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**Multi-Jurisdictional  
All Hazard Mitigation Plan  
2016 Update  
Sussex County, Delaware**



Prepared for:  
**Sussex County Emergency Operations Center**

Prepared by:



**September 2016**

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# SECTION 1: INTRODUCTION

## Overview

The purpose of the Sussex County Multi-Jurisdictional All Hazard Mitigation Plan Update (hereinafter referred to as the “Plan”) is to continue providing guidance for hazard mitigation in Sussex County. It identifies hazard mitigation goals, objectives and recommended actions and initiatives for County and municipal governments to reduce injury and damage from natural hazards.

This Plan meets the requirements for a local hazard mitigation plan under Final Rule, 44 CFR 201.6, published by the Federal Emergency Management Agency (FEMA) in September 2009.

This Plan update continues to keep Sussex County qualified to obtain all disaster assistance to include all categories of Public Assistance, Individual Assistance and Hazard Mitigation grants available through the Robert T. Stafford Disaster Relief and Emergency Assistance Act, P.L. 93-288, as amended. Future enhancements of the State All Hazard Mitigation Plan will allow the State to obtain greater funding for hazard mitigation planning and projects (20 percent of Federal Stafford Act disaster expenditures versus 7.5 percent for a standard state plan). It also keeps the state eligible for the annually funded Pre-Disaster Mitigation Program, and the Flood Mitigation Assistance Program.

*Without this plan, all eligible local jurisdictions would be ineligible to receive a variety of disaster recovery programs, including the Public Assistance Program to repair or replace damaged public facilities, and the Fire Management Assistance Program to help the State and communities recover the costs of major disasters. However, the State and local communities would remain eligible for certain emergency assistance and Human Services programs available through the Stafford Act.*

## Organization of the Plan

The Plan is organized to parallel the structure provided in the Final Rule, 44 CFR 201.4. The Plan has seven sections, appendices and the municipal mitigation assessment annexes.

- Section 1: Introduction
- Section 2: Planning Process
- Section 3: Hazard Identification
- Section 4: Risk Assessment
- Section 5: Capabilities and Resources
- Section 6: Mitigation Strategy
- Section 7: Plan Monitoring and Maintenance
- Appendix A: Municipal Mitigation Assessment Annexes
- Appendix B: Supporting Documentation
- Appendix C: Desired Plan Data

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- Appendix D: Adoption Resolutions for Sussex County and the Participating Municipalities
- Appendix E: Formal Approval Letters for Sussex County and the participating municipalities.

There are references to the CFR throughout the Plan. Where possible, these provide specific section and subsection notations to aid the review process.

### **Hazards and Risks**

The hazard identification, analysis, and vulnerability assessment, completed as part of the Plan Update, identified twelve (12) natural and three (3) human-caused hazards that have the greatest potential to adversely affect the people, environment, economy and property of Sussex County. Hazards that were considered include: Flood, Tropical Storm Winds, Severe Thunderstorm Wind, Tornado, Drought, Hail, Winter Storms, Earthquakes, Dam/Levee Failure, Terrorism, Energy Pipeline Failure, and Hazardous Material Release. Below are brief sketches of these hazards and the risks they pose to the County.

**Flood (Riverine and Coastal)** – Sussex County is at risk and vulnerable to flooding, validated by structures in the floodplain, number of flood insurance policies in effect and flood insurance claims paid. Flooding has resulted in six injuries and more than \$46.5 million in property damage. Of the 64 events recorded by the National Climatic Data Center, several events were considered notable based on such criteria as magnitude, number of deaths and amount of property damage.

The total potential annualized loss in Sussex County is \$129,520,000 with the greatest portion of that exposure being in the Atlantic Coast communities as well as areas adjacent to the Indian River. In a 100-year flood event, as many as 1,561 facilities could sustain slight damage and 72 facilities could sustain moderate damage.

**Severe Thunderstorm Wind** – All buildings and facilities are exposed to thunderstorms and could potentially be impacted. It is not possible to estimate the number of residential, commercial, and other buildings or facilities that may experience losses.

