these responsibilities.

A similar list was used to identify potential members of the County Working Group:

- Board of County Commissioners
- County Administrator's Office
- County Land Use / Economic Development Planner
- County GIS / IT Specialist
- County Soil & Water Conservation District
- County Engineering, Public Works, and Transportation Department Directors / Supervisors
- County Police, Fire, and Emergency Medical Services Coordinators
- County Volunteers Active in Disasters
- County Long-term Community Recovery Planning Committee

Together, more than 220 individuals were identified as contributors to the County and municipal Working Groups for the CC HMPU. About 60 percent of the members participated directly in the Working Group Meetings and more than a third were previously included in the NJ4 HMP Working Groups.

Part 2.1: Working Group Participation in the Appendices itemizes the members of each participating jurisdiction.

Working Group members reviewed briefing materials, contributed during Meetings, and reviewed draft versions of the CC HMPU documents. The duties and responsibilities of the Working Groups consisted of representing their communities' interests, and completing necessary planning tasks:

- Data collection - to provide background information and existing plans.
- Identification of critical facilities – to provide current inventory information.[4]
- Identification of mitigation measures –to identify and document specific mitigation measures.[5]
- Reviewing the Preliminary Draft Appendices.
- Reviewing the Public Review Draft Base Plan and Appendices.

The general sequence for the Working Groups' participation included:

- Project Kick-off Meeting – hosted by Cumberland County and attended by Municipal OEM Coordinators who served as the organizers and points-of-contact for the Municipal Working Groups.
- Round 1 and 2 Working Group Meetings – to develop and review work-in-progress.
- Preliminary Draft Appendices and Public Review Draft Base Plan and Appendices reviews – including soliciting public comment and compiling review comments from the Working Groups.
- Consideration and approval of any changes made in the Final CC HMPU as a result of NJOEM or FEMA review comments.

In all, more than thirty meetings were conducted during the planning process.

The composition of each participating municipality's Working Group demonstrates a wide range of relevant administrative, technical, legal, and fiscal professional experience and responsibility. However, due to the pandemic and related strains on time and resources during 2021, participation of private sector and community stakeholders at the municipal level was limited. FEMA encourages the planning process to be inclusive; that is, in addition to local governmental agencies and officials, Working Groups and participants should also involve broad community representation.

In accordance with FEMA guiding principles for inclusive participation at various levels, CCOEM and the municipal Working Groups will place a high priority on an expanded effort on stakeholder participation in future plan updates. This enhanced future effort is anticipated to include more concerted and targeted outreach to the public and other stakeholders, and the inclusion of Working Group members who are not elected or appointed municipal officials, or who are not contracted by municipalities to provide professional services.

[4] See *Part 3.4: Critical Facilities Inventory and Hazard Exposure Assessment* in the Appendices.
[5] See *Part 4.3: Mitigation Measures – Identification; Part 4.4: Mitigation Measures – Implementation;* and *Part 4.5: Multi-Jurisdictional Mitigation Measures* in the Appendices.

2.3 Public Participation

During development of the CC HMPU, a variety of opportunities were provided for the general public and interested parties to be involved and participate:

- Project Website - located at https://www.cumberlandcountynj.gov/OEM the Project Website provided access to project status information, documents for public review, and an opportunity to submit comments and questions. Participating jurisdictions provided links to the Project Website from their respective websites during the planning process and specifically to announce the availability of the Public Review Draft Base Plan and Appendices for public review.
- Public Education and Outreach Activities – conducted via community newsletters and/or at local schools, places of worship, and at established events such as county and local fairs, community service club meetings, etc.
- Working Group Meetings – conducted in a virtual forum open to the public.
- Public Meetings – including information items about the on-going planning process on the agendas for regularly scheduled public meetings of elected governing bodies or appointed officials and during the Public Review Draft Base Plan and Appendices review process.
- Direct Notifications – for the Public Review Draft review period provided to neighboring communities via County Offices of Emergency Management for Atlantic, Cape May, Gloucester, and Salem Counties
- Public Adoption Proceedings[6] - the governing bodies of all participating jurisdictions adopted the CC HMPU Base Plan and their respective Appendix. Meetings of the governing bodies at open public meetings during which the public had an opportunity to voice support or concerns regarding the content of the CC HMPU.

See *Part 2.1: Public Participation* of the Appendices for specific public participation opportunities provided, public comments received, and how this information was incorporated into the CC HMPU.

[6] See *Section 2.5: Plan Adoption and Approval*.

2.4 Plan Integration

The CC HMPU planning process included examining municipal hazard mitigation capabilities; potential for improving capabilities and coordination within and between jurisdictions; and plan integration considerations. *Section 4: Mitigation Measures* of the Base Plan includes summary observations and recommendations concerning:

- Hazard mitigation planning and mitigation measure implementation capabilities at the County and municipal levels.
- Coordination within municipal governments, between municipal governments and their communities, and between municipal, County, and state agencies responsible for hazard mitigation.
- Integration of hazard mitigation data, goals, measures, and/or recommendations with existing floodplain management plans and programs at the municipal level.

Specific documents obtained during the NJ4 HMP and CC HMPU processes from the Municipal Working Groups that were incorporated into these observations and recommendations regarding plan integration included:

- Flood Damage Prevention Ordinances
- Emergency Operations Plans
- Master Plans and Reexamination Reports
- Land Development Regulations Subdivision and Zoning Ordinances
- Stormwater Management Plans and Ordinances
- Wildland Fire Management Plans
- Capital Improvement Budgets and Capital Improvement Programs

2.5 Plan Adoption and Approval

In the State of New Jersey, counties and municipalities are empowered to manage their own affairs via an elected governing body. In Cumberland County, the governing body is known as the Board of County Commissioners. Municipalities are categorized as cities, townships, and boroughs. The governing body for cities and boroughs is typically referred as the City or Borough Council while townships usually convene a Township Committee.

The following is an excerpt from the relevant portion of the New Jersey Statutes Annotated (NJSA 40:20 et seq.)[7]:

> *The property, finances, and affairs of every county shall be managed, controlled and governed by a board elected therein, to be known as "the board of chosen freeholders of the county of [County name] and the executive and legislative powers of the county shall be vested in that board of chosen freeholders, except where by law any specific powers or duties are imposed or vested in a Constitutional officer.*

The adoption and approval sequence applicable to all participating jurisdictions was as follows:

Table BP.2-1: Adoption and Approval Process

Who	What
FEMA Region II, in consultation with NJOEM	Designated the Draft Base Plan and Appendices of the CC HMPU as "approvable pending adoption".
County and Municipal Working Groups	Reviewed the Final Base Plan and respective Appendices and recommended the corresponding governing body should adopt the relevant documents for their respective communities.
County and Municipal Elected Officials	Adopted Final Base Plan and respective Appendices by resolution in a public meeting.
Cumberland County Office of Emergency Management	Collected Adoption Resolutions and submitted to FEMA Region II via NJOEM for approval.
FEMA Region II via NJOEM	Issued a formal approval letter covering all participating jurisdictions.

[7] New Jersey Office of the Attorney General.

Section 3:
Hazard Identification and Risk Assessment

Contents of this Section

3.0 Interim Final Rule Requirements for Hazard Identification and Risk Assessment

As noted in Section 1.1, the Interim Final Rule (IFR) identifies requirements the *Cumberland County Multi-Hazard Mitigation Plan Update* (CC HMPU) must meet. The following are specific IFR requirements related to hazard identification and risk assessment (HIRA) covered in this section of the CC HMPU Base Plan:

Requirement §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.*

Requirement §201.6(c)(2)(i): *[The risk assessment shall include a] description of the type…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.*

Requirement §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) of this section. This description shall include an overall summary of each hazard and its impact on the community.*

Requirement §201.6(c)(2)(ii): *[The risk assessment]* ***must*** *also address National Flood Insurance Program (NFIP) insured structures that have been repetitively damaged floods.*

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.*

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)(ii)(A) of this section and a description of the methodology used to prepare the estimate.*

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.*

Requirement §201.6(c)(2)(iii): *For multi-jurisdictional plans, the risk assessment* ***must*** *assess each jurisdiction's risks where they vary from the risks facing the entire region.*

In addition, the Federal Emergency Management Agency (FEMA) has identified expectations for hazard mitigation plan updates including descriptions of natural hazard events and effects since the previous hazard mitigation plan was adopted.

3.1 Hazard History, Identification, and Ranking

3.1.1 Hazard History

During development of the *Mitigation Plan for Four New Jersey Counties* (NJ4 HMP) that was approved in 2016 for Cumberland County, and consistent with IFR requirements, the NJ4 HMP Steering Committee approved an assessment of hazards with the potential to impact the four-county region including historical hazard data. As part of the process, portions of the *Southern Delaware Valley Region Multi-jurisdictional Hazard Mitigation Plan* (SDVR HMP) as approved in 2011 were also retained.

For the *Cumberland County Multi-Hazard Mitigation Plan Update* (CC HMPU), relevant work from both the NJ4 and SDVR HMPs was retained and more recent occurrences of natural hazards for Cumberland County identified. The goal was to accurately identify historical data statistics to the extent possible, considering limitations of available data. Some data was collected from federal agency records regarding losses associated with natural hazards, including but not limited to:

- FEMA maintains records for federally declared major disasters
- The United States Army Corps of Engineers (USACE) and the Natural Resources Conservation Service collect data on losses during the course of some of their ongoing projects and studies
- The National Oceanic and Atmospheric Administration's (NOAA) National Climatic Data Center (NCDC) and Spatial Hazard Events and Losses Database for the United States (SHELDUS) collect and maintain data about natural hazards in summary format

According to these sources, from 1962 to 2014, southern New Jersey received 21 Presidential Disaster Declarations and six Emergency Declarations. Eleven of these disaster declarations were the result of significant flooding and seven occurred between a three-year period from 2011 when the SDVR HMP was approved and 2014 when the data was pulled together for the NJ4 HMP.

By comparison, the period since the NJ4 HMP plan development, from 2015 to 2021, was relatively calm in terms of natural hazards. Table BP.3-1 includes brief descriptions of particularly significant hazard events occurring during this period including the predominant declared emergency during the period, the COVID-19 pandemic.

Table BP.3-1: Recent Hazards, Declared Emergencies, and Major Disasters, 2015-2021
(Sources: NOAA/NCDC; FEMA; NJOEM and the Public Entity Risk Institute)

Date and Disaster (DR)	Nature of Event
January 22-24, 2016 (DR-4264)	WINTER STORM JONAS - Much of Cumberland County saw a foot or more of snow during this winter storm that caused power outages for over 100,000 New Jersey homes and led to 8 deaths. Sustained winds -- observed at 55 mph in North Fortescue in the morning of January 23rd -- contributed to coastal flooding in parts of the state.
January 20, 2020 - Ongoing	COVID-19 PANDEMIC (Emergency Declaration) - One of the deadliest pandemics in history, the COVID-19 Pandemic resulted in global economic and social disruption -- including business closures and transit service modifications -- for over a year. Over 3.75M people died from the coronavirus globally, and (as of June 7, 2021) more than 26,000 died in New Jersey. The unemployment rate in New Jersey was at its highest 16.8%. Through the CARES Act, $2.4B was provided by the federal government as relief to New Jersey businesses. By some estimates, 3 in 10 small New Jersey businesses closed permanently over the course of the pandemic.
August 4, 2020 (DR-4574)	TROPICAL STORM ISAIAS - With gusts in Fortescue observed at 77 mph, winds statewide were their strongest since Superstorm Sandy in 2012. 1.3 million customers lost power across the state at the storm's peak. Fortunately, there was no significant coastal surge.
January 31 through February 2, 2021 (DR-4597	WINTER STORM - At least a foot of snow fell in 13 of the state's counties, with 5 counties seeing more than two feet. NJ Transit bus and train service was suspended, as was USPS mail service in parts of the state. Some coronavirus vaccination sites were temporarily shut down. It was the first in a series of storms over the course of February that caused severe erosion and 6-meter drop-offs at some NJ DEP beach access points.

3.1.2 Hazard Identification

The participating jurisdictions' Working Groups determined that the following 11 hazards included in the NJ4 HMP and identified below, were still valid for the CC HMPU.

1. Coastal Erosion and Sea Level Rise
2. Dam Failure
3. Drought
4. Earthquake
5. Extreme Temperature
6. Flood
7. High Wind
8. Levee Failure
9. Severe Weather - Summer
10. Severe Weather - Winter
11. Wildfire

Note: Geologic Hazards was not included in the CC HMPU. Consistent with the 2019 New Jersey State Hazard Mitigation Plan (2019 NJSHMP), there is no current appreciable level of risk due to any component of Geologic Hazards in Cumberland County.

Sections 3.2.1 through 3.2.11 include a description, location and extent, community vulnerability, previous occurrences and future probability, and other relevant information for each hazard. In addition, Part 3 of each Appendix includes detailed information for these hazards as they relate to the participating jurisdictions.

3.1.3 Hazard Ranking

The identified natural hazards were ranked regarding relative risk to:

- Provide information to participating jurisdictions' Working Groups and interested parties about the potential impacts from the identified hazards
- Reflect hazard and risk perceptions at the local level

An objective process was used to rank the 12 hazards relative to each other on a county-wide basis. In addition, the Municipal Working Groups ranked these hazards during their respective Work Sessions.[1]

Calculated Prioritized Risk Index (CPRI)

As part of the 2016 NJ4 HMP planning process, the Planning Team selected the Calculated Prioritized Risk Index (CPRI) approach to produce objective hazard rankings. The CPRI methodology produces a weighted score based on four sub-categories established in the IFR guidance for hazard profiles:

- Probability of occurrence (P), weighted at 45%
- Severity of impacts (I), weighted at 30%
- Warning time before hazard onset (W), weighted at 15%
- Duration of the hazard exposure (D), weighted at 10%

[1] See *Section 2: Planning Process* for a description of the Municipal Working Groups and the Working Sessions conducted for the CC HMPU.

Weighting the components emphasizes the probability of occurrence and the severity of impacts while allowing for the influences of warning time (which provides an opportunity to prepare) and duration (which delays recovery).

An index value of "1" through "4" was assigned to each of these four components for each hazard. Tables BP.3-2 through BP.3-5 were used to determine the selected index value for each of the four component indices of the CPRI. The right-hand columns in these four tables identify representative hazard conditions, impacts, or consequences corresponding to the different index values.

Table BP.3-2: CPRI Probability of Future Occurrence Based on Previous Hazard Events

Probability	Index Value	Likelihood Per Year (per History of Events
Highly Likely	4	33%-100%
Likely	3	20%-33%
Possibly	2	10%-20%
Unlikely	1	0%-10%

Table BP.3-3: CPRI Magnitude/Severity of Potential Impacts Based on Previous Hazard Events

Magnitude/ Severity	Index Value	Anticipated Extent of Property Damage
Catastrophic	4	More than 50% of property is severely damaged
Critical	3	More than 25% but less than 50% of property is severely damaged
Limited	2	More than 10% but less than 25% of property is severely damaged
Negligible	1	Less than 10% of property is severely damaged

Table BP.3-4: CPRI Warning Time of Hazard Event Based on Hazard Definition

Warning Time	Index Value	Description
Less than 6 hours	4	Less than 6 hours warning time before event occurs
6-12 hours	3	6-12 hours warning time before event occurs
12-24 hours	2	12-24 hours warning time before event occurs
24+ hours	1	At least 24 hours warning time before event occurs

Table BP.3-5: CPRI Duration of Hazard Event Based on Hazard Definition

Duration	Index Value	Description
More than 1 week	4	Event lasts more than 1 week
Less than 1 week	3	Event lasts less than 1 week
Less than 1 day	2	Event lasts less than 1 day
Less than 6 hours	1	Event lasts less than 6 hours

Then, the CPRI was calculated with the following formula incorporating the index values and weighting scheme:

$$CPRI = (0.45 \times P) + (0.30 \times I) + (0.15 \times W) + (0.10 \times D)$$

Results from the NJ4 HMP were reviewed relative to updated information in the hazard profiles and scores adjusted accordingly. Applying the CPRI calculation results in a risk value between 1 and 4 for each hazard. The higher the score, the higher the overall relative risk associated with the hazard.

Table BP.3-6 below identifies the results of applying the CPRI methodology for Cumberland County.

Table BP.3-6: CPRI Rankings

Hazard	Probability	Magnitude / Severity	Warning Time	Duration	CPRI Score	CPRI Rank
Coastal Erosion and Sea-Level Rise	4	3	1	4	3.25	**1**
Flood	4	3	1	4	3.25	**1**
High Wind	4	2	3	1	2.95	**3**
Wildfire	3	1	4	3	2.55	**4**
Extreme Temperature	3	2	1	3	2.40	**5**
Severe Weather - Winter	3	2	1	3	2.40	**5**
Dam Failure	1	4	4	1	2.35	**7**
Levee Failure	1	4	4	1	2.35	**7**
Earthquakes	1	3	4	3	2.25	**9**
Drought	3	1	1	4	2.20	**10**
Severe Weather - Summer	3	1	3	1	2.20	**10**

Municipal Hazard Rankings

During development of the 2016 NJ4 HMP, each participating municipality ranked the hazards as high (H), medium (M), low (L), or not considered applicable (N/A). The hazards were ranked based on the experience and expertise of the Municipal Working Group members regarding the overall impact to the jurisdiction considering such factors as how often the hazard occurred, amount of property and infrastructure damages, number of people impacted, and time of recovery.

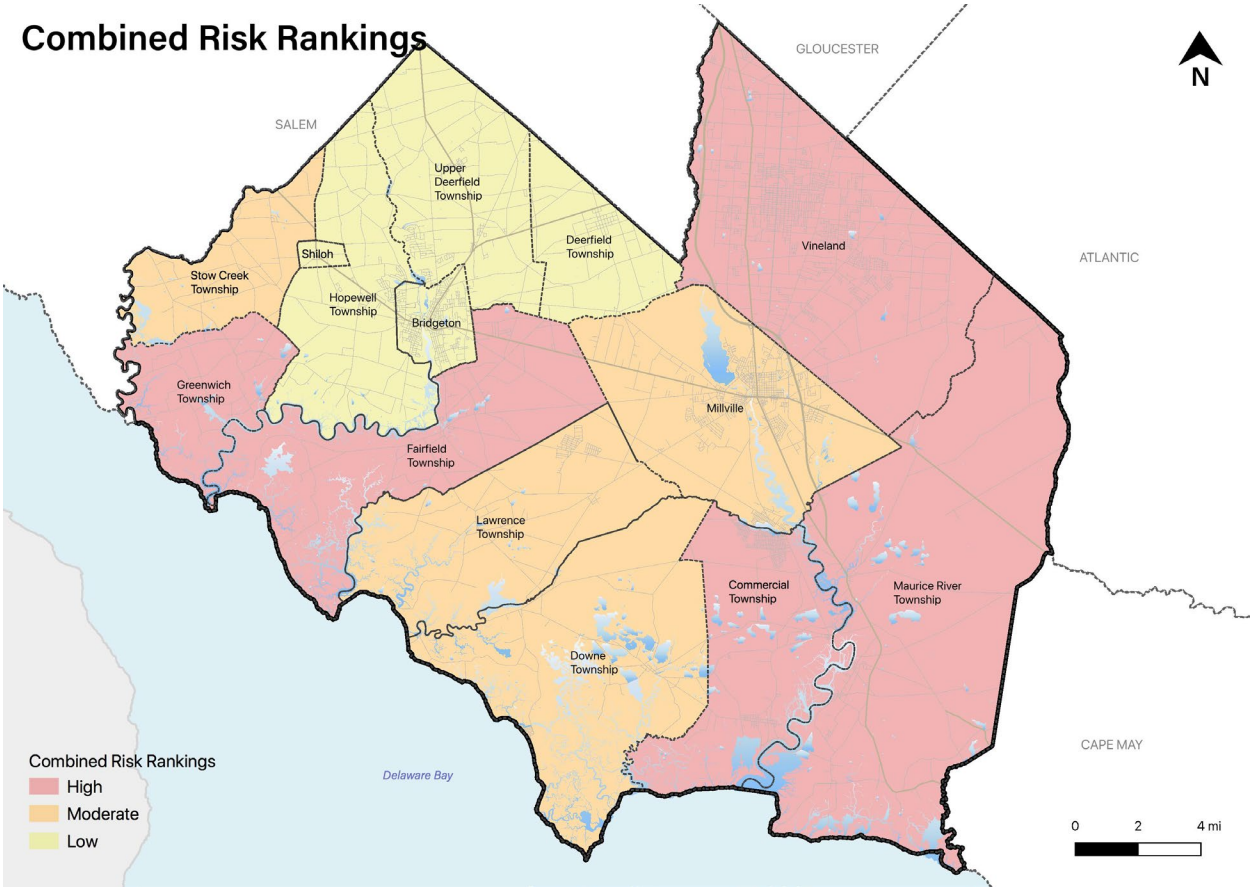
The participating municipalities' Working Groups for the CC HMPU reviewed all the rankings as part of the Working Group Meetings. In most cases, the NJ4 HMP results were reaffirmed. However, in a few cases, the rankings were adjusted by the Working Group.