**Tropical Storm Wind** – Vulnerability models calculate that the potential annualized loss from tropical storm winds is \$1,926,244. That amount is thought to be considerably understated. 396 critical facilities would sustain light wind damage, while 995 would sustain moderate damage from winds.

**Drought** – Although Sussex County as a whole is vulnerable to drought, it causes little damage to the built-up environment, predominantly affecting crops and farmland. The potential annualized losses from drought are \$14,659,834.

**Winter Storms** – Winter storms could potentially impact the entire County; therefore, estimated annualized losses cannot be broken down into distinct categories (residential, commercial, etc.). Potential annualized losses from winter storms are \$340,625.

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**Tornado** – It cannot be predicted where a tornado may touch down. All buildings and facilities are exposed to this hazard and could potentially be impacted. The potential annualized losses from tornadoes are negligible.

**Hail** - All buildings and facilities are exposed to hail and could potentially be impacted, so estimated annualized losses cannot be broken down into distinct categories (residential, commercial, etc.). The potential annualized losses from hail are negligible.

**Earthquake** – The coastal plain of the Mid-Atlantic is known to be a seismically quiet zone. The Peak Ground Acceleration for a 100-year event is greater than .0060. Potential annualized losses from an earthquake are \$190,778. Of the 1,280 potentially affected critical facilities County-wide, they all would sustain less than 1% damage.

**Dam/Levee Failure** – The approach for determining vulnerability to dam and/or levee failure consists of a number of factors. Data from the US Army Corp of Engineers (USACE) National Inventory of Dams (NID) and the HAZUS-MH demographic inventory was used, with an assumption that dam breaks most likely will occur at the time of maximum capacity. The estimated exposure of people to dam failure in Sussex County is 5,816.

**Terrorism** – A vulnerability assessment was conducted for Weapons of Mass Destruction (WMDs) in order to expand the scope of the hazard mitigation planning process to include vulnerability to acts of terrorism. Due to the sensitivity of the data and conclusions, more in-depth discussion is available in the complete risk assessment maintained at DEMA.

**Hazardous Materials** – Assessing vulnerability to a hazardous material (HazMat) release on a Countywide scale consisted of the type(s) of hazardous material(s) present, the potential for mass casualties, and potential consequences for the surrounding area. The assessment documented information for 13 identified hazardous material sites from the State's exposure data. High consequence events were then selected (high material toxicity and population density), and ALOHA was used for calculating the impact area.

**Energy Pipeline Failure** – Energy pipelines cross the State of Delaware. If any of these energy pipelines, oil or gas, were to rupture, such an event could endanger property and lives in the immediate area (within less than half a mile radius).

## Goals and Objectives

The Hazard Mitigation Steering Committee supported the update of the goals, objectives, and mitigation actions. The mitigation actions address or solve local mitigation issues and problems. The Sussex County Hazard Mitigation Steering Committee developed the following mission statement for the Sussex County All Hazard Mitigation Plan and the following goals for hazard mitigation.

**Mission Statement:** Continue to develop and update a comprehensive pre- and post-disaster hazard mitigation program guided by the adoption of stormwater management practices, the implementation of codes and regulations, the protection of critical facilities and infrastructure, the adoption of education and outreach efforts, pre-event planning and preparedness and the identification of projects designed to reduce the vulnerability of

## Introduction

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individuals, families, households, businesses, infrastructure and critical facilities to the negative effects of natural hazards.

**Goal #1** Sussex County and participating municipalities will continue to adopt enhanced stormwater management practices.

**Goal #2** Sussex County and participating municipalities will continue to adopt and enforce codes and regulations designed to reduce the impact of natural hazards.

**Goal #3** Sussex County and participating municipalities will continue to retrofit and protect critical facilities and infrastructure from natural and human-caused hazards.

**Goal #4** Sussex County and participating municipalities will continue to enhance education and outreach strategies to improve the dissemination of information to the public regarding hazards, including the steps that can be taken to reduce their impact.

**Goal #5** Sussex County and participating municipalities will continue to improve pre-event planning and preparedness activities.

**Goal #6** Sussex County and participating municipalities will continue to identify and implement sound hazard mitigation projects.