The hazard ranking results are shown in Table BP.3-7. In addition, a composite of these hazard ranking results is shown in Figure BP.3-1.

Table BP.3-7: Municipal Working Group Hazard Ranking Results

Municipality	Coastal Erosion & Sea Level Rise	Dam Failure	Drought	Earthquake	Extreme Temperature	Flood	High Wind	Levee Failure	Severe Weather - Summer	Severe –Weather - Winter	Wildfire
Bridgeton City	L	L	L	M	L	L	H	N/A	L	M	N/A
Commercial Township	H	M	L	L	L	H	M	H	L	L	H
Deerfield Township	N/A	N/A	L	L	M	M	M	N/A	M	M	L
Downe Township	H	N/A	L	L	M	H	H	L	M	M	L
Fairfield Township	H	H	H	L	H	H	M	N/A	H	H	H
Greenwich Township	H	H	L	L	L	H	H	H	L	L	L
Hopewell Township	N/A	L	L	L	L	M	M	L	M	L	L
Lawrence Township	H	M	L	L	L	M	M	M	M	L	H
Maurice River Township	H	M	L	L	M	H	H	H	M	M	H
Millville City	M	H	L	L	M	H	H	N/A	M	M	L
Shiloh Borough	N/A	N/A	L	L	M	L	M	N/A	M	M	L
Stow Creek Township	L	L	H	L	L	L	H	N/A	M	M	L
Upper Deerfield Township	N/A	L	M	L	M	L	M	N/A	M	M	L
Vineland City	N/A	M	M	M	H	M	H	N/A	M	H	H

Figure BP.3-1: Municipal Working Group Hazard Ranking Results (Composite)



Comparison of CPRI and Municipal Hazard Rankings

The results from the CPRI and the Municipal Hazard Rankings were compared to identify similarities and differences in how the hazards were ranked by each method. The high, medium, and low values in the Municipal Hazard Rankings were converted to 3, 2, and 1 scores, respectively and the average for each hazard across all the exposed participating municipalities was calculated. Instances where hazards were ranked as "not applicable" were not included in the converted scale value.

Table BP.3-8 below compares the results from the two methods.

Table BP.3-8: Comparison of CPRI and Municipal Hazard Rankings

Hazard	CPRI Rank	Municipal Hazard Rank (average score)
Coastal Erosion and Sea-Level Rise	**1**	**2** (2.44)
Flood	**1**	**4** (2.14)
High Wind	**3**	**1** (2.50)
Wildfire	**4**	**8** (1.77)
Extreme Temperature	**5**	**9** (1.71)
Severe Weather - Winter	**5**	**6** (1.86)
Dam Failure	**7**	**5** (1.91)
Levee Failure	**7**	**3** (2.17)
Earthquakes	**9**	**11** (1.14)
Drought	**10**	**10** (1.43)
Severe Weather - Summer	**10**	**6** (1.86)

Most of the hazards were similarly ranked by both methods. Four hazards showed noticeably different results (i.e., difference in rankings > 3): Wildfire, Extreme Temperature, Levee Failure, and Severe Weather – Summer. For example, the Severe Weather – Summer hazard was ranked 6th by the municipalities' hazard rankings and 10th using the CPRI method.

These differences in rankings may be attributed to the following:

- The CPRI examines the potential for risk based on objective criteria (as explained earlier in this section). The actual or perceived risk by the individual municipalities may be higher or lower than what was calculated by the CPRI.
- The CPRI is determined relative to the whole County while the individual municipalities' rankings only reflect hazards that are applicable to the community. So, for hazards such as Coastal Erosion and Sea Level Rise and Levee Failure, a high number of municipalities did not have exposure which lowered the average score on a county-wide basis.
- Municipal Working Groups may have misinterpreted sub-hazards. For example the Severe Weather – Summer hazard only included hail and lightning which resulted in a relatively low ranking from the CPRI versus a relatively high ("6th) by the Municipal Working Groups. The participants may have had difficulty separating other effects of severe summer storms that are accounted for in other hazards (e.g., high winds and heavy rains).
- Although there may be a moderate to high risk from a particular hazard, the Municipal Working Groups may have underestimated the risk due to a lack of personal experience or unfamiliarity with available data.

3.2 Hazard Profiles

The CC HMPU HIRA was produced to:

- Identify those natural hazards that may result in the most potential damage to the participating jurisdictions and their assets.
- Ascertain where additional study may be warranted
- Continue identification and prioritization of mitigation measures, building on those included in the SDVR and NJ4 HMPs.

This section provides summary profiles for each of the 12 natural hazards included in the CC HMPU including:

- **Description -** Defining the hazards including widely accepted indices and classifications.
- **Location and Extent –** Identifying:
  - Geographic areas within the region that could potentially be affected by hazards such as Coastal Erosion and Sea Level Rise, Flooding, and Wildfire.
  - Metrics that describe anticipated magnitude of hazards including maximum sustained wind speeds, areas of inundation due to flooding, etc.
- **Previous Occurrences and Future Probability -** Providing an overview of past significant events from national, state, and local databases and open sources.
- **Community Vulnerability -** Assessing potential impacts based on the exposure and vulnerability of people and property.

  Note: Wherever possible, results are focused on buildings and critical facilities. In addition, results are expressed in terms of building values where relevant data is available.

Relevant results from the CC HMPU HIRA have also been reported in *Part 3: Hazard Identification and Risk Assessment* in each of the 15 participating jurisdictions' Appendices along with links to related mapping and data.

In addition, it is important to note the following:

- In many cases, hazard profiles refer to either "Buildings" or "General Building Stock". These terms are interchangeable in this document. This information was extracted from "Impervious Surfaces" data from 2015[2] sourced from New Jersey Department of Environmental Protection (NJDEP) Geographic Information System digital data. However, this secondary product has not been verified by NJDEP and is not state-authorized or endorsed.
- More information about hazards in New Jersey can be found in the following open sources:
  - 2019 NJ SHMP[3].
  - New Jersey Office of Emergency Management website under the "Plan and Prepare" webpage[4].

[2] https://gisdata-njdep.opendata.arcgis.com/
[3] https://nj.gov/njoem/mitigation/2019-mitigation-plan.shtml
[4] https://nj.gov/njoem/plan-prepare/index.shtml

3.2.1 Coastal Erosion and Sea Level Rise

Description - Coastal Erosion and Sea Level Rise

Coastal erosion is a dynamic process that is constantly occurring at varying rates along the coasts and shorelines of the United States. Strong storms and hurricanes can erode large sections of coastline with a single event. The process of coastal erosion results in permanent changes to the shape and structure of coastlines.

Sea level rise refers to the increases in the average water level in oceans on a global scale, which is primarily attributed to changes in ocean volume due to ice melt and thermal expansion.

For additional information about coastal erosion and sea level rise, visit the NOAA coastal hazards page[5].

Location and Extent - Coastal Erosion and Sea Level Rise

In 2010, a report titled *The Likelihood of Shoreline Protection in New Jersey*[6] was produced for the Environmental Protection Agency (EPA). The purpose of the study was to identify and develop maps that differentiate between areas within the coastal zone of New Jersey that may be impacted as sea levels rise from areas where shores are expected to retreat naturally.

This report identifies the coastal erosion in Cumberland County is predominately concentrated along the shoreline of the Delaware Bay and the Maurice River and potential impacts for structures in the participating municipalities of Downe Township, Hopewell Township, Laurence Township, Maurice River Township, and Stow Creek Township.

In addition, *Coastal Increased Inundation Areas for Cumberland County*, released by FEMA as part of the flood risk tools in support of the current Flood Insurance Rate Maps (FIRMs) shows hypothetical increases of 1, 2, and 3 feet in the total water levels along the coast (sea level rise) using the inland extent of the 1% annual chance flood and identifies potential impacts in the participating municipalities of Bridgeton City, Commercial Township, Downe Township, Fairfield Township, Greenwich Township, Hopewell Township, Lawrence Township, Maurice River Township, Millville City, Stow Creek Township, and Upper Deerfield Township.

Mapping of the location and extent of coastal erosion and sea level rise have been provided for each of the potentially impacted participating municipalities.[7]

Previous Occurrences and Future Probability - Coastal Erosion and Sea Level Rise

The 2016 NJ4 HMP HIRA identified 12 “significant’ and 5 “minor” coastal erosion events between 1992 and 2014. No additional significant events have occurred between 2015 and 2021. Based on this total of 17 events in the 30-year period between 1992 and 2021, there is a 56.6% annual chance of an event, If only the significant events are considered, there is a 40.0% annual chance.

[5] http://oceanservice.noaa.gov/hazards/natural-hazards/
[6] Michael Craghan, Jennifer Kassakian, Daniel Hudgens, and James G. Titus. 2010. “New Jersey. G. Titus. 2010.. 2010.us. 2010Hudgens (editors). *The Likelihood of Shore Protection along the Atlantic Coast of the United States. Volume 1: Mid-Atlantic.* Report to the U.S. Environmental Protection Agency. Washington, D.C
[7] See *Part 3: Hazard Identification and Risk Assessment* in the Municipal Appendices for representative examples of hazard mapping and links to mapping for each participating municipality.

In addition, the report titled *Resilience – Preparing New Jersey for Climate Change*[8] referenced a study led by Rutgers University scientists which projected future rates of sea level rise. The projections are a best estimate and a range that account for uncertainties in future rates of global ocean warming and melting rates for large ice sheets covering Greenland and Antarctica. According to these projections, sea level is projected to rise by 7 to 16 inches by 2030, with a best estimate of ten inches in coastal areas of New Jersey.

By 2050, the range for anticipated sea level rise is 13 to 28 inches with a best estimate of eighteen inches, and by 2100 the range is 30 to 71 inches with a best estimate of forty-two inches. Even if the most conservative of these projections materialize, the implications for coastal communities will be substantial. In addition. episodic storm erosion generates the most significant erosion along the New Jersey coast. Typically, these storms can impact the coast over periods of hours (tropical cyclones) to several days (nor'easters). Although the storm events are short-lived, the resulting erosion can be equivalent to decades of long-term coastal change. Table BP.3-9 shows the additional area that would be inundated for each foot increase per county.

Table BP.3-9: Increased Inundation Areas in Cumberland County

1 Foot Increased Inundation	2 Foot Increased Inundation	3 Foot Increased Inundation
11.40 square miles	16.34 square miles	21.08 square miles

Community Vulnerability – Coastal Erosion and Sea Level Rise

Community vulnerability was completed for:

- Coastal erosion by locating buildings in the zone identified as susceptible to coastal erosion.
- Sea level rise by identifying buildings within the increased inundation zone of 3 feet.

Table BP.3-10 shows the summary tabulations by municipality.

Table BP.3-10: General Building Stock Exposure to Coastal Erosion & Sea Level Rise

Municipality	Number of Buildings Coastal Erosion	Total Value Coastal Erosion	Number of Buildings Sea Level Rise	Total Value Sea Level Rise
Bridgeton City	N/A	N/A	26	$ 3,513,912
Commercial TWP	N/A	N/A	94	$ 11,836,500
Downe Township	2	$ 173,500	628	$ 35,813,900
Fairfield Township	N/A	N/A	31	$ 1,665,267
Greenwich TWP	N/A	N/A	36	$ 2,091,800
Hopewell Township	1	No data available	9	$ 508,967
Lawrence Township	1	No data available	88	$ 4,175,800
Maurice River TWP	1	$ 80,800	239	$ 21,920,363
Millville City	N/A	N/A	27	$ 733,284
Stow Creek TWP	1	No data available	9	$ 974,000
Grand Total	**6**	**$ 254,300**	**1,187**	**$ 83,233,793**

[8] Resilience – Preparing for New Jersey Climate Change. A Gap Analysis From the New Jersey Climate Adaption Alliance. December 2013.

3.2.2 Dam Failure

Description - Dam Failure

A dam is defined by the NJDEP as any artificial dike, levee, or other barrier constructed to impound water on a permanent or temporary basis, that raises the water level five feet or more above the usual, mean low water height when measured from the downstream toe-of-dam to the emergency spillway crest or, in the absence of an emergency spillway, the top-of-dam. Dam failures can result from a variety of causes including lack of maintenance, seismic activity, improper design or construction, or the effects of large storms.

For additional information about dams in New Jersey, visit the NJDEP Bureau of Dam Safety and Flood Control website[9].

Location and Extent - Dam Failure

NJDEP indicates there are a total of 27 dams in Cumberland County as of summer 2014. In New Jersey, dams are ranked by hazard classification based on the potential for infrastructure and property damages downstream. Table BP.3-11 provides definitions for the three hazard classifications[10] and the numbers of each classification in Cumberland County.

Table BP.3-11: Dam Classifications

Classification	Definition	Number in Cumberland County
High Hazard	Failure or operational failure will probably cause loss of life and/or significant infrastructure losses	4
Significant Hazard	Failure or operational problems are unlikely to cause loss of human life, but can cause economic loss, environmental damage, and disruption of lifelines.	13
Low Hazard	Failure would probably cause no loss of human life and only low economic and/or environmental losses.	10

Table BP.3-12 indicates the locations of the high hazard potential dams for Cumberland County.

Table BP.3-12: Inventory of High Hazard Dams in Cumberland County

Dam Name	City	River/Stream	Length (ft)	Height (ft)
Sunset Lake Dam	Bridgeton City	Cohansey River	6200	20
East Lake Dam	Bridgeton City	Indian Fields Branch	500	17
Sunset Lake Raceway Dam	Bridgeton City	Cohansey River	5000	11
Union Lake Dam	Millville City	Maurice River	2000	35

[9] http://www.nj.gov/dep/damsafety/
[10] New Jersey Administrative Code- Dam Safety Standards (NJAC: 7-20): Dam Classifications

The severity of a dam failure event can depend on the size of the dam, extent of the failure, velocity of the floodwaters released, and additional factors such as the time of day when an event occurs, the extent of development within the inundation zone and whether the failure occurs during flooding or "sunny day" conditions. In New Jersey, inundation zones have been defined for the high hazard dams showing the potential extent for each dam on downstream communities.

Previous Occurrences and Future Probability - Dam Failure

NJDEP indicates there have been no previous catastrophic dam failures in New Jersey. However, Table BP.3-13 identifies four notable dam failure events in Cumberland County between 1999 and 2014. No other incidents were reported by the Municipal Working Groups in the ensuing years.

Table BP.3-13: Past Dam Failures in Cumberland County
(Source: NJDEP- Dam Safety, NewJerseyNewsroom.com, August 16, 2011, 2014 NJ SHMP)

Municipality	Incident Date/Event	Dam Name	Description
Upper Deerfield Township	September 16, 1999	Boswick Lake Dam	Experienced complete failure after Hurricane Floyd
Bridgeton City	August 14, 2011	Sunset Lake Raceway Dam	In western Cumberland County, rainfall totals ranged from seven to 11 inches. Four dams in the southern New Jersey failed (three in the region). Damage totals were estimated at $25 million, most of which occurred in Salem and Cumberland Counties
Upper Deerfield Township	August 14, 2011	Seeley's Mill Pond Dam	
Vineland City	August 14, 2011	Burnt Mill Pond Dam	

With a total of four previous dam failures (or partial failures) in Cumberland County between 1999 and 2021, the region experiences a notable dam failure event on average slightly less than once every five years, or with an 18.2% annual probability. In addition, as noted in the Municipal Appendices, significant repair and renovation efforts over the last several years have furthered reduced the chance of a dam failure in the near future.

Community Vulnerability – Dam Failure

Dam failure has potential for catastrophic impact on life and property. Table BP.3-14 shows the results of assessing community vulnerability due to the four high hazard dams in Cumberland County by estimating the number of exposed housing units and population downstream of each dam.

Table BP.3-14: High Hazard Potential Dam Summary Risk Assessment, Ordered by Population

Dam Name	Municipality	Population	Housing Units
Union Lake Dam	Millville City	4,033	1,849
Sunset Lake Dam	Bridgeton City	2,711	1,027
Sunset Lake Raceway Dam	Bridgeton City	1,514	416
East Lake Dam	Bridgeton City	224	76

Note: Locations and current disposition of all high and significant hazard dams are identified in the appropriate Municipal Appendices as well as inundation mapping for the high hazard dams. [11]

[11] See *Part 3: Hazard Identification and Risk Assessment* in the Municipal Appendices).

3.2.3 Drought

Description - Drought

A drought is an extended dry climate condition when there is not enough water to support urban, agricultural, human, and environmental water needs. It usually refers to a period of below-normal rainfall, but can also be caused by drying bores or lakes, or anything that reduces the amount of liquid water available. For additional information about droughts visit the National Integrated Drought Information System (NIDIS) website[12].

Location and Extent - Drought

The State of New Jersey is divided into six drought regions based on watershed and water-supply considerations that provide a regulatory basis for coordinating local responses to regional water-supply shortages. Cumberland County is located in the Coastal South Drought Region.[13]

Drought severity depends on numerous factors including duration, intensity, and geographic extent, as well as regional water supply demands by humans and vegetation. The severity of drought can be aggravated by other climatic factors, such as prolonged high winds and low relative humidity. Due to its multi-dimensional nature, drought is difficult to define in exact terms and also poses difficulties in terms of comprehensive risk assessments. One method used by scientists to calculate the severity and duration of a drought is shown in Table BP.3-15, the Palmer Drought Severity Index (PDSI) [14]. The PDSI is an important climatological tool that indicates prolonged and abnormal moisture deficiency.

Table BP.3-15: Palmer Drought Severity Index (PDSI)

Palmer Drought Severity Index	Condition
-4.0 or less	Extreme Drought
-3.0 or -3.9	Severe Drought
-2.0 or -2.9	Moderate Drought

Previous Occurrences and Future Probability - Drought

Data from the Northeast Regional Climate Center (NRCC) at Cornell University[15] was reviewed during the 2016 NJ4 HMP planning process to identify past drought events in southern New Jersey. Cumberland County falls into what the NRCC defines as the Southern Climate Division. Ten drought events were identified with a PDSI of severe or extreme (-3.0 to -4.0 or lower) for a period of two months or greater between 1930 and 2010.

No new events with these thresholds were found in the NRCC data in 2021. However, the 2019 NJ SHMP identified four events where USDA declared a drought disaster in 2012, 2015, and 2016. With a total of 14 significant drought events between 1930 and 2021, the region experiences a significant drought event on average once every 6.5 years: a 10.9% annual chance.