Work continues with local agencies and departments to develop projected timelines and potential funding sources for the actions identified in the mitigation strategy. Specific mitigation actions are contained in Section 6 and the Municipal Mitigation Assessment Annexes of the Plan.

### *Planning Process*

This Plan update is the product of the efforts consisting of a cross section of people from the County, municipalities and other interested parties. This effort builds on a number of mitigation planning initiatives dating back to 2004.

Staff from the Sussex County Emergency Operations Center led the development effort of the Sussex County All Hazard Mitigation Plan Update. The Director of the Emergency Operations Center directed the planning effort.

The Sussex County Hazard Mitigation Steering Committee, assembled by the Sussex County Emergency Operations Center and DEMA Natural Hazards Section, provided guidance and assisted with development of the All Hazard Mitigation Plan Update, including review of previous hazard mitigation planning initiatives, development of mitigation strategies, and the strategy implementation plan. The members of the Steering Committee and the Hazard Mitigation Working Group (HMWG) provided expertise and perspective to all aspects of the planning process, including, land-use planning, building codes, transportation, and infrastructure. Representation included members from the local government, law enforcement, fire service, Licensing & Inspections, emergency management community, state agencies, Public Works, emergency medical professionals, building officials, and private industry.

## Introduction

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Once the Plan update is promulgated by the Sussex County Council, and approved by FEMA, the Committee will function as an advisor to the State Hazard Mitigation Officer on hazard mitigation efforts, including future reviews and revisions.

Participation by local agencies was critical in the development of the Plan. Twenty-four stakeholders (listed below) participated by identifying potential vulnerable facilities along with agency-specific goals to address their vulnerabilities through mitigation actions and initiatives. The participating communities include:

- Bethany Beach, Town of
- Bethel, Town of
- Blades, Town of
- Bridgeville, Town of
- Dagsboro, Town of
- Delmar, Town of
- Dewey Beach, Town of
- Ellendale, Town of
- Fenwick Island, Town of
- Frankford, Town of
- Georgetown, Town of
- Greenwood, Town of
- Henlopen Acres, Town of
- Laurel, Town of
- Lewes, City of
- Millsboro Town of
- Millville, Town of
- Milton, Town of
- Ocean View, Town of
- Rehoboth Beach, City of
- Seaford, City of
- Selbyville, Town of
- Slaughter Beach, Town of
- South Bethany, Town of

## Adoption and Approval

### Interim Final Rule Requirement for Adoption and Approval

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**Requirement §201.6(c)(5):** [The local hazard mitigation plan shall include] documentation the plan has been formally adopted by the governing body of the jurisdiction requesting approval (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.

**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. Statewide plans will not be accepted as multi-jurisdictional plans.

### Adoption and Approval Procedure

**[Note to Reviewers:** The highlighted dates in Section 1.6.2 will be filled in after these events take place]

On [Insert DATE], the Federal Emergency Management Agency (FEMA) Region III determined that the Plan was “approvable pending adoption.” On [Insert DATE], the Sussex County Hazard Mitigation Working Group met and recommended that Sussex County and the participating municipalities should adopt the Plan. The Plan was submitted to the Sussex County Council as well as the appropriate entity for each participating municipality for review and adoption. The resulting Adoption Resolutions were then submitted to FEMA Region III for approval. FEMA

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## Introduction

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subsequently issued formal approval letters to Delaware Emergency Management Agency (DEMA) for Sussex County and each participating municipality that adopted the Plan. DEMA, in turn issued approval letters to the approved jurisdictions.

### Participating Municipalities

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Sussex County and the following 24 municipalities and institutions participated in the Plan update by taking an active part in the planning process, identifying mitigation actions, and [will adopt] the Plan:

- Town of Bethany Beach
- Town of Bethel
- Town of Blades
- Town of Bridgeville
- Town of Dagsboro
- Town of Delmar
- Dewey Beach
- Town of Ellendale
- Town of Fenwick Island
- Town of Frankford
- Town of Georgetown
- Town of Greenwood
- Town of Henlopen Acres
- Town of Laurel
- City of Lewes
- Town of Millsboro
- Town of Millville
- Town of Milton
- Town of Ocean View
- City of Rehoboth Beach
- City of Seaford
- Town of Selbyville
- Town of Slaughter Beach
- Town of South Bethany

To determine if municipal participation in the planning process was adequate for the purposes of this Plan and the FEMA plan review process, the following were established as minimum criteria:

1. Attendance by a representative of each municipality at two (2) meetings where the development of the Plan was discussed;
2. Completion of portions of the capability assessment survey regarding the identify and participation of floodplain administrators, and the current status and update intervals for master plans, zoning plans and capital improvement plans;
3. Identification and documentation of at least two (2) mitigation actions for identified hazards; and
4. Adoption of the Plan after designation of the Plan as “approvable pending adoption” is received from DEMA and FEMA.

### Adoption Resolutions

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**Appendix D** contains the signed Adoption Resolutions for Sussex County and the participating municipalities.

### Approval Letters

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**Appendix E** contains the formal Approval Letters for Sussex County and the participating municipalities.

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4. Adoption of the Plan after designation of the Plan as “approvable pending adoption” is received from DEMA and FEMA.

### **Adoption Resolutions**

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**Appendix D** contains the signed Adoption Resolutions for Sussex County and the participating municipalities.

### **Approval Letters**

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**Appendix E** contains the formal Approval Letters for Sussex County and the participating municipalities.

# SECTION 2: THE PLANNING PROCESS

## Contents of this Section

- Requirement for the Planning Process
- Description of the Planning Process
- Involvement by the Public and Other Interested Parties
- Review and Incorporation of Plans, Studies, Reports, and Other Information

## Requirement 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(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.

## The Planning Process

This section describes the planning process undertaken by Sussex County and The Olson Group Planning Team in preparation of the Plan Update.

The Plan update was prepared in accordance with the process established in the State and Local Mitigation Plan Development Guides produced by the Federal Emergency Management Agency (FEMA), and the requirements of the September 16, 2009 Final Rule (FR). The process includes four basic steps.

- Organize resources,
- Assess risks,
- Develop a mitigation plan, and
- Implement the plan and monitor progress.

### Organize Resources

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The Sussex County Office of Emergency Management was the lead agency for the development of the Plan update. At the beginning of the process, a consultant firm, The Olson

## Planning Process

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Group Ltd, was hired to provide technical support to the County and all of the member municipalities. In addition, several individuals and organizations worked together to develop the Plan update. These participants were organized into two different committees including:

- Sussex County Hazard Mitigation Steering Committee (HMSC)
- Sussex County Hazard Mitigation Working Group

The Sussex County Hazard Mitigation Steering Committee was comprised principally of the Sussex County Emergency Operations Center Director, Sussex County Department representation, Sussex County’s Local Emergency Planning Committee (LEPC) members and Delaware Emergency Management Agency (DEMA) representatives. This committee was formed to provide focus and leadership on behalf of the participating jurisdictions in the development of these Plan updates. The Hazard Mitigation Steering Committee met regularly during the duration of the planning process to receive progress reports from the consultant, review and comment upon draft documents and procedures, and implement relevant tasking and coordinate efforts within the County and participating jurisdictions.

**Table 2-1** identifies the primary membership of the Hazard Mitigation Steering Committee.

**Table 2-1: Hazard Mitigation Steering Committee**

Name & Title	Organization
Joe Thomas, Director	Sussex County Emergency Operations Center
Charles Stevenson, Assistant Director	Sussex County Emergency Operations Center
Jeff Shockley, Sussex County Floodplain Manager	Sussex County Government
Megan Nehrbas, GIS Specialist	Sussex County GIS
Art Paul, State Mitigation Planner	Delaware Emergency Management Agency (DEMA)
Adam Montella, Project Manager	The Olson Group, Ltd. (OGL)
Anthony Mangeri, Planning Lead	The Olson Group, Ltd. (OGL)
Hana Beckerle, Planner	The Olson Group, Ltd. (OGL)
Pete Dennen, Senior Planner	The Olson Group, Ltd. (OGL)