[12] www.drought.gov
[13] NJDEP Division of Water Supply and Geoscience
[14] NOAA. NWS. Climate Prediction Center. Drought Indices – Explanation.
[15] https://www.nrcc.cornell.edu/regional/drought/drought.html

Community Vulnerability - Drought

Droughts have the ability to impact many sectors of the economy and reach well beyond the area experiencing physical drought. Drought impacts potentially include reduced crop productivity, increased fire hazard, reduced water levels, and damage to wildlife and fish habitat.

In Cumberland County, vulnerability to drought is considered greatest to the agricultural industry. Prolonged drought can damage and destroy crops and increase vulnerability to wildland fires. According to the most recent agricultural census (2017)[16], the market value of agricultural products attributed to Cumberland County totals over $200 million. This represents an increase of approximately 25% since the previous census in 2012 which is consistent with increases statewide. Table BP.3-16 summarizes the agricultural statistics for Cumberland County and indicates changes since the 2016 NJ4 HMP.

Table BP.3-16: Agricultural Statistics in Cumberland County for 2017 (Change since 2012)

Number of Farms	% of Farms in State	Land In Farms (Acres)	Market Value of Products Sold ($1,000)	% of State Total
560 (-3.9%)	5.66% (-0.76%)	66,256 (+2.68%)	$212,649 (+24.8%)	19.37% (+2.45%)

The risk assessment results shown in Table BP.3-17 for drought was completed by identifying the total land area vulnerable to drought based on the amount of agricultural land acreage in each municipality[17].

Table 3-17: Agricultural Land Area by Municipality, Ordered by % of Municipality Land Area
(Source: NJDEP, Land Use Land Cover)

Municipality	Land Area (Sq. Miles)	Agricultural Land Area (Sq. Miles)	Agricultural Land Area (Acres)	% of Municipality Total
Shiloh Borough	1.21	0.94	604	77.93%
Hopewell Township	29.87	18.94	12,122	63.41%
Upper Deerfield Township	31.10	18.38	11,766	59.11%
Stow Creek Township	18.30	10.24	6,555	55.96%
Deerfield Township	16.76	7.07	4,523	42.16%
Greenwich Township	17.84	5.99	3,837	33.60%
Fairfield Township	41.26	6.71	4,297	16.27%
Vineland City	68.42	9.98	6,389	14.59%
Lawrence Township	36.92	5.27	3,370	14.26%
Millville City	42.00	4.86	3,112	11.58%
Commercial Township	32.13	1.07	687	3.34%
Bridgeton City	6.18	0.14	91	2.24%
Maurice River Township	93.11	1.97	1,263	2.12%
Downe Township	48.61	0.85	541	1.74%
	1,321.19	**291.40**	**186,499**	**22.06%**

Based on previous occurrences, it is reasonable to assume that droughts will continue in the County, but with no injuries, deaths, property, or significant crop damage, the impact will continue to be reasonably low.

[16] USDA Census of Agriculture, 2017
[17] NJDEP 2007 Land Use Land Cover

3.2.4: Earthquake

Description - Earthquake

An earthquake is a sudden release of energy from the earth's crust that creates seismic waves. At the earth's surface, earthquakes may manifest themselves by a shaking or displacement of the ground, which may lead to loss of life and destruction of property. For additional information about earthquakes visit the United States Geological Survey (USGS), Earthquake Hazards Program[18].

Location and Extent - Earthquake

Review of the 2019 NJ SHMP and other sources indicates that earthquakes are most likely to occur in northern counties where more faults are concentrated. However, the entire State is susceptible to the effects of earthquakes, including Cumberland County.

Although earthquakes are less common in the southern part of New Jersey, there have been previous events in the region. Over the past 200 or more years, seismic events in the region have been relatively low on magnitude scales and there are no known deaths or injuries from earthquakes. However, some past earthquake events were severe enough to cause minor property damage such as broken windows or contents falling from shelves.

The size of an earthquake is expressed quantitatively as magnitude. The most common method for determining the magnitude of an earthquake is the Richter scale. On the Richter Scale, magnitude is expressed in whole numbers and decimal fractions. At the high end of the Richter scale, earthquakes with magnitude 8.0 or greater can totally destroy communities near the epicenter. However, earthquakes recorded in New Jersey rarely exceed magnitudes of 2.5 which are usually not felt and occasionally in the 4.0 to 5.0 range where the earthquake is often felt but causes only minor damage.

Previous Occurrences and Future Probability - Earthquake

As part of the 2016 NJ4 HMP HIRA, 180 earthquakes were identified with epicenters in New Jersey between 1783 and June 2013[19]. During this 230-year time period, most events were minor with magnitudes ranging from 0.4 to 5.3. Of the 180 earthquakes, 11 had an epicenter in the NJ4 HMP region and occurred between 1939 and 2012. Four of these events had magnitudes higher than 2.5 but none were larger than 3.5. A review of USGS records for the CC HMPU identified an additional four earthquake events in the vicinity. Table BP.3-18 provides basic information for these earthquakes.

Table BP.3-18: Earthquake Activity 2014-2021

Date	Location	Magnitude
January 25, 2015	4 kilometers (km) ESE of Downingtown, Pennsylvania	2.6
August 14, 2015	3 km SE of Mendham, New Jersey	2.6
November 30, 2017	3 km NNE of Little Creek, Delaware	4.1
September 9, 2020	3 km WSW of Marlboro, New Jersey	3.1

With a total of 15 previous earthquakes having epicenters in the vicinity between 1939 and 2021, Cumberland County can anticipate an earthquake event on average approximately every 5.5 years, an 18.3 percent annual probability.

[18] https://www.usgs.gov/programs/earthquake-hazards/hazards
[19] NJDEP, New Jersey Geological and Water Survey

Community Vulnerability - Earthquake

The primary cause of earthquake damage to man-made structures is ground shaking. Depending on the severity of ground shaking, debris and falling building material can create a threat to life and property. Severe enough ground shaking, particularly for longer periods, can result in the complete collapse of some unreinforced or lightly engineered structures. In the absence of data regarding construction of the general building stock in Cumberland County, a decision was made to identify buildings constructed before the International Building Code (IBC) was adopted for broad use in New Jersey in the 1970's. The assumption is that these older buildings may not have been built with local earthquake risk taken fully into account. Also, over time, deferred maintenance of some older buildings may also contribute to increased vulnerability. Once identified, municipalities can collaborate with residents and property owners for these older buildings to conduct field assessments and determine if individual structures may be at risk for failure in the event of an earthquake.

Structures built before 1976 was considered as this was shortly before the IBC was enacted in New Jersey. This year is also the mid-point of a natural break based on historical building permit records (reported by 10-year increments). Only buildings with a date indicated in the general building stock records were considered. Table BP.3-19 shows the results of this compilation for the 14 participating municipalities.

Table BP.3-19: General Building Stock Built before 1976

Municipality	Buildings with date (#)	Buildings built before 1976 (#)	Buildings built before 1976 (% of total)	Total Building Value ($1,000)	Building Value built before 1976 ($1,000)	Building Value built before 1976 (% of total)
Vineland City	23,739	17,324	73%	$3,648,302	$2,178,283	60%
Millville City	10,374	7,339	71%	$1,306,443	$797,788	61%
Bridgeton City	4,533	4,278	94%	$348,275	$303,141	87%
Upper Deerfield TWP	3,319	2,322	70%	$449,678	$272,789	61%
Commercial TWP	2,502	1,864	75%	$212,403	$152,622	72%
Fairfield TWP	2,139	1,626	76%	$238,551	$165,665	69%
Hopewell TWP	1,949	1,461	75%	$232,230	$157,990	68%
Maurice River TWP	2,069	1,419	69%	$267,723	$168,215	63%
Deerfield TWP	1,486	871	59%	$149,850	$66,665	44%
Lawrence TWP	1,753	838	48%	$243,120	$93,903	39%
Downe TWP	870	629	72%	$80,889	$55,923	69%
Greenwich TWP	474	414	87%	$59,541	$50,707	85%
Stow Creek TWP	578	369	64%	$74,565	$44,276	59%
Shiloh Borough	270	239	89%	$34,855	$28,312	81%
Totals	56,055	40,993	73%	$7,346,423	$4,536,279	62%

3.2.5: Extreme Temperature

Description - Extreme Temperature

Temperatures that are significantly above or below normal are considered extreme temperatures.

Extreme Heat - The National Weather Service (NWS) initiates alert procedures such as special weather statements for "extreme heat" when the heat index, i.e., the combined effects of temperature and humidity, is expected to exceed 105˚F-110˚F (depending on local climate), for at least two consecutive days.[20] For additional information about extreme heat see the NWS Extreme Heat webpage[21] .

Extreme Cold - What constitutes "extreme cold" varies across different areas of the United States. In the Northeast, below zero temperatures may be considered as extreme cold. [22] For additional information about extreme cold visit the visit the NWS WinterWeather website[23].

Location - Extreme Temperature

In general, all people and structures in Cumberland County are potentially exposed to extreme temperatures consistent with the climate of the Northeast United States. In the Northeast:

- Periods of warmer than normal temperatures typically occur several times a summer. Most extreme heat events are less than a week in duration. Exposure for people to extreme heat, in particular during periods of high humidity, can exceed the body's ability to compensate and may lead to hyperthermia, a potentially fatal condition.

- Periods of colder than normal temperatures typically are less than a week in duration but can occasionally last for longer periods up to several weeks. Freezing temperatures can cause severe damage to certain crops and other vegetation. Pipes may freeze and burst in homes that are poorly insulated or without heat. Exposure for people to extreme cold, especially when combined with high winds, can lead to frostbite, permanent damage to the body, hypothermia, or even death.

Previous Occurrences and Future Probability - Extreme Temperature

In 2016, the NCDC database for the period between 2001 and 2014 identified 17 extreme heat events and 5 extreme cold events relevant for Cumberland County. Thirty-one injuries but no deaths were attributed to the extreme heat events while no injuries but one death was attributed to the extreme cold events. A review of the NCDC records for the period since 2014 yielded two additional extreme heat events in July 2017 with no injuries or fatalities reported but no additional extreme cold events

Based on the 24 events between 2001 and 2021, on average, an extreme temperature event occurs 1.2 times per year. Extreme heat events are more likely at 95% annual probability with extreme cold at 25% annual chance of occurrence.

[20] NOAA-Heat Wave Description
[21] http://www.nws.noaa.gov/os/heat/index.shtml
[22] NOAA–Winter Storms…The Deceptive Killers
[23] https://www.weather.gov/lwx/winter

Community Vulnerability – Extreme Temperature

Community vulnerability for the extreme temperature hazard was determined by identifying municipalities with higher percentages of vulnerable populations (older than 65 and younger than 18) and lower median household incomes. This approach was used for the assessment based on the availability of data as well as assuming these population categories would be potentially most at risk to the impacts from either an extreme heat or extreme cold event. Lower income residents may also be more vulnerable if they are unable to afford air conditioning during a heat wave or to heat their homes adequately during periods of extreme cold.

Results from the U.S. Census (American Community Survey – five-year estimates), were used to identify municipalities with older and younger populations as well as those with a below average household income. The municipalities were ranked high, medium, or low based on criteria for each category. A scoring system was then applied to integrate the rankings for each category into a composite vulnerability ranking by municipality based on the population and income data. The vulnerability ranking system is shown in Table BP.3-20 and participating municipality results in Table BP.3-21.

Table BP.3-20: Composite Vulnerability Ranking System – Extreme Temperature

	Median Household Income	Population over 65 Under 18	Population under 18	Composite Hazard Ranking (Combined Scoring)
Low	>$68K	<12%	<22%	4-5
Moderate	$56K - $68K	12%-15%	22%-24%	6
High	<$56K	>15%	>24%	7-8

Table BP.3-21: Composite Vulnerability Ranking – Extreme Temperature

Municipality	Median Household Income	Population over 65 years of age	Population under 18 years of age	Composite Ranking
Bridgeton City	High	Low	High	High
Commercial TWP	High	Low	High	High
Deerfield TWP	Low	Moderate	High	Moderate
Downe Township	High	High	Low	High
Fairfield Township	High	Moderate	Low	Moderate
Greenwich TWP	High	High	Low	High
Hopewell Township	Moderate	High	Low	Moderate
Lawrence Township	Low	Low	High	Low
Maurice River TWP	Low	High	Low	Low
Millville City	High	Low	High	High
Shiloh Borough	Moderate	High	Low	Moderate
Stow Creek TWP	Low	High	Low	Low
Upper Deerfield TWP	High	High	Moderate	High
Vineland City	High	Moderate	High	High

3.2.6: Flood

Description - Flood

Flooding is defined as a condition of partial or complete inundation of normally dry land. Hundreds of floods occur each year in the United States, including overbank flooding of rivers and streams and inundation along lakeshores and coast lines. Riverine flooding typically results from large-scale weather systems generating prolonged rainfall. Coastal flooding is usually related to ocean storm surge, brought on by severe winds associated with low-pressure systems which push water shoreward and cause increases in tide levels and water surface elevations. For additional information about riverine and coastal floods visit NOAA's Flood Monitor page[24].

Location and Extent - Flood

The source for determining the potential location and extent of flooding for an area is FEMA's Flood Insurance Rate Maps (FIRMs). The "effective FIRM" is the official map of a community that participates in the National Flood Insurance Program (NFIP). The FIRM is referenced in the community's Flood Damage Prevention Ordinance and delineates special flood hazard areas (SFHA) and risk premium zones applicable to the community. Flood zones identified on the FIRM include the SFHA with Zones A, AE, V, et al corresponding to areas with a 1% annual chance of flooding, and "X500" denoting areas with a 0.2% annual chance of flooding. The effective FIRM for Cumberland County was last updated as of June 2016. The majority of the 1% annual chance of flooding areas in the County roughly correspond to areas adjacent to the Delaware Bay and its tributaries.

Previous Occurrences and Future Probability - Flood

One way to measure the future probability of flooding is to determine how many flood events have occurred over a discrete period of time and calculate the anticipated occurrence rate. For example, the 2016 NJ4 HMP identified 23 flood events in Cumberland County between 1996 and 2014, No additional Presidential disaster declarations were made for flooding in Cumberland County in the subsequent period from 2015 to 2021. In addition, according to the 2019 NJ SHMP, there were four flooding events in that period due to heavy rain (one event in 2015 and three separate events in 2017). Given that there were three major events with significant property damage and 24 other noted events for the 25-year period, there is a 12.0% annual chance of an event with significant property damages and an 96.0% annual chance of a notable flood event.

It is important to note that based on the most recent FIRMs, the risk of coastal flooding is increasing in Cumberland County. Since earlier versions of effective FIRMs in the 1980s, the 1% annual chance flooding SFHA has increased considerably.

Another method for getting a sense of the likelihood of future flood occurrences is to look at NFIP data. The NFIP maintains a database of claims information for millions of policies nationwide. Table BP.3-22 summarizes the NFIP statistics in the County between 1978 and October 2021 for the 13 participating municipalities in Cumberland County. This data, which was shared with each of the participating municipalities' Working Groups, indicates a total of 738 claims were made during the 44-year period for an average of nearly 17 claims per year.

https://water.weather.gov/ahps/?current_color=flood

Table BP.3-22: Summary of NFIP Statistics between 1978 and October 2021

Municipality	# of Policies	# of Claims	Total Claim Payments ($1,000)	Claims per Policy	Payments per Claim	RL	SRL
Bridgeton City	17	13	$78.18	0.76	$6,014	0	0
Commercial Township	30	28	$541.12	0.93	$19,325	1	1
Deerfield Township	3	8	$47.15	2.67	$5,893	1	0
Downe Township	121	424	$8,001.33	3.50	$18,871	41	4
Fairfield Township	12	18	$122.44	1.50	$6,802	3	1
Greenwich Township	8	3	$18.20	0.38	$6,066	0	0
Hopewell Township	3	1	$0.00	0.33	$0	0	0
Lawrence Township	16	40	$1,364.03	2.50	$34,101	2	1
Maurice River Township	82	108	$1,472.95	1.32	$13,638	10	0
Millville City	67	36	$246.81	0.54	$6,856	4	0
Shiloh Borough	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Stow Creek Township	1	1	$0.00	1.00	$0	0	0
Upper Deerfield Township	6	3	$47.02	0.50	$15,672	0	0
Vineland City	72	55	$511.55	0.76	$9,301	7	0
Totals	**438**	**738**	**$12,450.76**	**1.68**	**$16,871**	**69**	**7**

In addition to NFIP claims, Table BP.3-23 includes data on “repetitive flood loss” (RL) and “severe repetitive loss” (SRL) properties, which are defined as:

- RL Property: A structure covered by a contract for flood insurance made available under the NFIP that has incurred flood-related damage on two occasions, in which the cost of the repair, on average, equaled or exceeded 25% of market value of the structure at the time of each such flood event.

- SRL Property: A structure that is covered under an NFIP flood insurance policy and: has at least four NFIP claim payments (including building and contents) over $5,000 each, and the cumulative amount of such claims payments exceeds $20,000; or for which at least two separate claims payments have been made under such coverage, with the cumulative amount of such claims exceeding that market value of the insured structure.

The 2019 NJ SHMP indicates there were 4,877 RL properties in New Jersey as of August 2018[25], of which 103 were located in Cumberland County, or 2.11% of the total in the State. Only three counties had a lower number of RL properties at that time. More recent figures provided by NJ OEM in October 2021 for the CC HMPU included a reduced number for Cumberland County at 69 RL properties. These updated lists were shared with each of the participating municipalities’ Working Groups,

[25] 2019 NJ SHMP. Page 8-20.

Community Vulnerability - Flood

Comparing building locations to the FIRM provides an understanding of the potential exposure of community assets. Exposure does not automatically translate to vulnerability and risk but is a necessary step to identify assets that should be evaluated in more detail. For example, the 2019 NJ SHMP includes a number of assessments of flood exposure using the SFHA or 1% annual chance flood zones for Cumberland County as displayed in Table BP.3-23.

Table BP.3-23: Cumberland County Flood Exposure

Metric	SFHA
Land Area (square miles) / Percent of Total Area[26]	154.59 / 30.81%
Population / Percent of Total Population[27]	11,572 / 7.37%
General Building Stock Value / Percent of Total Value	$1,244,782,689 / 3.9%

A detailed analysis was conducted to identify general building stock and critical facilities located in or near the SFHA, Table BP.3-24 includes part of the results of this analysis and shows the numbers, value, and percent of total buildings in each participating municipality (except for Shiloh Borough that has no mapped floodplains and does not participate in the NFIP).