The general workflow for the project consisted of the following steps:

- The Olson Group developed preliminary update versions of documents and plan sections for review by the HMSC. The documents were presented in approximately the same sequence as the information is presented in the Plan.
- HMSC representatives reviewed and directed OGL to make revisions in the documents and plan sections.
- HMSC representatives were also responsible for reviewing work-in-progress with participating municipalities and including any revisions per municipal input in directions to OGL.
- OGL worked directly with municipalities in one-on-one sessions to identify and document mitigation actions included in Section 6.
- OGL provided a Committee Draft Plan to all participants via the HMSC for review and comment.
- HMSC representatives directed OGL to make any revisions in their respective County plans prior to submittal to DEMA and FEMA for review.

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## Planning Process

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The Sussex County representative on the HMSC was the County EOC Director and provided guidance to the participating Sussex County municipalities via the Sussex County HMWG. The HMWG included all municipal OEM coordinators and related agencies within the County. The OGL planning team members attended the HMWG meetings. The planning team typically presented work-in-progress updates similar to presentations provided to the HMSC.

Guidance provided to the HMWG by the County EOC Director at the meetings and via e-mail correspondence included the following:

- **Data Collection** – A “wish list” of desired information was provided by The Olson Group and relayed to the participating municipalities via the local OEM coordinators. A copy of the “wish list” is included in Appendix C.
- **Critical Infrastructure Inventory** – The Olson Group provided the HMWG with spreadsheets with default data listings per HAZUS-MH. The HMWG members reviewed the information and provided revisions that were then compiled for use in developing mitigation actions. The Olson Group also provided, via the County EOC Director, directions for capturing more detailed information regarding critical infrastructure for use in this Plan update and future planning efforts.
- **Municipal Stakeholder Engagement** – HMSC identified the types of stakeholders to enlist in the planning effort including other municipal departments, schools, hospitals, etc. The HMWG members were then responsible for following up with potential stakeholders. In some cases, stakeholders participated with the local coordinators in the one-on-one meetings used to identify and document mitigation actions.

The HMWG was responsible for representing their community, serving as the point of contact between their community and the HMSC, and completing necessary planning tasks including:

- **Data Collection** - As described above, the participating municipalities were asked via the “wish list” to provide updates to background information and existing plans.
- **Identification of Local Mitigation Actions** – OGL conducted one-on-one municipal working sessions with local coordinators and in some cases, other municipal stakeholders to identify and document specific updates to mitigation actions.
- **Reviewing the Plan Products of the HMSC** – As noted above, presentations were made on a regular basis to the HMSC by the EOC Director and/or OGL to review work-in-progress and secure their agreement with the recommendations made by OGL and the directions provided by the EOC Director. In most cases, agreement was reached without dissent. In a few cases, HMWG members requested additional information. In addition, HMWG members were responsible for reviewing their individual municipality’s mitigation actions.

**Table 2-2** The information on the following page identifies the membership of the Sussex County HMWG.

## Planning Process

**Table 2-2: Sussex County Hazard Mitigation Working Group (HMWG) Members**

Name, Title	Organization
Joe Thomas, Director	Sussex County Emergency Operations Center
Charles Stevenson	Sussex County OEM
Jeff Shockley	Sussex County CFM
Darin Cathell	Town of Bethany Beach
	Town of Bethel
Vicki Prettyman	Town of Blades
Jesse Savage	Town of Bridgeville
	Town of Dagsboro
Sara Bynum-King	Town of Delmar
	Dewey Beach
	Town of Ellendale
Patricia J. Schuchman	Town of Fenwick Island
Joanne Bacon	Town of Frankford
Gene Dvornick	Town of Georgetown
John F. McDonnell	Town of Greenwood
Thomas Roth	Town of Henlopen Acres
Jamie Smith	Town of Laurel
Paul Eckrich	City of Lewes
Sheldon P. Hudson	Town of Millsboro
Eric Evans	Town of Millville
Kristy Rodgers	Town of Milton
Charles F. McMullen	Town of Ocean View
Keith W. Banks	City of Rehoboth Beach
Charles Anderson	City of Seaford
W. Scott Collins	Town of Selbyville
Robert Wood	Town of Slaughter Beach
Melvin A. Cusick	Town of South Bethany

**Table 2-3.** Identifies the meetings conducted during the update of the Plan. The meetings focused primarily on the review of work-in-progress for the development of the Plan Update.