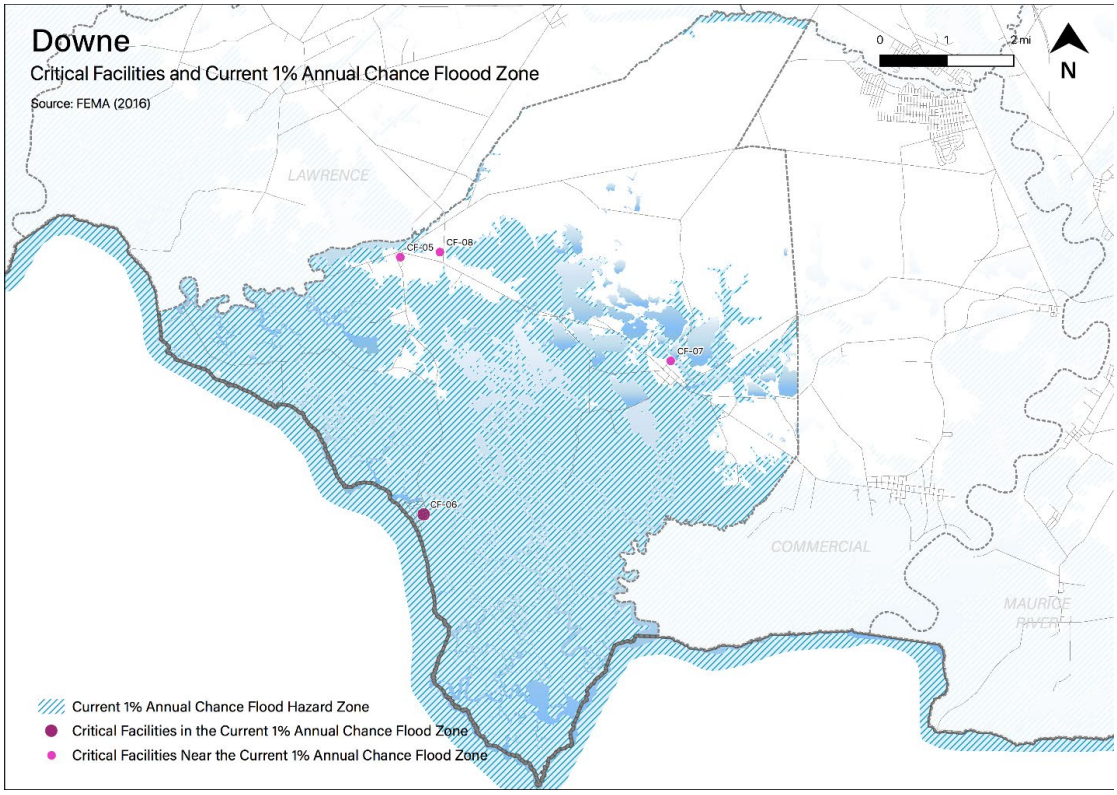
Table BP.3-24: Number, Percent and Value of Buildings in or near the SFHA

Municipality	Buildings In 1%	% of total	Value of Buildings in 1% ($1,000)	% of total value	Buildings W/I 500 feet	% of total	Value of Buildings W/I 500 feet ($1,000)	% of total value
Bridgeton City	111	2%	$23,636	3%	1,402	25%	$208,326	24%
Commercial Township	238	8%	$26,199	11%	1,223	42%	$128,071	52%
Deerfield Township	3	-	$200	-	146	7%	$13,771	7%
Downe Township	828	50%	$49,095	37%	1,448	87%	$111,104	83%
Fairfield Township	111	4%	$5,855	2%	598	20%	$53,986	14%
Greenwich Township	56	8%	$3,548	6%	304	42%	$28,405	45%
Hopewell Township	27	1%	$759	-	604	22%	$54,024	20%
Lawrence Township	111	5%	$5,831	2%	436	20%	$40,775	15%
Maurice River Township	461	17%	$43,852	11%	1,456	53%	$170,876	44%
Millville City	224	2%	$30,319	2%	2,476	21%	$312,464	23%
Shiloh Borough	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Stow Creek Township	9	1%	$786	1%	167	14%	$13,437	17%
Upper Deerfield Township	12	-	$684	-	505	11%	$78,357	13%
Vineland City	241	1%	$19,076	-	2,780	11%	$407,705	10%
Totals	**2,432**	**4%**	**$209,840**	**2%**	**13,545**	**20%**	**$1,621,301**	**18%**

Mapping based on the current FIRMs for Cumberland County municipalities has been provided as part of each Municipal Appendix (except Shiloh Borough) in *Part 3: Hazard Identification and Risk Assessment*. Figure BP.3-2 is an example from one community, Downe Township, showing the location of critical facilities that are in or near the 1% annual chance zone.

[26] Includes land and water)
[27] Subject to limitations of analysis methodology

Figure BP.3-2: Downe Township Critical Facilities and 1% Annual Chance Flood Zone



It is clear that the highest levels of the flood risk in the County are concentrated along the shoreline of the Delaware Bay and its tributaries. In addition, the following three factors provide overall perspective on flood hazard risk in Cumberland County.

- Of the 27 identified flood hazard events between 1996 and 2021, three events accounted for the bulk of reported property damages over the 25-year period, i.e., $27 million. In simplified terms, the average annual damages could be estimated at more than $1 million. However, it is important to note the result is skewed to the high side since $25 million in damages was experienced in a single event due to Tropical Storm Irene in August 2011.

- The 738 claims made against the NFIP between 1978 and 2021, yield an average of nearly 17 claims per year. With an average payment of $16,871 per claim, annual claims under the NFIP are anticipated to be $282,970 per year. However, this is potentially skewed to the low end due to the third factor listed below.

- The NFIP appears to be substantially undersubscribed as seen when comparing totals for data in Tables BP.22 and BP.23:

    - 2,432 buildings, representing 4% of all structures in the County are located within the 1% annual chance flood zone but there are only 438 active NFIP policies. This means roughly 5 out of 6 structures in the SFHA are uninsured.

    - The discrepancy is more dramatic when comparing the number of policies (438) to the number of buildings within 500 feet of the SFHA (13,545, representing 20% of the total number in the County). Although not within the SFHA, being near the delineated zone means there is still risk and in this case, only 1 in 30 structures are insured.

Community Vulnerability - Storm Surge)

In addition, the 2019 NJ SHMP includes summary statistics for the potential impacts of storm surge. Using the SLOSH inundation zones from the FEMA Coastal Flood Loss Atlas (CFLA). The initial analysis included calculating the land area and estimated the population within Categories 1 - 4 for.

Table BP.3-25 identifies the area and percent of land area (in square miles) in the County exposed to SLOSH inundation zone Categories 1 through 4.

Table BP.3-25: Total Land Area (Square Miles) Located Within SLOSH Inundation Zones 1-4
(Source: 2019 NJ SHMP)

County	Total Area (Land and Water)	Category 1		Category 2		Category 3		Category 4	
		Area	% Total	Area	% Total	Area	% Total	Area	% Total
Cumberland	501.8	92.8	18.50%	155.6	31.00%	173.1	34.50%	189.2	37.70%

In addition to calculating the land area for each SLOSH inundation zone, the 2019 NJ SHMP estimated the population exposed to surge. To estimate the population exposed to the surge inundation areas, the SLOSH zones were overlaid on Census block population data in GIS. Since census blocks do not follow the boundaries of the floodplain, the census blocks with their centroid in the SLOSH boundaries were used to calculate the estimated population exposed to the hurricane surge hazard.

Table BP.3-26 summarizes the 2010 Census population in the category 1 through 4 SLOSH zones.

Note that these population statistics only consider permanent residents and do not account for the seasonal population increases along the coast during the summer months which overlaps with a portion of the hurricane season (June 1st – November 1st each year).

Table BP.3-26: Estimated Population Located Within SLOSH Inundation Zones 1-4
(Source: 2019 NJ SHMP)

County	Total Population (2015 ACS)	Category 1		Category 2		Category 3		Category 4	
		Population	% Total	Population	% Total	Population	% Total	Population	% Total
Cumberland	157,035	2,198	1.40%	8,48	5.40%	15,075	9.60%	19,472	12.40%

3.2.7: High Wind

Description - High Wind

High winds can be caused by tropical cyclones, which originate over tropical/subtropical waters with an organized cyclonic wind circulation, including tropical storms (cyclones with sustained winds of at least 39 mph), hurricanes (warm-core cyclones with wind speeds exceeding 74 mph), and Nor'easters (cyclonic storms that typically track up the east coast of the United States). High winds can also result from tornados, a rapidly rotating vortex or funnel of air extending ground ward from a cumulonimbus cloud. When the lower tip of a vortex touches earth, the tornado becomes a force of destruction. For additional information about hurricanes and tropical storms visit NOAA's National Hurricane Center website[28] and for tornadoes visit NOAA's National Severe Storms Laboratory (NSSL) website[29].

Location and Extent - High Wind

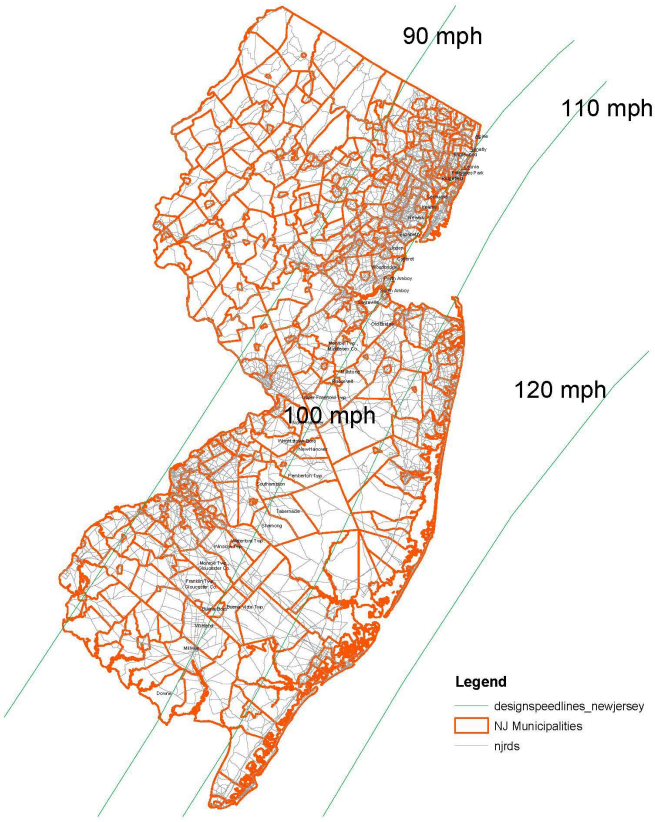
All of Cumberland County is subject to high winds. There are established ways to characterize high wind events. Hurricanes are classified using the Saffir-Simpson Scale which has five categories with wind speeds ranging from 74 to more than 155 miles per hour. Tornadoes have a different system called the Enhanced Fujita Scale which has six categories with wind speeds ranging from 65 to over 200 miles per hour, the latter category is defined as "Incredible".

However, for mitigation purposes, the relevant issue is determining wind loads that can be anticipated for buildings and infrastructure which may cause damage to roof systems or failure of doors and windows. The severity of the high wind hazard is measured primarily by velocity of winds, although effects are clearly exacerbated by duration and the presence of windborne debris.

To protect life and property from wind events, all counties within the State of New Jersey are required to comply with the design wind loads developed by the International Building Code (IBC) and the International Residential Code (IRC). The building code administered within the incorporated areas of Cumberland County requires all new construction to be designed and constructed to a range between 90 and 110 mph wind loads depending on the location.

Figure BP.3-3 identifies minimum design wind speeds for New Jersey per the New Jersey Department of Community Affairs-Division of Codes and Standards Wind Speed Considerations)[30]

Figure BP.3-3: New Jersey Wind Zone Map
(Source: Department of Community Affairs)



[28] http://www.nhc.noaa.gov/
[29] http://www.nssl.noaa.gov/education/svrwx101/tornadoes/
[30] https://www.nj.gov/dca/divisions/codes/resources/windspeed.html

In addition, design wind speeds for any location can be found on a website managed by the Applied Technology Council using GPS coordinates[31].

Previous Occurrences and Future Probability - High Wind

NJ4 HMP's HIRA reported ten tropical storms and two hurricanes with impacts for the region between 1950 and 2013 as listed by the National Hurricane Center, including Hurricane (aka Superstorm) Sandy in 2012. As noted in Table BP.3-1, there has been one additional tropical storm since 2013, Tropical Storm Isaias in August 2020.

In addition to tropical cyclones, the high wind hazard includes tornadoes. In the NJ4 HMP HIRA, eight tornadoes were noted per the NCDC for Cumberland County between 1950 and June, 2014 with a combined property damage of $25,802,500, of which $25 million attributed a single event in 1975. Per the Office of the New Jersey State Climatologist[32], one additional tornado was recorded in Cumberland County in August 2019 in Millville City.

High winds from thunderstorms (separate from tornado winds) are also part of the hazard. The NCDC indicated there have been 137 significant thunderstorm wind events in Cumberland County with an aggregate damage figure of $4,230,000 (including direct damage from strong winds as well as the costs of interrupted business, lost wages, lost tax base, etc.). One event in 2020 near Greenwich Township resulted in most of this damage amount at $3.65 million.

Table BP.3-27 summarizes these results and approximates future probability of occurrence.

Table BP.3-27: Future Probability for High Wind Events

Type of High Wind Event	Number of Occurrences	Number of Years	Recurrence Interval (years)	Annual Probability
Tropical Cyclone	13	72	5.54	18.06%
Tornadoes	9	72	8.00	12.50%
Thunderstorms	137	72	0.53	>100.00%
Combined	**159**	**72**	**0.45**	**>100.00%**

A high wind event is a certainty at least once every year. This result is skewed by the number of thunderstorms which are typically less severe. However, the more severe tropical cyclones and tornadoes both have better than a one in ten chance of occurring in any given year.

Community Vulnerability – High Winds

Similar to the assessment of community vulnerability for earthquake in Section 3.2.4, the community vulnerability assessment for the high wind hazard was completed by identifying buildings constructed before the IBC was adopted for broad use in New Jersey in the 1970's. The assumption is that these older buildings may not have been built with local high wind risk taken fully into account. Once identified, municipalities can collaborate with residents and property owners for these older buildings to conduct field assessments and determine if individual structures may be at risk for failure in the event of a high wind event.

Table BP.3-19: General Building Stock Built before 1976 in Part 3.2.4: Earthquake shows the number and value of these older buildings for each participating municipality.

[31] https://hazards.atcouncil.org/
[32] https://climate.rutgers.edu/stateclim/climatologies/njtornado.html

3.2.8: Levee Failure

Description - Levee Failure

A levee is a natural or constructed slope or wall, either earthen or concrete and often parallels the course of a river. The main purpose of a constructed levee is to prevent flooding to adjacent development or farmland. Levee failure can occur in numerous ways but the most common is the breaching. A breach occurs when part of the levee breaks away, leaving an opening for water to inundate land located behind the levee. Failure can also occur when floodwaters rise above the lowest point on the top of a levee. For additional information about levees see the United States Army Corp of Engineers Levee Safety Program[33].

Location and Extent - Levee Failure

A comprehensive inventory of levees for Cumberland County was completed in 2010 by the US Department of Agriculture (USDA) Natural Resources Conservation Services (NRCS). The purpose was to identify and characterize the location, extent, and characteristics of existing levees/dikes. In addition, the study also examined the vulnerability of people and property protected by the levees. The resulting *South Jersey Levee Inventory* (SJLI)[34] indicated there are 28 levees in Cumberland County, listed in Table BP.3-28. Most of the levees are located in rural areas with low population densities. In addition, according to the SJLI, none of the levees are accredited as providing sufficient flood control by FEMA and therefore structures protected by levees still require flood insurance.

Table BP.3-28: NJ4 HMP Levee Inventory
(Sources: SJLI, USDA – Natural Resources Conservation Service, November, 2010)

Municipality	NCRS #	Levee Name	Length (Feet)
Commercial Township (n=3)	81	Port Norris	21,458
	85	Port Norris North	488
	86	Berrytown	6,797
Downe Township (n=1)	88	Maple Street	2,809
Fairfield Township (n=5)	60	Sea Breeze Road	7,014
	61	Private Landowner (unknown)	8,049
	62	Back Neck 1	1,443
	63	Back Neck 2	4,047
	64	Rock Creek	1,565
Greenwich Township (n=4)	47	Pine Mount King	665
	48	Pine Mount Bacons Neck Road	2,002
	50	Market Street	855
	51	Mill Creek (Union Bank)	4,552
Hopewell Township (n=1)	58	Pease Road	899
Lawrence Township (n=11)	67	Private Landowner North (unknown)	5,379
	68	Private Landowner South (unknown)	1,979
	68A	Private Landowner Southeast (unknown)	961
	69	Sayres Neck North	4,044
	70	Sayres Neck South	12,772

[33] http://www.usace.army.mil/Missions/CivilWorks/LeveeSafetyProgram.aspx
[34] http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs141p2_018319.pdf

Municipality	NCRS #	Levee Name	Length (Feet)
	71	Sayres Neck Southeast	2,169
	73	Jones Island Road	5,605
	74	Bay Point Road	6,273
	75	Blizzard Neck Gut	9,996
	75A	Bay Point Road South	2,936
	76	Nancy Gut	2,430
Maurice River Township (n=2)	82	Heislerville	14,984
	107	Thompson	5,537
Millville City (n=1)	83	Private Landowner (unknown)	5,914

Previous Occurrences and Future Probability - Levee Failure

The 2010 SJLI report indicates there is little or no published information on levee failures in South Jersey[35]. In addition, according to the 2019 NJ SHMP, "there have been no major documented levee failures in New Jersey to date". However, anecdotally, there have been several significant levee failure events in the region. In the NJ4 HMP, 14 previous levee failure events between 1933 and 2014 were documented in the region. Using these limited records, the region experiences a levee failure event on average approximately every six years. Given one event roughly every six years, there is roughly a 17 percent annual probability of a future levee failure events occurring in the region.

Note: See Part 3 of the Municipal Appendices for additional information provided by the Working Groups.

Community Vulnerability – Levee Failure

The community vulnerability assessment for levee failure hazard involved creating a 1,000-foot buffer around each levee included in the SJLI. GIS tools identified parcels that intersect with the 1,000-foot buffer around each levee. This approach provides a rough indication of risk adjacent to the levees in each municipality but is not an indication of the area flooded if a levee were to overtop or breach during a flood event. The results of the parcel analysis are shown in Table BP.3-29.

Table BP.3-29: Total Number of Parcels in Each Municipality Intersecting a 1,000 Foot Levee Buffer, Ordered by # of Parcels
(Sources: NJGIN - Parcel Data, NRCS, South Jersey Levee Inventory, FEMA - DFIRM)

Municipality	# of Levees	# of Parcels Intersecting 1,000 Foot Buffer
Commercial Township	3	267
Downe Township	1	13
Fairfield Township	5	41
Greenwich Township	4	43
Hopewell Township	1	15
Lawrence Township	11	98
Maurice River Township	2	44
Millville City	1	385
Stow Creek Township	0	2
Grand Total	**28**	**908**

[35] USDA - NRCS. SJLI – History of Levee Failures. November, 2010

3.2.9: Severe Summer Weather

Description - Severe Summer Weather

Severe summer weather includes hail and lightning. Hail is a form of precipitation comprised of spherical lumps of ice. Known as hailstones, these ice balls typically range from 5 mm–50 mm in diameter on average, with much larger hailstones forming in severe thunderstorms. Lightning events are generated by atmospheric imbalance and turbulence due to a combination of conditions. Lightning occurs during all thunderstorms and can strike anywhere. Generated by the buildup of charged ions in a thundercloud, the discharge of a lightning bolt interacts with the best conducting object or surface on the ground. The air in the channel of a lightning strike reaches temperatures higher than 50,000 degrees Fahrenheit. For additional information about severe summer weather visit NOAA's Severe Weather page[36].

Location and Extent - Severe Summer Weather

The entire region is subject to the effects from hail and lightning.

The severity of hailstorms is measured by duration, and size of the hail itself. The NWS and the Tornado and Storm Research Organization (TORRO) have developed tables measuring the intensity of hail with 11 categories with hail diameters ranging from less than 0.33 inches up to greater than 4 inches .

The extent or severity of lightning can be determined using the number of cloud-to-ground lightning incidences per square mile. Per the U.S. National Lightning Detection Network (NLDN)[37], Southern New Jersey averages from six to nine lightning strikes per square mile in a given year. This is significantly lower than the central plains and southeast US with strike densities ranging from 12 to 33 per square mile, but more than areas west of the Rocky Mountains.

Previous Occurrences and Future Probability - Severe Summer Weather

Specific consistent data for severe summer weather components is difficult to attain. However, the 2016 NJ4 HMP identified 30 hail events as reported by the NCDC for the period 1969 through June 2014 with a combined total of $75,000 in property damage. Ten of these events had hail larger than 1.5 inches in diameter. The NJ4 HMP also reported 8 lightning events for the same period with damages totaling $2,000. Records in the 2019 NJ SHMP extend through 2017 but only indicate one additional event in Cumberland County. Most of the impacts were in terms of power outages from lightning strikes.