**Table 2-3: Plan Update Meetings**

Date	Meeting	Attendees
November 30, 2015	Project Kick-off Meeting	Sussex EOC, Olson Group
January 8, 2016	Steering Committee Coordination	Sussex EOC, Olson Group
January 20, 2016	HMSC Kick-off Meeting	Sussex EOC, HMSC, Olson Group
January 20, 2016	HMWG Kick-off Meeting	Sussex EOC, HMWG, Olson Group
March 24, 2016	HMSC Meeting	Sussex EOC, HMSC, Olson Group

## Planning Process

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Date	Meeting	Attendees
March 24, 2016	HMWG Meeting	Sussex EOC, HMWG, Olson Group
August 8, 2016	County Council Presentation	County Council, Sussex EOC, Olson Group
August 9 /10, 2016	One-on-one municipal working sessions.	HMWG, Olson Group
September 1, 2016	Public Meeting with Mallard Lake Community	Sussex EOC, HMSC, HMWG, Olson Group
September 1, 2016	Steering Committee Coordination and Public Meeting	Sussex EOC, HMSC, Olson Group

**Appendix C.1** contains documentation for these meetings including agendas, sign-up sheets, presentation materials, and meeting notes where appropriate.

### Assess Risks

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In accordance with general mitigation planning practice, as well as the established FEMA process, risk assessment forms the basis for this Plan update by quantifying and verifying information about how natural and man-made hazards affect Sussex County and the participating municipalities.

The processes used to complete the hazard identification and risk assessments and the results of these activities are described in Sections 3 and 4 of this Plan update. The assessment determined several aspects of the risks of hazards faced by the County and the participating municipalities:

- Natural hazards that are most likely to affect Sussex County;
- How often hazards are expected to impact Sussex County;
- Expected severity of the hazards;
- Areas of Sussex County that are likely to be affected by hazards;
- How Sussex County’s assets, operations, people, and infrastructure may be impacted by hazards;
- How private and commercial assets, operations, and infrastructure may be impacted by hazards; and
- Expected future losses if the risk is not mitigated.

The HMSC first identified all hazards with the potential to impact the County during the initial plan development. Next, using a rating system (explained in detail in Section 3), the HMSC reviewed and validated the updated list of hazards. The results of this update process were discussed and validated by the HMWG. These hazards are described in the Hazard Identification, Profiling, and Prioritization portion of the Plan (*Section 3*).

As a result of in-depth examination of the characteristics of the list of hazards, the HMSC was able to make qualitative determinations that allowed further refinement of the focus of this Plan update to the most predominant risks to the area. The results of this prioritization process were also discussed and validated by the HMWG.

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## Planning Process

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For each of these hazards, the consultants performed detailed risk assessments, i.e. calculations of future expected damages, expressed in dollars where appropriate. The results of the risk assessment were also made available to the public during public presentations. The full process and results of this work is presented in the Risk Assessment portion of this Plan Update (*Section 4*).

### Develop the Mitigation Plan Update

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The HMSC developed a series of goals and objectives in response to the results of the original risk assessment. A capability assessment review and update was also conducted to help determine the capacity of the County and the participating municipalities to implement hazard mitigation projects. In addition, the HMSC and the consultant worked with the participating municipalities on an individual basis to identify potential problems and hazard mitigation project solutions to include in the Mitigation Strategy Plan Update. The Mitigation Strategy Plan was discussed and validated by the HMWG. The results of these efforts are detailed in Sections 5 and 6.

### Implement the Plan and Monitor Progress

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Finally, the HMSC validated a process for on-going monitoring and revisions to the Plan over the next five years. **Section 7** details the resulting monitoring, evaluation, and plan update procedures. This step was also reviewed and validated by the HMWG.