Based on these limited data, with a total of 31 past hail events in the region between 1969 and 2017, the County experiences a notable hail event every 1.5 years on average. For lightning strikes, the data indicates a notable event will occur less frequently, on the order of once every 6 years.

[36] https://www.weather.gov/safety/thunderstorm
[37] https://www.vaisala.com/en/products/national-lightning-detection-network-nldn

Community Vulnerability – Severe Summer Weather

Hail

Community vulnerability for hail was completed by determining the percentage of the total land area vulnerable to hail based on the amount of agricultural land acreage in each municipality. One of the greatest risks from hail is associated with crop damages. Therefore the amount of agricultural lands can be used to provide an indication as to the overall potential exposure to hail.

Using the same analysis method as in Section 3.2.3 for drought, the agricultural land use category from the Land Use Land Cover (LULC) data from the NJDEP was used as the source to determine the number of acres (and square miles) in each municipality. The agriculture land area in each municipality was determined using GIS to split the LULC polygons following the municipality borders. Additional fields were then added to the LULC data to determine the square miles and number of acres in each municipality. The results of the land area analysis are shown in Table BP.3-17 in Section 3.2.3.

Lightning

Similar to the assessment of community vulnerability for earthquakes and high winds in Sections 3.2.4 and 3.2.7 respectively, the community vulnerability assessment for lightning was completed by identifying the older housing stock in the County. The assumption is that modern building codes would include safer and improved electrical systems with proper grounding that would make structures less vulnerable to lightning strikes.

Once identified, municipalities can collaborate with residents and property owners for these older buildings to conduct field assessments and determine if individual structures may be vulnerable to damage from lightning strikes.

Table BP.3-19: General Building Stock Built before 1976 in Part 3.2.4: Earthquake shows the number and value of these older buildings for each participating municipality.

3.2.10: Severe Winter Weather

Description - Severe Winter Weather

Severe winter weather brings forms of precipitation that occur only at cold temperatures, such as snow, sleet, or a rainstorm where ground temperatures are cold enough to create icy conditions. Severe winter weather can result in flooding, storm surge, closed highways, blocked roads, downed power lines, structural failures, and hypothermia. For additional information about severe winter weather, visit the NWS WinterWeather website[38].

Location and Extent - Severe Winter Weather

Cumberland County is subject to severe winter weather and the potential for severe winter storms (snow and ice) is considered uniform for the entire County, i.e., all people and assets have the same degree of exposure .Seasonal snowfall in the County averages about 14"[39] but there can be significant variation from year to year. Generally, the winter storm season in the County runs from December to March but February is the month when maximum accumulations on the ground are usually reached.

Previous Occurrences and Future Probability - Severe Winter Weather

The NJ4 HMP HIRA identified nine severe winter weather events between 1996 and 2014 that impacted the entire region including five events which resulted in a Presidential Disaster Declaration. The 2019 NJ SHMP identified five events between 2015 and 2016 and an additional event occurred in January and February 2021. With a total of 15 past severe winter weather events over this 26-year period, it can be expected that the County will experience a significant severe winter weather event on average every 1.7 years potentially resulting in injuries, property damage and power outages.

Community Vulnerability – Severe Winter Weather

Winter storms occur frequently enough in the County to be a threat to people and property. The NJ4 HMP estimated the total risk from winter weather over a100-year horizon at $24,298,639 or approximately $24,300 per year. This includes cost of injuries and property damage. No substantially different data has been collected since that time that would dramatically alter this result.

In addition, assessing community vulnerability for severe winter weather is similar to the process used for earthquakes, high winds, and the lightning component of severe summer weather in Sections 3.2.4, 3.2.7, and 3.2.9, respectively. The community vulnerability assessment for severe winter weather was completed by identifying the older housing stock in the County. The assumption is that modern building codes would include safer and improved structural requirements and that older structures therefore may be less able to withstand heavier snow loads.

Once identified, municipalities can collaborate with residents and property owners for these older buildings to conduct field assessments and determine if individual structures may be vulnerable to damage from heavy snow loads.

Table BP.3-19: General Building Stock Built before 1976 in Part 3.2.4: Earthquake shows the number and value of these older buildings for each participating municipality.

[38] https://www.weather.gov/lwx/winter
[39] Office of the New Jersey State Climatologist

3.2.11: Wildfire

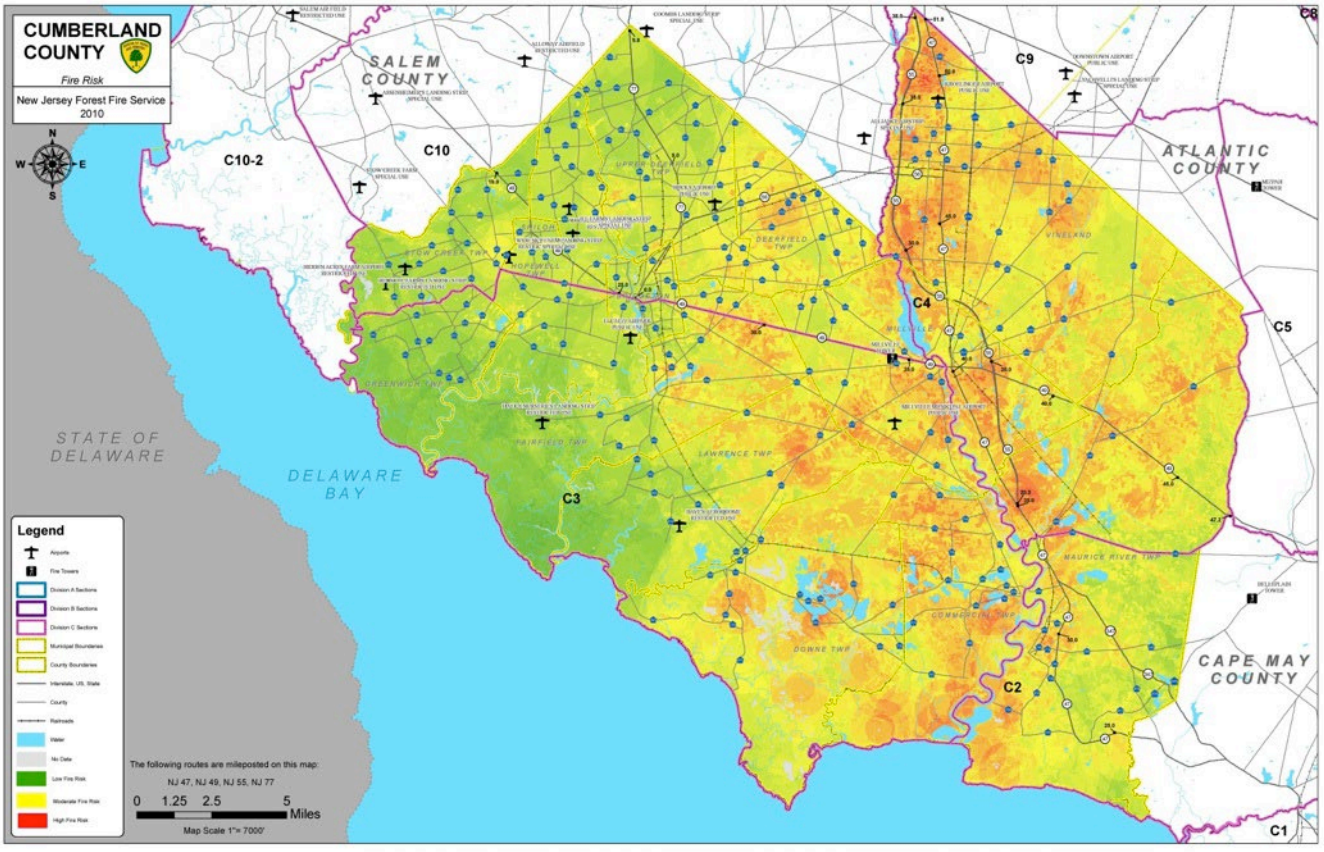
Description - Wildfire

Wildfires are uncontrolled fires often occurring in wildland areas, which can consume houses or agricultural resources if not contained. Common causes include lightning, human carelessness, and arson. Wildfires are fueled by naturally occurring or non-native species of trees, brush, and grasses. The areas of highest risk to life and property are the Wildland Urban Interface (WUI). The United States Forest Service (USFS) defines the WUI as the area where houses meet or intermingle with undeveloped wildland vegetation. This makes the WUI a focal area for human-environment conflicts such as wildland fires, habitat fragmentation, invasive species, and biodiversity decline. For additional information about wildfires visit the State of New Jersey Forest Fire Service (NJFFS) website[40].

Location and Extent - Wildfire

Figure BP.3-4 identifies the wildfire fuel hazard risk for Cumberland County.

Figure BP.3-4: Cumberland County Wildfire Risk
(Source: New Jersey Forest Fire Service, 2010)



The potential for wildfires exists over the entire County, although the probability is relatively low particularly in the urban areas due to the detection and suppression capabilities that exist.

[40] http://www.state.nj.us/dep/parksandforests/fire/

Previous Occurrences and Future Probability - Wildfire

In the NJ4 HMP region, wildfire occurrence and severity has historically been low, and duration a matter of hours to a day. According to the 2019 NJ SHMP, nine wildfire events have occurred between 1997 and 2018 and no wildfires in Cumberland County have required a federal response. In addition, NCDC records indicate these events have been relatively small and resulted in no injuries, deaths, and only minimal property damage.

With a total of nine past wildfire events in the County over a 21-year period, the region experiences a wildfire event on average roughly once every two and a third years. At this rate, there is a 43% annual probability of a future wildfire event occurring in the County. While past wildfire data indicates that the probability of future wildfires occurring is fairly high, impact on property and life in the County is not anticipated to be substantial.

Community Vulnerability - Wildfire

The community vulnerability assessment for wildfire included analyzing data from the NJFFS and the United States Forest Service (USFS). There are no records of deaths or injuries and no recorded loss of property from wildfires in the County.

Table BP.3-30 shows the results of overlaying locations of buildings with high-risk wildfire interface zones.

Table BP.3-30: Wildfire Exposure
(Source: NJDEP (GIS), NJFFS)

Municipality	Structures in High-Risk Wildfire Zones	Building Value	Percent of Total Building Value
Bridgeton City	3	$ 136,400	0.02%
Commercial Township	51	$ 2,068,200	0.84%
Deerfield Township	2	$ 213,700	0.11%
Downe Township	0	$ -	0.00%
Fairfield Township	29	$ 2,125,600	0.56%
Greenwich Township	3	$ 145,550	0.23%
Hopewell Township	0	$ -	0.00%
Lawrence Township	79	$ 10,312,400	3.82%
Maurice River Township	12	$ 967,600	0.25%
Millville City	343	$ 24,115,650	1.74%
Shiloh Borough	0	$ -	0.00%
Stow Creek Township	0	$ -	0.00%
Upper Deerfield Township	47	$ 9,665,600	1.63%
Vineland City	136	$ 12,016,277	0.30%
Totals	**705**	**$ 61,766,977**	0.69%

3.3 Risk Assessment Results

Relevant results from the CC HMPU HIRA have been reported in *Part 3: Hazard Identification and Risk Assessment* in each of the 15 participating jurisdictions' Appendices along with links to related data and mapping.

In addition, please note the following:

- All 15 Appendices identify "critical facilities. Critical facilities are prime candidates for mitigation measures due to important functions staged from these facilities prior to, during, and after natural hazards including emergency services and housing vulnerable populations. A substantial effort was undertaken to identify and address hazard-related issues affecting existing critical facilities during the NJ4 HMP planning project and to update those lists for the CC HMPU.

  A broad range of facilities considered "critical" was employed and includes (but is not limited to the following):

  - Municipal administrative offices
  - Emergency Operations Centers (EOCs)
  - Data storage centers that contain services or records that may become lost or inoperative
  - Fire protection and emergency medical services facilities, including fire and rescue companies, ambulance companies, and other buildings essential to providing emergency services
  - Police facilities
  - Schools and day care centers for children and the elderly
  - Emergency shelters
  - Emergency medical care facilities that provide direct patient care, including hospitals, clinics, outpatient services, nursing homes, and housing for the elderly
  - Flood-control or storm-protection infrastructure
  - Communications facilities that serve in the transmission, switching, and/or distribution of telephone and/or data traffic (publicly owned, managed, or operated only)
  - Power-generation facilities that serve in the generation, transmission, and/or distribution of electric power (publicly owned, managed, or operated only)
  - Water facilities that serve in the transmission and/or distribution of water by a utility that supplies water for the purposes of drinking, irrigation, fire suppression, or electrical generation (publicly owned, managed, or operated only)
  - Sewer and wastewater treatment facilities that serve in the collection, transmission, and/or treatment of sewerage and wastewater (publicly owned, managed, or operated only)
- More information about hazards in New Jersey can be found in the following open sources:
  - 2019 NJ SHMP[41].
  - New Jersey Office of Emergency Management website under the "Plan and Prepare" webpage[42].

[41] https://nj.gov/njoem/mitigation/2019-mitigation-plan.shtml
[42] https://nj.gov/njoem/plan-prepare/index.shtml

3.4 Hazard Exposure Field Assessments

The processes used in developing a HIRA for an HMP typically are coarse grained, i.e., they do not provide much detail regarding hazard exposure and risk at the individual facility or structure level. The HIRA hopefully points in the right direction but rarely provides the necessary level of detail to make informed decisions for specific properties.

The CC HMPU has focused on developing tools and procedures for taking a closer look. This process is intended for two general audiences:

- Owners and operators of critical facilities
- Owners, residents, and businesses in privately owned structures

The intent for both audiences is the same, to enable individuals to make an initial assessment of potential hazard exposure and determine if further, more detailed follow-up efforts are appropriate to identify possible mitigation measures based on observed vulnerabilities.

The questions are relatively simple. For example, the following is a series of questions for determining if there is any reason to be concerned about potential structural failure or contents damage from high winds or severe winter weather (i.e., heavy snow loads):

- Is there visible deterioration or damage to exterior roofing materials including shingles, metal roofing, flashing, etc.? [Yes/No]
- Are there visible signs inside the building of water damage from the upper part of the building, e.g., stained ceiling tiles, stained roof supports (if accessible), etc.? [Yes/No]
- Is there a lack of information on the wind speed “rating” (i.e., the wind speed that can be experienced without damage), for the building doors or windows, e.g., information on frames, information from construction and/or permit documents, etc.? [Yes/No]
- Are there loose or poorly secured items that could become windborne debris during a high wind event, e.g., antennas, lumber, wooden spools, empty containers such as metal drums, furniture, etc., located on the property surrounding the building? [Yes/No]

This level of assessment does not require a subject matter expert and can be conducted by individual property owners as well as facility managers. There are similar series of questions for other hazards with broad potential impacts such as earthquakes as well as for facilities and structures that may be exposed to hazards with more limited extent such as coastal erosion, sea level rise, flooding, or wildfire.

Upon completion of the field evaluations, critical facility owner/operators and individuals will have a better understanding of the potential risks to their facility or structure. After reviewing the possible areas of vulnerability to natural hazards, an owner/operator or individual property owner may wish to take steps to reduce exposure and address identified vulnerabilities. Hazard mitigation measures to address these vulnerabilities range from very small-scale interventions, carrying little to no cost, up to large capital projects including facility replacement.

Updates to the Municipal and Multi-Jurisdictional Mitigation Measures lists in the participating jurisdictions’ Appendices will address mitigation measures for structures and contents, primarily. However, additional consideration should be given to continuity of operations, levels of insurance, and other related concerns. Implementation of identified mitigation measures will require financial, technical and administrative resources.

Strategies for accomplishing mitigation measures in a resource constrained environment include:

- Partnering with local engineers, architects and other professions for project development, project scoping, and grants applications
- Identifying in-kind resources of technical assistance, such as local universities and professional associations (See *Section 4: Mitigation Measures* for more information on this type of strategy)
- County and regional collaboration with owner/operators of similar facilities to seek grant funding for regional solutions

Additional strategies include:

- Conducting periodic reviews of facility operating procedures to ensure continuity of operations
- Conducting periodic reviews of insurance policies to ensure adequacy in the face of a changing risk environment
- Identifying minor changes to routinely scheduled maintenance that can accomplish mitigation goals without requiring additional resources. For example, a previously scheduled and funded building improvement that might be modified to increase wind protection; or slight modifications to annual landscaping improvements to incorporate fire safety.
- Incorporating hazard and risk considerations into ordinary purchasing, such as decisions around the materials from which new furniture purchases will be made.
- Annual education in preparedness and hazard mitigation, including personal preparedness, to all facility staff
- Preparing a list of desired mitigation retrofits to be included with any application for public assistance following a future declared disaster

To support implementation of the CC HMPU and this facet in particular, Cumberland County will prepare and distribute a digital version of the field assessment questions with links to specific resources for identified vulnerabilities. In addition, the following are two notable resources for facility owner/operators and individuals:

- The Insurance Institute for Business & Home Safety (IBHS)[43] is a scientific research and communications organization that provides resources for commercial building owners focused on resilience and hazard mitigation.
- The Federal Alliance for Safe Homes (FLASH)[44] provides information geared towards homeowners looking for hazard mitigation solutions. FLASH guidance can also be utilized for certain critical facilities.

Both IBHS and FLASH also provide resources for business continuity.

[43] https://ibhs.org/commercial/
[44] https://www.flash.org/index.php

3.5 Future Development Hazard and Risk Assessment

The NJ4 HMP identified areas in the region where development may occur in the future based on recent trends in population growth. This was determined by identifying municipalities that have experienced the highest increases in population between years 2000 and 2010. This historical population was used as an indication of areas where development is occurring and might be assumed to continue in the future. These areas of recent population increase were then compared to municipalities considered to be at higher risk (based on the amount of land area) from three hazards including Coastal Erosion and Sea Level Rise, Flood, and Wildfire.

In addition, as part of the SDVR HMPs, the five Planning Areas from the New Jersey State Development and Redevelopment Plan (SDRP)[45] and Smart Growth areas were used with GIS to isolate buildable lands. To identify areas suitable for development in the region:

- Smart Growth areas were identified within Planning Areas 1 and 2 (Metropolitan and Suburban)
- Since both Planning Area categories include developed urban areas, areas categorized as "Urban" by NJDEP Land Use Land Cover data within the Smart Growth areas were eliminated as buildable land
- Areas outside Smart Growth boundaries and also within Planning Areas designated as not suitable for development were also eliminated from the land area identified as suitable for development.

Figures BP.3-4 shows areas of future growth identified from the SDVR HMPs for Cumberland County. Highlighted in tan on each map is the remaining buildable land as identified in 2010 from within the Smart Growth areas for the County. Also identified on the map are the FEMA designated 1% annual chance flooding (100-year floodplain) and 0.2% annual chance flooding (500-year floodplain) from the effective flood insurance rate map (FIRM).

For the NJ4 HMP, the percent change in population from the 2000 and 2010 census in each municipality was used as an indication of past and future development trends. After determining the change in population, each municipality with an increase in population during this 10-year period was ranked low, medium, or high based on the percent increase. However, for the subsequent ten-year period between 2010 and 2020, as reported as part of the Context for the CC HMPU, population declined county-wide at a rate of 4.34 percent and the only municipalities that registered any growth were inland.