## Public Involvement and Other Interested Parties

During the development of this Plan Update, public participation was actively solicited. The HMWG hosted public presentations/meetings, provided drafts of the Plan Update for review, and invited comments on the contents of the Plan. For each meeting, the public and interested parties were notified of the meetings via public notice in area newspapers, notice on the Hazard Mitigation Plan Update website, and emails to interested groups. These public outreach efforts are detailed in **Table 2-4**. In addition, attendance lists, presentation materials, and meeting notes are compiled in **Appendix C.2**.

Response to this outreach was less than hoped for, as the attendance lists document; however, future outreach by Sussex County and municipal coordinators, including proposed public education and work with stakeholders and other interested parties over the next five years will improve public involvement for the next Plan update.

## Planning Process

**Table 2-4: Public Involvement**

Date	Type of Involvement	Meeting Location
	Website with hazard mitigation and plan development information poster	N/A
	Public meeting with presentation and open discussion	
	Public meeting with presentation and open discussion	
	Draft Plan posted on County website and hard copy distributed to each municipality	N/A

As part of the development of the Plan update and to the extent possible, Floodplain Administrators were engaged in Plan development and review in many municipalities. In some cases, the Municipal Coordinator who led work on this Plan update was also the Floodplain Administrator for the community. Involvement of Floodplain Administrators' in the process is shown in **Table 2-5**. Proposed efforts to increase outreach to Floodplain Administrators will result in enhanced participation in the next Plan update.

**Table 2-5: Sussex County Floodplain Administrator Involvement**

Municipality	Floodplain Administrator Name	Method of Involvement
Town of Bethany Beach	Susan Frederick	Municipal Point of Contact
Town of Bethel		
Town of Blades	Vikki Prettyman	Municipal Point of Contact
Town of Bridgeville	Jerry Butler	Municipal Point of Contact
Town of Dagsboro		
Town of Delmar	William Hardin	Municipal Point of Contact
Dewey Beach		
Town of Ellendale		
Town of Fenwick Island	Patricia J Schuchman	Municipal Point of Contact
Town of Frankford	Cheryn Lynch	Municipal Point of Contact
Town of Georgetown	Jeff Ward	Municipal Point of Contact
Town of Greenwood	John F McDonnell	Municipal Point of Contact
Town of Henlopen Acres	Richard Kollar	Municipal Point of Contact
Town of Laurel	Ken West	Municipal Point of Contact
City of Lewes	Henry Baynum Jr	Municipal Point of Contact
Town of Millsboro	George K Niblett	Municipal Point of Contact
Town of Millville	Don Williams	Municipal Point of Contact
Town of Milton	John Collier	Municipal Point of Contact
Town of Ocean View	Charles F McMullen	Municipal Point of Contact
City of Rehoboth Beach	Damalier Molina	Municipal Point of Contact

## Planning Process

Municipality	Floodplain Administrator Name	Method of Involvement
City of Seaford	Joshua Littleton	Municipal Point of Contact
Town of Selbyville	Mike Deal	Municipal Point of Contact
Town of Slaughter Beach	Robert Clendaniel	Municipal Point of Contact
Town of South Bethany	Joe Hinks	Municipal Point of Contact

Prior to adoption by the County and the participating municipalities, notice was sent to adjacent jurisdictions and other interested parties that the Draft and Final Plan Updates were available for review. Minutes of meetings (and attendee lists) and copies of relevant correspondence are included in **Appendix C.2 and C.3**.

### Review and Incorporation With Other Plans

#### Federal Government

Selected key Federal sources of information and pre-existing planning work are presented in **Table 2-6**.