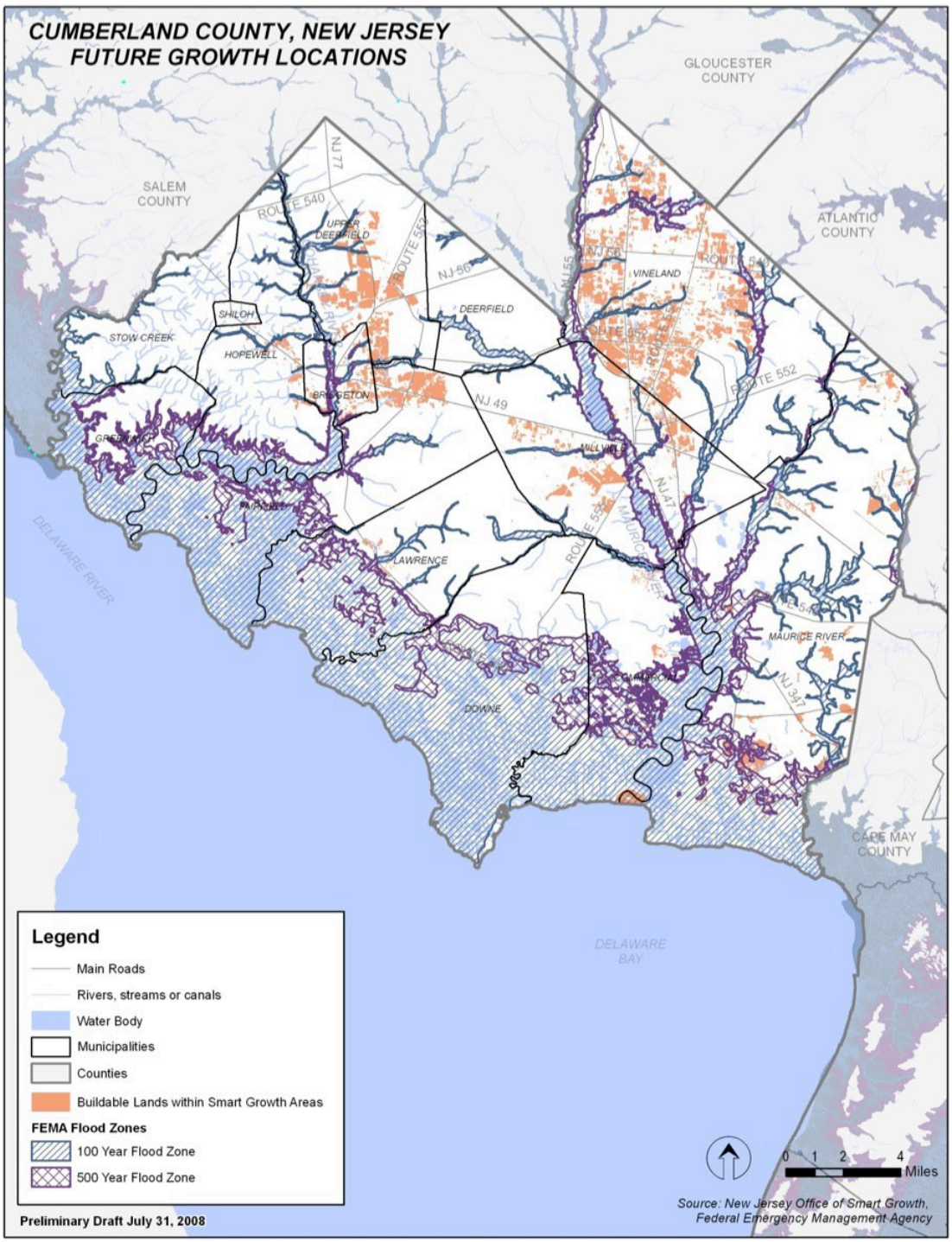
As a result, it was considered tenuous to make conclusions about future growth based on such disparate statistics and with competing unknown factors for the immediate future:

- Long-term negative impacts on growth related to the Covid-19 pandemic
- Long-term positive effects of the proposed "Ocean 1" wind farm off the shores of southern New Jersey, with support facilities to be built in neighboring Lower Alloways Creek Township in Salem County

Implementation of the CC HMPU should include follow-up by municipalities, supported by Cumberland County OEM, to better assess potential increased risk to new development that may occur in potential hazard prone areas. Implementation should also include outreach to property owners and the land development community regarding best practices for risk reduction. The implementation and follow up should incorporate revisions to master plans and land development ordinances to better account for sensitive areas due to hazard conditions (including wildland interface, areas in proximity to flood zones, increased inundation zones, etc.) in future land development proposals and the plan review and approval process.

[45] New Jersey Office of Planning Advocacy @ https://nj.gov/state/planning/assets/docs/2001-state-plan/stateplan030101.pdf

Figure BP.3-4: Future Growth Locations in Cumberland County
(Sources: 2001 New Jersey State Development and Redevelopment Plan, FEMA, NJDEP)



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Section 4:
Mitigation Measures

Contents of this Section

4.0 Interim Final Rule Requirements for Mitigation Measures

Requirement §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.*

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.*

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. [The mitigation strategy] must also address the jurisdiction's participation in the National Flood Insurance Program (NFIP), and continued compliance with NFIP requirements, as appropriate.]*

Requirement: §201.6(c)(3)(iii): *[The mitigation strategy section **shall** include] an action plan describing 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.*

Requirement §201.6(c)(3)(iv): *For multi-jurisdictional plans, there **must** be identifiable action items specific to the jurisdiction requesting Federal Emergency Management Agency (FEMA) approval or credit of the plan.*

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*

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.*

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.*

4.1 Mitigation Goals and Strategies

Section 4.1 includes:

- *Goal statements*
- *Overarching strategies for the participating jurisdictions' mitigation programs*

Goals

Goals were originally established by County and Municipal Working Groups during the 2011 *Southern Delaware Valley Region Hazard Mitigation Plan* (SDVR HMP). These goal statements were subsequently validated by the four County Hazard Mitigation Working Groups during development of the 2016 *Mitigation Plan for Four New Jersey Counties* (NJ4 HMP).

As part of the *Cumberland County Multi-Hazard Mitigation Plan Update* (CC HMPU) planning process, these goals were again reviewed by the participating jurisdictions' Working Groups for use in *Part 4.1: Mitigation Goals and Strategies* in the Appendices. All mitigation measures in the Appendices are related to at least one of these four goal statements:

Goal 1: Improve education and outreach efforts regarding potential risk of natural hazards and appropriate mitigation measures that can be used to reduce risk (including programs, activities, and projects)

Goal 2: Improve data collection, use, and sharing to reduce the risk of natural hazards

Goal 3: Improve capabilities and coordination at municipal, county, and state levels to plan and implement hazard mitigation measures

Goal 4: Plan and implement projects to mitigate identified natural hazards, known problems, and areas of concern

Strategies

Based on these goals, the results of the CC HMPU Hazard Identification and Risk Assessment (HIRA), and experience of participants in the plan update process, each participating jurisdiction Working Group reviewed prior strategies from the NJ4 HMP and confirmed an overarching strategy for mitigation for the CC HMPU. Because risk and hazard mitigation issues across the County have common roots in predominant natural hazards and constraints on capabilities and resources, these strategy statements are similar.

The mitigation measures described in *Part 4.3: Mitigation Measures – Identification*, *Part 4.4: Mitigation Measures – Implementation*, and *Part 4.5: Multi-Jurisdictional Mitigation Measures* of the Appendices reflect these strategies.

- Provide opportunities for residents and property owners to access available information about risk reduction and mitigation measures, in particular for historic structures and cultural resources
- Stay informed regarding changing conditions and related improvements in hazard and risk data available from county, state, and federal agencies due to future natural hazard events and increasing understanding of the effects of climate change and use the information as part of periodic evaluations of, and refinements or additions to, the municipality's mitigation program
- Seek long-term, comprehensive, and balanced protection for community assets including protecting historic structures, cultural heritage sites, natural resources, and infrastructure investments from the threat of natural hazards

- Address short-term needs to preserve existing systems and features that already protect community assets but are in poor working condition or are in danger of imminent failure (e.g., storm drainage pipe systems; flood gates and sluices; and dams, dikes, or levees)
- Focus on projects to address known problems or areas of concern for critical facilities and vulnerable populations and work to identify additional areas of concern for critical facilities and vulnerable populations for future plan updates
- Institutionalize hazard mitigation into municipal activities and programs through regular interactions of the County and Municipal Working Groups and better integration of related regulatory programs and planning initiatives

In addition, the Cumberland County Appendix articulates strategies focusing on support for their constituent municipalities:

- Work with Municipal Offices of Emergency Management (OEM) to provide opportunities for residents and property owners to access available information about risk reduction and mitigation measures
- Work with Municipal OEMs, engineering, and public works officials to resolve multi-jurisdictional mitigation measures

4.2 NJ4 HMP Mitigation Measures

Section 4.2 includes a summary regarding the status of mitigation measures identified for the participating jurisdictions in the NJ4 HMP.

All 14 municipalities participated in the NJ4 HMP along with Cumberland County. During that planning process, all participating jurisdictions' Working Groups identified known problems and areas of concern that then became the basis for mitigation measures to include in the NJ4 HMP. For situations where these problems and concerns still existed at the time of the CC HMPU planning process, the related NJ4 HMP mitigation measures were prime candidates to include in the updated Appendices.

As part of the CC HMPU planning process, during Working Sessions with County and Municipal Working Groups, the status of the mitigation measures from the NJ4 HMP was discussed. A series of questions were asked of the Working Group Members about each of the NJ4 HMP mitigation measures:

- Was the mitigation measure implemented and completed?
- If the mitigation measure was implemented, when was it completed and what was the funding source?
- If the mitigation measure was not implemented, why not?
- If the mitigation measure is on-going or has not been implemented, is it still considered valid and should it be included in the CC HMPU Appendices?
- If the mitigation measure is no longer considered valid, what is the explanation?
- If the mitigation measure is still valid, is it an activity, program, or project that can be undertaken by the county or municipality without the direct involvement of other jurisdictions?
- If other jurisdictions need to participate in a mitigation measure, who are the other potential partners for these multi-jurisdictional mitigation measures?

Table BP.4-1 summarizes the status of the mitigation measures included in the NJ4 HMP.

Table BP.4-1: Status of NJ4 HMP Mitigation Measures

Status	Tally	Percent of Total
Completed – Municipal Mitigation Measure	32	12.2%
Completed – Multi-Jurisdictional Mitigation Measure	11	4.2%
Work-in-Progress – Municipal Mitigation Measure to be carried over	98	37.3%
Work-in-Progress – Multi-Jurisdictional Mitigation Measure to be carried over	31	11.8%
No progress – Municipal Mitigation Measure to be carried over	53	20.2%
No progress – Multi-Jurisdictional Mitigation Measure to be carried over	24	9.1%
Not Completed – Municipal Mitigation Measure no longer considered valid	10	3.8%
Not Completed – Multi-Jurisdictional Mitigation Measure no longer considered valid	4	1.5%
Totals	**263**	**100.0%**

Observations from Table BP.4-1 include:

- A total of 263 mitigation measures were identified in the NJ4 HMP, an average of 17.5 mitigation measures per the 15 participating jurisdictions
- Completed mitigation measures represent 16.3% of the total
- Completed and Work-in-Progress mitigation measures represent 65.4% of the total
- Mitigation measures where no progress was made accounted for 29.3% of the total
- Mitigation measures no longer considered valid accounted for 5.3% of the total

See Table 9 in the participating jurisdictions' Appendices for detailed explanations regarding the disposition of all the NJ4 HMP mitigation measures.

4.3 County and Municipal Mitigation Measures - Identification

Section 4.3 includes information about mitigation measures identified in the CC HMPU Appendices.

Each of the participating jurisdiction's Appendices includes a tabulation of mitigation measures in *Part 4.3: Mitigation Measures – Identification* that are considered the responsibility of the participating jurisdiction to implement. The tables in Part 4.3 includes the following information regarding each mitigation measure:

- **Mitigation Action, Program, or Project** – Entries provide brief descriptions of what the mitigation measure entails. Where the mitigation measure addresses an issue related to a critical facility, the number of the critical facility is cross-referenced.
- **Hazard(s)** – Entries indicate which hazard or hazards the mitigation measure will reduce or eliminate. Typically, these entries reflect at least one of the identified hazards that are profiled and assessed in the CC HMPU HIRA and identified by the participating jurisdiction as a hazard of high concern.
- **Goal(s)** – Entries in the Goal(s) column indicate the relevant goal(s) addressed by each mitigation measure. All of the mitigation measures identified in the CC HMPU Appendices are related to at least one of the four goals.
- **Existing or New Structures** – Entries in the *Existing or New Structures* column identifies if the mitigation measure is applicable to a structure already in place or one that is yet to be built or both.

A total of 118 County and municipal mitigation measures were identified during the Working Group Work Sessions and originated from multiple sources. These mitigation measures reflect and include:

- Goals and strategies as described in Section 4.1
- Projects carried over from the NJ4 HMP as explained in Section 4.2
- New projects, programs, or activities identified by the Working Groups
- Addressing Repetitive Flood Loss Properties if applicable

Generally, mitigation measures identified by the participating jurisdictions include:

- *Public outreach and education* to help residents, businesses, and property owners understand the impacts of natural hazards and mitigation options including working with constituents and property owners that are vulnerable to damage from repetitive flooding, coastal inundation, high winds, or periodic wildfires
- *Back-up emergency power* for emergency service providers such as police and fire companies or places that house and care for vulnerable citizens like hospitals, schools, and housing for seniors or individuals with access and functional needs
- *Strengthening critical facilities* that provide valuable functions, like schools that serve as emergency shelters, to better resist the effects of high winds on windows and doors or heavy winter storms on roofs
- *Infrastructure improvements* for public utilities such as storm water pump stations, drinking water wells, and sewage treatment plants to avoid damage and ensure continuous operation during a natural disaster
- *Mitigation for public and private properties* for specific hazards such as flood and wildfire
- *Drainage improvements* to alleviate flooding of roads and streets, preserve access for emergency vehicles and evacuation routes, and prevent property damage
- *Strengthening or expanding dams and levees* and improving coordination for system management

Table BP.4-2 shows the number of each type of mitigation measure identified for each participating jurisdiction.

Table BP.4-2: County and Municipal Mitigation Measures

Jurisdiction	M1 and other Capability and Coordination Measures	Generators	Harden Critical Facilities	Repetitive Loss Property Mitigation	Other Public / Private Flood Mitigation	Dam / Levee Failure	Wildfire	Miscellaneous Studies	Other	Totals
Cumberland County	2	1	2							5
Bridgeton City	1	10								11
Commercial Township	1	2	2	1	2					8
Deerfield Township	1	3		1						5
Downe Township	1	6		1	1					9
Fairfield Township	2	7		1	3		1		1	15
Greenwich Township	1				3	1			1	6
Hopewell Township	2	3	1							6
Lawrence Township	1	2	2			1				6
Maurice River Township	1	3		1			1			6
Millville City	1	6	2	1	2					12
Shiloh Borough	1	1	1							3
Stow Creek Township	1	1	1							3
Upper Deerfield Township	1	6			2			1		10
Vineland City	1	8	2	1		1				13
Totals	**18**	**57**	**13**	**7**	**13**	**3**	**2**	**1**	**2**	**118**

Municipal Mitigation Programs

Mitigation measures related to the first three goals are generally programmatic. While these types of measures do not usually have high capital costs, they require an investment of time by the participating jurisdictions' staff and involved citizens.

All 14 CC HMPU Municipal Appendices include a "M-1" mitigation measure intended to address these programmatic issues, related to Goal #s 1 through 3 and consistent with the Municipal Adoption Resolution:

- Identify and pursue outreach and education opportunities to inform municipal residents, businesses, and property owners regarding:
  - Current hazards and risks
  - Changing conditions and actions that may reduce / increase risk
  - Best practices for hazard mitigation at the individual or property level.

- Prioritize critical facilities and complete site and facility evaluations to identify vulnerabilities and potential mitigation measures.
- Compile relevant data regarding hazard impacts.
- Conduct regular Municipal Working Group meetings
- Seek out and take advantage of opportunities to integrate hazard mitigation into other community planning initiatives

County Mitigation Program

The Cumberland County Appendix has a complimentary mitigation measure to support municipal efforts consistent with articulated strategies. Key potential aspects of the County Mitigation Program include support for:

- Support municipal outreach and education programs by providing access to current resources and reference materials that Municipal Working Groups can use to inform residents, businesses, and property owners, and that these community members can use themselves to identify and accomplish mitigation measures within their own means.
- Support efforts by Municipal Working Groups to survey municipal critical facilities by providing data management services including facilitating periodic updates to inventory and hazard exposure data.
- Support regular Municipal Working Group meetings and related implementation efforts including reminders at quarterly Municipal OEM Coordinators' meetings, tracking progress toward implementation of municipal mitigation measures, training regarding implementation issues such as project scoping, identification of current available options for funding, etc.
- Support on-going plan maintenance and update processes by Municipal Working Groups by providing the most up-to-date information about natural hazards including refinements to flood mapping, evolving data regarding climate change, and related impacts of sea level rise and hazard event frequencies.
- Facilitate meetings with state, county, and municipal officials to discuss and resolve implementation issues related to multi-jurisdictional mitigation measures. The County can also help coordinate in areas of common interest as in the ongoing work with the municipalities to identify and permit temporary debris management sites throughout the County.

4.4 County and Municipal Mitigation Measures - Implementation

Section 4.4 describes issues related to implementation of mitigation measures identified in the CC HMPU Appendices.

Each of the CC HMPU Appendices includes a tabulation of mitigation measures in *Part 4.4: Mitigation Measures – Implementation* that repeats the list of mitigation measures and identifying numbers from *Part 4.3: Mitigation Measures – Identification*. The table in Part 4.4 includes the following implementation-related information regarding each mitigation measure:

- **Responsible Part(ies)** – Entries indicate one or more agencies or organizations that will be accountable for following up with implementation of the mitigation measure.
- **Priority** – During development of the County and Municipal Appendices, the Working Groups agreed upon priority rankings. General criteria the Working Groups considered were engineering feasibility, costs versus benefits, and potential environmental impacts. *Priority* column entries record the initial relative importance of mitigation measures per the Working Groups.

  Note: These priorities are subject to change depending on funding availability or changes in community concerns during subsequent plan maintenance activities. Plan maintenance activities described later in Section 4.4 include annual evaluation of priorities as well as in response to specific grant availability notifications.
- **Project Type** – Standardized entries in the *Project Type* column help determine funding options and implementation mechanisms at the County and municipal levels.
- **Estimated Cost ($)** – Entries include estimates provided by the County and Municipal Working Groups or approximate ranges for projects that are in early stages of development. When specific cost estimates have been prepared, the source of this information is noted.
- **Target Date** – Entries represent completion dates or targets for completion for each mitigation measure. In most cases, target dates are based on the assumed availability of funding.
- **Next Step(s)** – Entries in the *Next Step(s)* column attempt to identify the next incremental task in the implementation sequence.

The remainder of Section 4.4 provides an overview of other essential components of the plan implementation process:

- Funding and Technical Assistance
- Plan Maintenance
- Adaptation Planning

Funding and Technical Assistance

Past funding for mitigation measures in Cumberland County has been accomplished through an array of federal HMA and state grant programs as well as local resources. However, significant federal or state grant allocations for pre-disaster mitigation efforts are not anticipated and waiting for the next large natural disaster declaration for an infusion of mitigation funding does not reduce risk in the interim. In addition, in New Jersey, post-disaster mitigation funding is often focused on Atlantic Ocean coastal communities and areas with higher property values. Finally, in 2021 and 2022 as this plan was developed, local resources are stretched to the limit by the on-going Covid-19 pandemic. Therefore, communities will need to be creative, cooperative, and proactive to realize risk reduction on a meaningful level.

Recommended approaches are not as easy to describe in a planning document as simply listing grants and funding mechanisms. Successful approaches involve engaging a broad spectrum of stakeholders and employing combinations of funding sources in solving what are increasingly sticky issues related to funding for any public endeavor. While these programs are not necessarily designed to be used together, communities are finding success in doing just that.

One recommended technique requires a "patchwork quilt" or "mosaic[1]" approach to funding mitigation measures, i.e., combining a variety of public and private resources to implement risk reduction measures. This approach begins from the community needs, focusing on identifying the best mix of solutions and not on seeking projects that fit a particular funding source. All too often, communities find themselves designing solutions based on funding, and not based on the needs. The patchwork quilt approach explicitly begins from the identification of solutions. FEMA Region II compiled a resource guide in July of 2020, *New Jersey Mitigation Resource Guide: Federal funding, technical assistance and other resources to support hazard mitigation*[2], which includes a comprehensive list of federal, state, and other sources of funding. Nationally, the *U.S. Climate Resilience Toolkit*[3], is a frequently updated source for information on a wide range of grant sources.

There are several other guides available that cover the wide array of funding sources, as well as resource hubs such as the Georgetown Climate Adaptation Clearinghouse[4] which includes case studies and other resources. However, it can be very time consuming to pursue each possible source of funding, requiring targeted staff time for grant writing, as well as creating a high administrative burden. One challenge of this approach is the need to manage different grant requirements, funding timelines, and reporting mechanisms. Technical assistance, and collaborative partnerships such as Silver Jackets teams[5], have been instrumental to the success of this approach.

Federal Grants and Assistance - The *New Jersey Mitigation Resource Guide*, described above, provides a comprehensive listing of federal grant programs as of 2020. In addition to those programs, the Congressional Research Service released a summary of hazard mitigation resources available from FEMA as of February of 2022,[6] including new programs such as the STORM Act State Revolving Loan Program for Hazard Mitigation. Federal funding for hazard mitigation and climate adaptation is available from several agencies including: the U.S. Department of Housing and Urban Development; U.S. Department of Commerce, Economic Development Administration; and the U.S. Department of Agriculture. Technical assistance is also available from many federal agencies, including those that work on the arts, such as the National Endowment for the Arts.

State Grants and Assistance - There are several state specific programs available to New Jersey counties. The *New Jersey Mitigation Resource Guide*, described previously, provides a comprehensive listing of state grant programs as of 2020. These programs include the Community Wildfire Hazard Mitigation Assistance Program through the New Jersey Forest Fire Services and the Blue Acres Program, from the New Jersey Department of Environmental Protection. Additional targeted information is available in 2019 New Jersey State Hazard Mitigation Plan in *Appendix G: NJ OEM Mitigation Program Handouts*[7].

Local Funding Options - Local funding can be challenging for many jurisdictions to obtain but identifying local funding does have several advantages. The primary advantage is retaining more control over the projects and timelines. Local funding can also serve as a match for state, federal and foundation funding. One local funding mechanism for hazard mitigation is Capital Improvement Programs which typically address local infrastructure and other related needs.

[1] http://nhma.info/wp-content/uploads/2017/10/Roadmap_20171001.pdf
[2] https://www.fema.gov/sites/default/files/2020-09/fema_region-03_mitigation-funding-resource-guide_new-jersey_09-24-2020.pdf
[3] https://toolkit.climate.gov/content/funding-opportunities
[4] https://www.adaptationclearinghouse.org
[5] https://silverjackets.nfrmp.us/State-Teams/New-Jersey
[6] https://crsreports.congress.gov/product/pdf/R/R46989
[7] https://nj.gov/njoem/mitigation/pdf/2019/mit2019_Appendix_G_NJOEM_Program_Handouts.pdf

One model comes from the State of Colorado which has provided guidance to local governments on how to integrate Capital Improvement Programs with hazard mitigation planning[8]. Other sources of local funding include permits, fees, and developer contributions. Proceeds from permits and fees can be allocated specifically towards hazard mitigation, while developers can be required to incorporate best management practices such as water retention, or to provide offsets for drainage impacts. An advantage of tying hazard mitigation to new development is that it also prevents the creation of additional risk through such development while benefiting existing properties and the community as a whole.

Individual property owners, including land lords, can also be incentivized towards hazard mitigation actions. Partners such as universities and non-profits can assist local government employees in educating the public regarding their risk and the actions that they can take. Some private sector partners, such as hardware stores, can also play a role in the provision of information and with basic technical assistance. Many communities have successfully leveraged such partnerships to encourage small scale mitigation actions. The NJ Sea Grant Consortium has a series of tools that can be used for education for homeowners, renters and business owners[9]. The tools focus on preparedness, hazard mitigation and climate adaptation.

Foundations - Foundations provide funding at the national, regional and local level. Some foundations focus specifically on climate, or on the needs of particular populations, or certain sectors. Applying for foundation funding can be time consuming and can often have a low success rate. However, building relationships with local foundations, including corporate foundations, can greatly increase the odds of success. Even foundations that do not focus on hazard mitigation may still be willing support projects that serve their constituencies, such as social service non-profits or minority owned businesses.

There are many search tools that can assist a grants manager with identifying possible sources of foundation funding. Some are comprehensive databases that require payment of a fee, while other information is freely available. There are several community foundations located within New Jersey[10] and their websites can be readily accessed. Many corporate foundations also have active portfolios within the state and across the region[11]. The New Jersey State League of Municipalities has compiled a list of corporate giving programs in New Jersey[12]. A technical assistance partner may also have access to the paid databases and may be able to allocate some time and resources to the search for relevant and applicable grants.

Technical Assistance - In addition, engaging outside technical assistance can enhance limited in-house resources in local government agencies. Several of the federal and state programs described in prior sections also include a technical assistance component. Local colleges and universities can provide planning or GIS assistance. Nonprofits, foundations, and professional organizations dedicated to hazard mitigation, resilience, and climate adaptation can provide resources, research, and in some cases, direct assistance to implement measures. Exploring outside technical resources and establishing relationships with these organizations can expand the capabilities of local government agencies with limited staff or in-house capabilities.

Professional associations, and their state chapters, are a frequent source of technical assistance and in-kind contributions. These associations include groups such as the Thriving Earth Exchange[13] and the Anthropocene Alliance[14], which pair scientists with local communities for the purposes of problem solving related to climate and hazards.

[8] https://planningforhazards.com/capital-improvement-plan
[9] https://njseagrant.org/extension/coastal-concerns/emergency-preparedness/
[10] https://www.causeiq.com/directory/community-foundations-list/new-jersey-state/#search_section
[11] https://www.tgci.com/funding-sources/nj/top
[12] https://www.njlm.org/582/Corporate-Giving-Programs
[13] https://thrivingearthexchange.org
[14] https://anthropocenealliance.org/support/

Other sources of support are state chapters of professional associations such as the American Planning Association[15], Association of State Flood Plain Managers[16], American Society of Civil Engineers[17], American Institute of Architects[18], and the American Society of Adaptation Professionals[19].

National collaborative models such as the Silver Jackets Program can also provide technical assistance and allow local communities to network with similarly situated communities elsewhere. Other programs include the National League of Cities Leadership in Community Resilience Program,[20] the Greening America's Cities Program[21], and the Resilient Cities Network[22].

Plan Maintenance

FEMA hazard mitigation planning guidelines strongly recommend that hazard mitigation plans be maintained between periodic updates. Most FEMA-approved hazard mitigation plans, including the CC HMPU, list coherent, comprehensive plan maintenance procedures that include:

- Monitoring implementation of mitigation measures
- Evaluating planning assumptions and available data
- Updating risk assessments, goals, and related mitigation measures including identifying thresholds that should trigger a plan update

However, very few of these plan maintenance procedures have been consistently followed. There are many reasons for this, both good and bad. Most hazard mitigation programs are administered by local OEMs and, particularly in recent years in New Jersey, municipal and county OEMs have been burdened with response and recovery activities from frequent disaster events and the Covid-19 pandemic. Actively implementing and maintaining a risk reduction plan at the same time as trying to address basic issues of public health and safety or addressing the range of issues in the aftermath of a large storm is a significant challenge.

Maintaining an active Working Group and delegating responsibilities to members or subcommittees of that group can help alleviate potential resource problems. In some municipalities, it may be worth considering a shift in the primary responsibility for planning to other individuals or organizations in the community such as planning or engineering departments on a local or regional basis.

Regardless of how municipalities address resource issues, a key area where plan implementation and maintenance procedures can be improved is by working to ensure that hazard mitigation is institutionalized within the existing government structures and organizations.

One way the CC HMPU works toward this goal is by incorporating specific information regarding these roles into the formal adoption resolution by the elected officials:

- Expectations and responsibilities for "Responsible Parties" identified in the mitigation measures
- Membership and roles of the Working Group
- Periodic reporting requirements including frequency and content
- Opportunities for public participation

[15] https://njplanning.org
[16] https://www.njafm.org
[17] https://www.ascenewjerseysection.org
[18] https://aia-nj.org
[19] https://adaptationprofessionals.org/about/
[20] https://www.nlc.org/initiative/leadership-in-community-resilience-program-application/
[21] https://www.epa.gov/smartgrowth/greening-americas-communities
[22] https://resilientcitiesnetwork.org

The following describes in more detail key aspects of the Plan Maintenance approach for the CC HMPU including:

- Method for Monitoring the Plan
- Schedule for Monitoring the Plan
- Method and Schedule for Evaluating and Updating the Plan
- Circumstances that will Initiate Plan Review and Updates
- Evaluating and Revising Priorities
- Continued Public Involvement

Method for Monitoring the Plan

The County and Municipal Working Groups will monitor the CC HMPU for several related purposes:

- Maintain the currency of hazard and risk information
- Ensure that mitigation measures continue to reflect the priorities of the jurisdiction and stakeholders
- To comply with FEMA and the State of New Jersey requirements for plan maintenance and maintain eligibility for federal disaster assistance and mitigation grants

The OEM Coordinator for each participating jurisdiction will lead the effort to periodically monitor their respective Appendices with respect to the purposes noted above, according to the schedule and update triggers noted below.

Specifically, monitoring activities will consist of:

- Soliciting and reviewing reports from Working Group members regarding status of implementation of mitigation measures. Status reports will indicate if mitigation measures have been:
  - Scoped and/or documented for FEMA grant applications
  - Submitted for FEMA funding programs
  - Approved (or denied approval) for FEMA funding
  - Documented for funding by other means (e.g., municipal capital improvement plans)
  - Funded (or not approved for funding) by other means
  - Under construction
  - Completed
  - (for completed projects only) Subject to hazard conditions such that avoided losses can be documented
- Tracking progress of sources of improved or revised data for use in subsequent updates on an annual (at a minimum) basis including:
  - Critical facility evaluations
  - HIRA data compilation efforts, in particular for drainage and stormwater management system problem areas
- Preparing a report of the status of implementation of mitigation measures in the Appendices and the availability of improved or revised data. The report will include recommendations to the Working Group regarding the need and/or advantages of undertaking updates to all or part of the Appendix prior to the five-year required update.

Schedule for Monitoring the Plan

Informal monitoring activities will be ongoing. In addition to the FEMA mandated five-year update cycle, the OEM Coordinator for each participating jurisdiction or their designee will perform monitoring activities for the jurisdiction's Appendix every twelve (12) months, or more often as circumstances require.

In addition to the scheduled reports, the OEM Coordinator will convene meetings after any natural hazard events that prompt preparation of Preliminary Damage Assessments (PDAs) to review the effects of such events. Based on those effects, adjustments to the mitigation priorities identified in Part 4 of the Appendices may be made or additional event-specific measures identified.

Cumberland County OEM has an additional role in reminding Municipal OEM Coordinators to schedule these reviews and then providing support for these meetings.

Method and Schedule for Evaluating and Updating the Plan

Comprehensive evaluation of and updates to the CC HMPU will be undertaken on a five-year cycle (at a minimum). No less than one year prior to the five-year anniversary of CC HMPU adoption date or sooner if circumstances require, the OEM Coordinator will initiate a comprehensive review of the jurisdiction's Appendix with particular attention to FEMA guidance.

The criteria to be used in this evaluation include (but are not limited to) the following:

- Assessing whether or not goals and objectives in the CC HMPU and the Appendix address current and expected conditions
- Determining if there are any changes in risk factors and/or data that would be relevant to natural hazards in the CC HMPU and within the jurisdiction
- Determining if capabilities have changed relative to the county and municipalities' ability to plan and implement hazard mitigation projects
- Determining if significant changes have occurred in the availability of funding at federal and state levels to support hazard mitigation planning and implementation
- Results in implementing the CC HMPU and Appendix per monitoring reports

The OEM Coordinator will prepare a report:

- Describing the updated requirements
- Summarizing the staff evaluation of the Appendix, highlighting areas that require updating, and explaining the reasons why the updates are needed
- Providing detailed recommendations about how the Appendix should be updated, noting any technical work that may be required

The report will sequentially be provided to the Working Group and the jurisdiction's elected board for consideration. The report will also be posted on the jurisdiction's website for public review and comment.

The Working Group and elected officials will review the report and recommendations and advise the OEM Coordinator how to proceed on the individual recommendations for the updates. The OEM Coordinator will initiate activities to conduct the recommendations and will prepare draft updates to the Appendix on a schedule determined in cooperation with the Working Group and elected officials.

When the draft updates are completed, the Working Group will be convened to conduct the comprehensive evaluation and revision. The Working Group will produce a final draft of the updated Appendix for consideration by the elected officials. The elected officials will review the updated Appendix, indicate any desired changes, approve and adopt the Appendix in sufficient time to meet FEMA plan update requirements.

Circumstances that will Initiate Plan Review and Updates

This section identifies the circumstances or conditions under which the OEM Coordinator will initiate reviews and updates of the Appendix when appropriate:

- On the recommendation of the OEM Coordinator or on its own initiative, the elected officials for the jurisdiction may initiate a review and update at any time
- At approximately the twelve-month anniversary of the initial Plan adoption and every twelve months thereafter
- After natural hazard events that appear to significantly change the apparent risk to the jurisdiction's assets, operations, and/or constituents

Evaluating and Revising Priorities

In evaluating and revising priorities, it will be important to consider which measures will have real impacts and are attainable, not just project types that are eligible for funding under FEMA's HMA programs. Waiting for limited and competitive funding in annual grant programs such as FEMA's Building Resilient Infrastructure and Communities (BRIC) and Flood Mitigation Assistance (FMA), or funding that only becomes available after presidentially declared disasters such as the Hazard Mitigation Grant Program (HMGP) can mean missed opportunities for implementing measures that reduce risk.

Communities can start by prioritizing mitigation measures that require little or no federal funding to be implemented. Improving floodplain management and conducting public outreach and education campaigns are effective means of reducing risk. Implementing these measures may require cooperation between departments – for example, coordinating between Municipal OEM Coordinators, Floodplain Administrators, and Construction Officials to implement floodplain management ordinance freeboard elevation requirements. Or it could mean establishing partnerships with non-governmental organizations to distribute public information on low cost retrofit measures to address minor flooding. Such efforts can have real impacts while communities work to secure federal or state funding for other more costly hazard mitigation measures.

In addition, a more systematic evaluation process can be employed, such as the "STAPLEE" process recommended by FEMA. The acronym incorporates the first letters of specific review criteria including Social, Technical, Administrative, Political, Legal, Economic, and Environmental.[23]

Continued Public Involvement

The CC HMPU and the Appendices will be evaluated and updated periodically and when certain triggering events occur. The OEM Coordinator and Working Group will utilize available tools and sustained efforts to include the public in the implementation and update process.

The OEM Coordinator, with the support of the Working Group, will undertake public outreach and awareness activities including (but not limited to):

- Providing and maintaining links on the jurisdiction's website to:
  - The jurisdiction's Appendix including features that make it possible for website visitors to submit comments at any time
  - HIRA results per the Section 3 of the CC HMPU Base Plan
  - Mitigation measures information and resources per Section 4 of the CC HMPU Base Plan
  - Notices regarding periodic Working Group work sessions including an invitation for members of the public to participate in these meetings

[23] The STAPLEE process is described in FEMA's State and Local Mitigation Planning 'how-to' Guide #3: Developing the Mitigation Plan https://www.fema.gov/media-library/assets/documents/4267, pages 2-12 through 2-20.

- Responding to public comments or expressions of interest by local residents, property owners, and businesses
- Development and circulation of annual newsletters or conducting workshops on natural hazards to educate the public and help make them aware of the risk faced by individual property owners.
- Continuing updates on the progress of implementing the Appendix and future updates at regularly scheduled elected and appointed boards and commissions within the community
- Speaking engagements to civic groups and organizations regarding the results of the CC HMPU and the Appendix, the implications for individual property and business owners and the on-going process of plan implementation and maintenance

Adaptation Planning

Hazard mitigation planning and implementation is intended to reduce risk to people, property, and communities. The plan maintenance and update processes rely on an on-going review of hazards to identify and quantify risk so coherent mitigation measures and implementation strategies can be devised. Risk assessment procedures are based on what has happened in the past. If past trends and patterns are a good predictor of what may happen in the future, then the process is reliable. However, when trends and patterns are not consistent or predictable, then long-term decision-making becomes more challenging.

For natural hazard mitigation, much of the risk faced by communities in New Jersey is related to weather. Unfortunately, trends indicate that weather related natural hazards have been and will continue to worsen, and will cause even more damage in the future:

- Since 1900, temperatures in southern New Jersey have increased approximately 3°F (1.5°C) and precipitation has increased by about 5” (0.13m) a year.
- Due to a combination of land sinking, sand loss from erosion, and sea level rise, the tidal gauges at Cape May, NJ have reported a relative sea level rise of 6” (0.18m) since 1970.
- There have been large increases in summer stormflows in the northeast United States in the last 60-80 years, leading to increasing frequency of small floods in recent years.

Future changes will affect most critical infrastructure, including:

- Buildings and other structures
- Energy supply - Power generation: hydropower, energy infrastructure design, wind engineering, thermal plant cooling, fuel supply
- Transportation - Highways, culverts, bridges, rail, airports, ports, navigation, pipelines
- Water Resources - Dams, levees, irrigation, reservoir management, flood risk management, drought management
- Urban Water Systems - Storm water management, municipal water supply and wastewater
- Coastal Management - Erosion, seawalls, groins, dredging

As weather patterns change, risk from natural hazards can also increase. If the information available about the potential changes to the weather patterns is not well developed, it is hard to anticipate the consequences. Planning for a changing future is referred to as “adaptation.”

According to the US Environmental Protection Agency, adaptation is efforts by society or ecosystems to prepare for or adjust to future changes in weather. These adjustments can be:

- Protective: Guarding against negative impacts
- Opportunistic: Taking advantage of any beneficial effects

It is important to note that hazard mitigation and the protective adjustments related to adaptation are highly similar; both seek to reduce risk from hazards by altering the exposure or the vulnerability. Best practices advance multiple goals, e.g. adaptation, mitigation, and reduced costs. Of course, multiple stakeholders mean multiple priorities and perceived benefits.
Note: Institutionalizing a process of annual evaluations and a program of looking critically at data and assumptions as well as revising mitigation measures and priorities accordingly are consistent with an adaptation-oriented approach to plan implementation and maintenance.

Adaptation (and hazard mitigation) benefits stakeholders in many ways:

- Reduces the loss of life, property, essential services, critical facilities and economic hardship.
- Reduces short-term and long-term recovery and reconstruction costs.
- Increases cooperation and communication within the community through the planning process.
- Increases potential for state and federal funding for recovery and reconstruction projects.

Many communities are already implementing adaptation solutions. Adaptation addresses short and long-term efforts, ranging from land use planning and coastal zone management to comprehensive emergency planning, preparedness, and recovery. New Jersey already has hazard mitigation plans in effect, strengthening these for future changes will result in adaptation.

Adaptation solutions for natural hazards facing New Jersey include:

- Take sea-level rise projections into account for infrastructure siting, i.e., develop new facilities or infrastructure in high hazard areas in a way that responds to changing conditions or do not develop if the risk is too high.
- Plan for relocation and redevelopment as informed by floodplain management techniques.
- Retrofit and adapt public infrastructure.
- Strengthen building codes for increased resiliency and risk reduction.
- Build houses and infrastructure with natural hazards such as flooding in mind.
- Improve evacuation routes.
- Improve stormwater management systems and infrastructure.

Adaptation for individual homeowners and property owners include:

- Disconnect your downspouts or install rain barrels to reduce water entering the sewer system.
- Plant trees and install high efficiency air conditioning to address heat waves.
- Install high efficiency appliances and lighting to reduce peak demands.

Adopting an adaptation approach to plan implementation and maintenance involves challenges:

- Data about future conditions available to use for making decisions is based on extrapolation and assumptions. Data is also not yet available at a level of resolution that helps local communities make informed decisions. It simply takes too long to judge if all the assumptions are correct or to wait until projections are refined so municipalities are learning to gather and use information for their own use as it becomes available, recognizing that refinements in plans and programs may be needed as the quantity and quality of information improves.

  Note: The CC HMPU and Municipal Appendix include data collection and maintenance provisions that are consistent with an adaptation planning and implementation approach.

- There are differences in how organizations and agencies look at and solve problems. The resulting silo mentalities can impede the kind of cooperative efforts needed for adaptive planning. The solution is to increase the integration of different groups efforts to improve common knowledge and understanding and to find common solutions to many problems that extend beyond individual municipal boundaries.

Note: The CC HMPU and Municipal Appendix are focused on multi-jurisdictional problems as well as local issues. The collaborations on specific current issues can be used as a starting point for joint efforts on more substantial long-term adaptation planning issues.

4.5 Multi-Jurisdictional Mitigation Measures

Section 4.5 includes information about multi-jurisdictional mitigation measures identified in the CC HMPU.

Most of the CC HMPU Appendices include a tabulation of multi-jurisdictional mitigation measures in *Part 4.5: Multi-Jurisdictional Mitigation Measures.* The table in Part 4.5 includes the following information regarding each mitigation measure:

- Problem Description
- Hazard(s) Addressed
- Goal(s) Addressed
- Applies to Existing or New Structures
- Potential Participants

The first four items on this list are analogous to similarly named columns described in *Section 4.3: Mitigation Measures – Identification*. The following provides an overview of the process used to identify multi-jurisdictional measures that also helps define the fifth column heading, i.e., *Potential Participants*.

During the NJ4 HMP Work Sessions held in the spring and summer of 2014, the Municipal Working Groups identified SDVR HMP mitigation measures that should be carried over in the NJ4 HMP as multi-jurisdictional mitigation measures. In many cases, mitigation measures are clearly the responsibility of the municipality to implement. However, in these situations, the municipality for various reasons did not believe it could implement the problem that needs mitigation.

This situation arose most often where the perceived problem involved drainage or stormwater management issues related to a county, state, or federal highway. In these situations, implementation requires participation and/or leadership from other levels of government, including county, state, and federal agencies. Also, it was not unusual for municipalities to identify multi-jurisdictional problems that will potentially require participation by multiple municipalities. Again, the simple example is a stormwater management problem in one municipality that requires the participation of one or more neighboring upstream municipalities to resolve.

For the CC HMPU planning process, the Working Groups either carried over or identified new multi-jurisdictional mitigation measures that Municipal Working Groups believe are partly or wholly the responsibilities of other governments agencies. The total multi-jurisdictional measures identified for the CC HMPU is sixty-two (62)[24]. This list will be referred to the County Working Group for consideration as part of the CC HMPU implementation process. The County OEM and appropriate members of the County Working Group will meet with municipalities to confirm specific responsibilities amongst different level(s) of government to address these problem areas including identifying appropriate agencies or departments who will be able to take a lead role for implementing these mitigation measures

Note: It is important to recognize identification of the multi-jurisdictional mitigation measures are initially based solely on opinions of the Municipal Working Groups and other agencies and individuals may not immediately share that opinion. However, part of the process of reviewing these recommendations from Municipal Working Groups is to identify areas where there are different opinions about who may be responsible and agree regarding the best way to proceed to resolve these problem areas.

[24] See Part 4.5 of the Cumberland County Appendix for a compilation of the multi-jurisdictional mitigation measures for all the participating municipalities.

Maintaining strong relationships with constituent municipalities and neighboring communities is critical when implementing hazard mitigation measures. Hazards have no respect for jurisdictional boundaries and certain types of construction projects, such as major flood risk reduction measures and drainage improvements, will require multi-jurisdictional implementation. Furthermore, coordinating with other municipalities on data acquisition and management initiatives and public outreach and education campaigns would allow communities to combine resources and meet shared goals to reduce risk in their region.

Another important characteristic of the multi-jurisdictional measures is the different levels of government agencies identified in the "Potential Partners" column including:

- Municipality – Municipality
- Municipality – County
- Municipality – State
- Municipality – Federal
- Municipality – Multiple (e.g., "Municipality - County and State" or "Municipality - State and Federal")

4.6 Resources and Plan Integration

Section 4.6 identifies available resources at the County and municipal levels as well as plans and documents considered in the development of capability building and plan integration recommendations for the CC HMPU.

Resources

As part of the CC HMPU, the County and Municipal Working Groups were tasked with completing a short survey regarding capabilities.

Survey Methodology

The survey was targeted to a selection of Working Group members that potentially included:

- OEM Coordinator
- Deputy OEM Coordinator
- Floodplain Administrator
- Building Inspector / Construction Official
- Any other individual(s) with a direct role in planning and/or implementing mitigation in the jurisdiction (e.g., Community Planner, Engineer, Public Works Director)

The survey was conducted on-line and focused on four basic metrics:

- **Position Type** – Identifying the extent to which staff were available on a full-time basis
- **Time in Position** – Measuring tenure in the community, i.e., longer time on the job could translate to being more familiar with the community
- **Experience** – Recording experience in three key areas, hazard mitigation planning, HMA grant administration, and floodplain management
- **Training / Certifications** – Looking at the type of training staff may have undertaken for hazard mitigation planning and implementation and floodplain management

Survey Observations

There were 85 individual responses to the survey. Specific results for each community and a comparison to the County as a whole can be found in Part 4.6 of each participating jurisdictions' Appendix. The key observations that are apparent included the following:

- Approximately half of available staff are full-time and about the same number have been in their positions for more than 5 years.
- More than half indicated they had no experience in any of the three key areas.
- Less than a quarter indicated they had any specific training or certifications for hazard mitigation or floodplain management.

This is not unusual for communities relative to hazard mitigation planning and implementation but does not necessarily reflect the intellectual capacity of these individuals to come together for a project of this type. It also does not speak to the resource issue that is probably more important that capability, i.e., availability. Although some of the individuals included in the survey are full-time OEM Coordinators, that responsibility includes all aspects of emergency management and in recent years in New Jersey and many other areas, that is a full-time position without any additional focus on hazard mitigation.

Recommendations

Building capabilities within the Municipal Working Groups, in particular in areas related to varied challenges such as climate change, sea level rise, and evolution of the National Flood Insurance Program implications for Cumberland County is daunting. Seeking education and training opportunities from State and federal partners is one of the ways this can be accomplished using existing training programs. However, there is a substantial need for support from individuals and organizations outside of traditional government agencies to shore up the "capability" and "availability" issues. Seeking partnerships with academia and related non-governmental organizations to support sustained efforts for mitigation has not been explored in depth before and is worth the effort moving forward to effect change in the effectiveness of the County and municipal mitigation programs

Plan Integration

The update of the SDVR HMP for the NJ4 HMP included reviewing existing plans and documents provided by the participating municipalities and identifying plan integration considerations. The primary focus was placed on the review of the following plans and documents:

- Flood Damage Prevention Ordinances
- Emergency Operations Plans
- Master Plans and Reexamination Reports

In addition, participating municipalities provided a wide array of other documents that were examined including:

- Stormwater Management Plans and Ordinances
- Land Use and Development Plans and Ordinances
- Environmental Resource Inventories
- Economic Assessments and Development Plans
- Community Sustainability Plans
- Long-term Disaster Recovery Plans
- Dam Emergency Action Plans and Inundation Studies
- Wildland Fire Management Plans
- Mitigation Projects
- Municipal Budgets and Capital Improvement Plans
- Recreation Master Plans, Open Space Preservation Plans, and Farmland Preservation Plans
- Online Tools

Table BP.4-3 identifies the primary plans and documents collected from each of the participating municipalities.

Table BP.4-3: Plans and Documents

Municipality	Flood Damage Prevention Ordinance	Emergency Operations Plan	Master Plan	Reexamination Report	Other
Bridgeton City	☑	☑	☑		☑
Commercial Township	☑	☑			☑
Deerfield Township	☑	☑	☑		☑
Downe Township	☑	☑	☑	☑	☑
Fairfield Township	☑	☑	☑	☑	☑
Greenwich Township	☑	☑	☑	☑	☑
Hopewell Township	☑	☑	☑		☑
Lawrence Township	☑	☑	☑		☑
Maurice River Township	☑	☑	☑	☑	☑
Millville City	☑	☑	☑	☑	☑
Shiloh Borough	n/a	☑	☑		☑
Stow Creek Township	☑	☑	☑		☑
Upper Deerfield Township	☑	☑	☑	☑	☑
Vineland Township	☑	☑	☑	☑	☑

Methodology

After collecting all provided materials from the municipalities, the Planning Team conducted a series of reviews. The purpose of the reviews was to determine the extent to which components of hazard mitigation planning and implementation were included in these documents. Due to the sheer number of documents compiled for the NJ4 HMP region, a representative sample of Master Plans, Reexamination Reports, Floodplain Management Ordinances, Emergency Operations Plans, and other materials were reviewed.

Components that were sought out in these plans and documents included information related to natural hazard identification, risk assessments and mitigation such as:

- Lists of hazards faced by the municipality, critical facilities or sensitive populations
- Descriptions of preventative measures for hazards of the area

Hard copy plans and documents were reviewed by focusing on sections most likely to contain hazard or mitigation-related information like the Land Use Element of the Master Plan or the Vulnerability Risk Assessment of the Emergency Operations Plan. Search functions were also used to find key words in digital and on-line versions of plans and documents such as “freeboard” or “flood hazard”.

In addition, the date of documents was noted. Older documents may contain relevant but out-of-date information, for example flood plain delineations based on out-of-date FIRMs.

Results

The review was intended to answer the question: “*To what extent do these documents reflect up-to-date hazard risk and mitigation?*” The following summarizes the results of the plans and documents that were the main focus of this review that was not significantly different at the time of the CC HMPU planning:

- With the exception of references to the potential extent of flooding in Flood Damage Prevention Ordinances, brief listings of hazards in Emergency Operations Plans and occasional references to regulatory floodplains, there is little or no direct mention of the full range of natural hazards that can affect Cumberland County and its constituent municipalities.
- With the exception of brief, incomplete, and often out-of-date lists of critical facilities in Emergency Operations Plans, there is little or no direct mention of critical facilities or the role these facilities play in community sustainability.
- With the exception of brief, incomplete, and often out-of-date lists of facilities that house or serve vulnerable populations in Emergency Operations Plans, there is little or no direct mention of vulnerable populations or the special needs these constituents may have during emergencies.
- Few if any references were found to on-going or dedicated funding sources for hazard mitigation measures originating at the municipal or county level.

During the review, a few examples were found which could be portrayed as integration of mitigation considerations into other plans and documents including the following representative item:

- **Greenwich Township (Cumberland County) Master Plan:** Page 53 of the Township's Master Plan identifies flood hazard, flood insurance, and their application to land development.

Recommendations

Recommendations relevant to most if not all participating jurisdictions in the CC HMPU related to Plan Integration are provided under the following categories corresponding to the primary elements, plans, and documents including:

- Hazard Assessments
- Floodplain Damage Prevention Ordinances
- Emergency Operations Plans
- Master Plans and Reexamination Reports
- Other Plans and Documents

Hazard Assessments

In reviewing information about assets, hazard identification, vulnerability, risk, and impact assessments, it is apparent that there are redundant yet inconsistent references to similar and overlapping information. Some inconsistencies are the result of differences in mapping and information due to time intervals between studies or plans while other inconsistencies are due to incomplete data in one or both documents being compared. It is difficult to maintain data on hazards for one purpose let alone for multiple, often disparate uses.

It is recommended as part of the implementation of the CC HMPU that the County and municipalities work to reduce redundant and inconsistent resource, vulnerability, and risk assessments for community plans and programs including (but not limited to) hazard mitigation plans (HMPs), emergency operations plans (EOPs), long-term recovery plans, master plans and reexamination reports, flood management plans and ordinances, stormwater master plans and ordinances, transportation plans, and environmental resource inventories. This recommendation has three components:

- Expand the CC HMPU HIRA to include manmade and technological hazards and identify potential impacts and consequences related to emergency operations, recovery planning, land use planning, etc.
- Maintain the resulting hazard vulnerability, impact, and risk assessment on an annual basis coordinated with updated information available from county, state, and federal sources
- Cross reference the hazard vulnerability, impact, and risk assessment into all documents during periodic updates to HMPs, EOPs, master plan reexamination reports, etc.

Flood Damage Prevention Ordinances

During development of the NJ4 HMP in 2014 and 2015, FEMA updated Flood Insurance Rate Maps (FIRMs) for the coastal regions of the four counties. The updated FIRMs were provided to all National Flood Insurance Program (NFIP) communities to adopt as the effective FIRMs during 2016. This provided an excellent opportunity for NFIP communities to examine their existing Flood Damage Prevention Ordinance (FDPO) and update with appropriate templates per New Jersey Department of Environmental Protection (NJDEP) model ordinances[25].

In addition, the following is recommended for consideration for further updates and enhancements of the FDPOs:

- Update FMOs with.
- In coastal communities, consider including or increasing freeboard provisions in existing or updated FMOs consistent with results in CC HMPU HIRA re: “Coastal Erosion and Sea Level Rise” for increased inundation above the Base Flood Elevation (BFE) and “Flood” for storm surge. For new or reconstructed buildings and infrastructure in the coastal communities, the anticipated increase in flood elevations during the projected life span of built assets should be accounted for to reduce or prevent increased future risk.
- Consider having community Floodplain Administrator qualifications include current Certified Floodplain Manager (CFM) status. There are a number of courses offered on a frequent basis in New Jersey for this certification process and attaining and maintaining CFM status is not an onerous process. Having someone in the community who is well versed in the requirements of the NFIP as well as current practices regarding flood insurance and mitigation would be of benefit to many of the communities in the region.
- Consider enrollment in the NFIP Community Rating System (CRS). As flood insurance premiums increase as a result of recent legislation, more property owners will be looking for ways to reduce their premiums. Flood insurance is no substitute for mitigation measures such as elevation or flood proofing but keeping rates as affordable as possible will contribute to community stability and sustainability. The CRS program provides for a range of discounted rates for flood insurance policies within participating jurisdictions that meet planning and floodplain management goals.

Emergency Operations Plans

EOPs help communities organize resources and capabilities for emergency response and recovery activities before, during, and after a disaster strikes. Both EOPs and HMPs are intended to reduce the impacts of disaster events. However, HMPs differ primarily in focusing on pre-disaster preventative measures.

EOPs and HMPs also differ in terms of the types of hazards addressed. While both plans typically address a full range of natural disasters, HMPs do not generally cover man-made or accidental occurrences where there are no cost-effective applicable mitigation strategies. For example, EOPs in urban areas usually include provisions to respond to aircraft incidents but HMPs rarely attempt to identify mitigation measures for such occurrences.

Areas of common interest can be identified and provisions integrated in both documents to support the goals and strategies in the other. A relevant example in Cumberland County is evacuation planning. For both natural and technological hazards, evacuation planning is an integral part of EOPs. Part of the EOP planning process should highlight limitations in the evacuation transportation systems which could hinder or delay efficient evacuation in an emergency. Limitations can include portions of roads or bridges that are flood prone. Any such limitations should be integrated into the communities HMP as a high priority and there are good examples of measures of this type in the CC HMPU.

[25] http://www.nj.gov/dep/floodcontrol/modelord.htm

The following are recommendations that should be considered as part of future EOP updates and/or as part of update and maintenance of the CC HMPU HIRA:

- Review the following questions and identify any potential mitigation measures that have not already been integrated into the HMP:
  - Does the EOP contain current information (e.g., shelter use, back-up emergency power generator capability, etc.) about critical facilities that house vulnerable populations or critical functions?
  - Does the EOP contain information on maintaining or reducing evacuation times?
  - Does the EOP show which major evacuation routes are prone to inundation from tidal or riverine flooding?
  - Do the post-disaster recovery components of the EOP (often included as part of Emergency Support Function 14) include policies or provisions to ensure that any reconstruction or new construction following a disaster event consider mitigation measures to reduce the risk of repetitive losses (including Public Assistance Section 406 mitigation measures)?
- Cross reference list of natural hazards included in the CC HMPU Appendices and augment with list of manmade hazards relevant for the community
- Cross reference results of risk assessment included in the CC HMPU Appendices and augment with impacts and consequences relative to response and recovery
- Cross reference list of Critical Facilities and the results of the Critical Facility Hazard Exposure Assessment from the CC HMPU Appendices as part of the Hazard, Vulnerability and Risk Assessments in the EOP
- Augment information in Critical Facilities list to include relevant response and recovery information (such as floor plans and evacuation plans for schools and public buildings, lists of hazardous materials maintained on site, etc.)

Master Plans and Reexamination Reports

The New Jersey Municipal Land Use Law requires municipalities to adopt reasonable rules and regulations regarding land use and development in their communities. The resulting Master Plans must be revisited on a ten-year time frame to identify any changes in land use, policy, or programs as part of Reexamination Reports.

The following is recommended for consideration as part of periodic updates and reexaminations:

- Incorporate CC HMPU Appendices as elements in Master Plans and Reexamination Reports
- Cross reference CC HMPU HIRA results as part of development suitability requirements

More specifically, recent changes to the New Jersey Municipal Land Use Law (MLUL), enacted in 2021, call for the following requirements in the land use plan element of the municipal Master Plan:

"…any land use plan element adopted after the effective date of P.L. 2021, c.6 (C. 40:55D-28), a climate change-related hazard vulnerability assessment which shall:

(i) Analyze current and future threats to, and vulnerabilities of, the municipality associated with climate change-related natural hazards, including, but not limited to increased temperatures, drought, flooding, hurricanes, and sea-level rise;

(ii) Include a build-out analysis of future residential, commercial, industrial, and other development in the municipality, and an assessment of the threats and vulnerabilities identified in subsubparagraph (i) of this subparagraph related to that development;

(iii) Identify critical facilities, utilities, roadways, and other infrastructure that is necessary for evacuation purposes and for sustaining quality of life during a natural disaster, to be maintained at all times in an operational state;

(iv) Analyze the potential impact of natural hazards on relevant components and elements of the master plan;

(v) Provide strategies and design standards that may be implemented to reduce or avoid risks associated with natural hazards;

(vi) Include a specific policy statement on the consistency, coordination and integration of the climate change-related hazard vulnerability assessment with any existing or proposed hazard mitigation plan, floodplain management plan, comprehensive emergency management plan, emergency response plan, post-disaster recovery plan, or capital improvement plan; and

(vii) Rely on the most recent hazard projections and best available science provided by the New Jersey Department of Environmental Protection."

Other Plans and Documents

One key recommendation that would help many communities move forward with mitigation is to initiate and incorporate a hazard mitigation "Trust Fund" as part of CIP process to set aside dollars on a continuing basis to build funding for municipal mitigation measures and to cover future non-federal match