**Table 2-6: Federal Documents and Data Utilized**

Existing Program, Policy, and Technical Documents	Method of incorporation into the Plan
FEMA Disaster Declarations database and other general hazard data	Used in hazard identification and risk assessment (HIRA) development and history of loss data for multiple hazards
FEMA/National Flood Insurance Program Flood Maps (Flood Insurance Rate Maps, Digital Flood Insurance Rate Maps (DFIRM))	Preliminary DFIRM data were used in developing HIRA, strategies and mitigation actions
FEMA Community Status Book, Community Rating System Eligible Communities	Used in developing capability assessments and mitigation actions
FEMA Tornado Activity in the United States	Used in developing HIRA and history of loss data
FEMA Severe Repetitive Loss data	Used in developing HIRA, strategies, and mitigation actions
FEMA Repetitive Loss data	Used in developing HIRA, strategies, and mitigation actions
National Oceanic and Atmospheric Administration (NOAA)/National Climatic Data Center database	Used in developing history and description of major hazard events for multiple hazards
NOAA Coastal Service Center-Historic Hurricane Tracks Database	Used in developing HIRA, strategies, and mitigation actions
NOAA National Severe Storms Laboratory database	Used in developing HIRA, strategies, and mitigation actions
NOAA Crop Loss database	Used in developing HIRA and history of loss data
The United States Army Corp of Engineers (Risk estimates)	Used in developing HIRA, strategies, and mitigation actions
US Census Bureau data	Used in developing various risk assessments and establishing planning context

## Planning Process

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Existing Program, Policy, and Technical Documents	Method of incorporation into the Plan
US Geological Survey (USGS) National Hazard Seismic Mapping Project	Used in developing HIRA and history of loss data
USGS Large Floods in the United States database	Used in developing HIRA and history of loss data
US Environmental Protection Agency Toxic Release Inventory	Used in developing hazard identification, strategies, and mitigation actions
US Department of Transportation Hazardous Materials Incident Data	Used in developing hazard identification, strategies, and mitigation actions

### State of Delaware

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Selected state sources of information and pre-existing planning work are presented in this section.

#### Delaware Hazard Mitigation Plan

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Delaware completed the current 2014 State Hazard Mitigation Plan Update to meet the requirements of FR Section 201.4(d), which mandates that States update their mitigation plans every three years, “to reflect changes in development, progress in statewide mitigation efforts, and changes in priorities.”

The State Hazard Mitigation Plan Update is a demonstration of Delaware’s commitment to reduce risks from natural hazards and serves as a guide for both state and local decision makers as they commit resources to reducing the effects of natural hazards on lives and property. It is designed to outline a strategy to reduce risks from natural hazards in Delaware, and to aid State and local emergency management officials in developing hazard reduction programs.

It is DEMA's intent to use the State Hazard Mitigation Plan Update as a way to provide data to local and regional governments to support their mitigation planning processes, and to provide guidance on best practices.

The statewide mitigation strategies, goals, and objectives, methods of incorporating a varied cross section of relevant disciplines, hazard specific information, and specific data sources are present within the State Hazard Mitigation Plan Update and were utilized in the development of the Sussex County All-Hazards Hazard Mitigation Plan.

#### Sussex County

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Delaware is a *home rule* State, which means that the authority to create laws and control land use resides within the municipal governments, and not with County governmental entities. Counties throughout Delaware are expected to act in the best interest of, and for the protection of the citizens residing within the confines of their County. State statutes do give limited authorities to the counties, but the more significant authorities rest with the individual municipalities.

## Planning Process

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### Municipalities

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Upon initiating the Plan development process, the EOC Director made initial contacts to the HMWG. Concurrent with that effort, all of the local OEM coordinators were made aware of the significance of this plan update effort. A comprehensive “wish list” of documents, data sources, maps, studies, emergency operations plans, land use data, laws, and ordinances was provided to the local OEM coordinators with the request to collect as much of the items as possible.

In some cases, information that may exist at the municipal level was not uniformly provided or available. During the next five years, Sussex County Emergency Operations Center (SCEOC) and the municipal coordinators will be taking steps to locate, review and incorporate all the indicated documents in the next Plan update.

## SECTION 3: HAZARD IDENTIFICATION

### Contents of this Section

- Requirement for Hazard Identification
- Hazard Identification and History
- Hazard Profiles
- Hazard Prioritization

### Requirement for Hazard Identification

**44CFR §201.6(c)(2)(i):** *[The risk assessment shall include a] description of the...location and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.*

**44CFR §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.*

**44CFR §201.6(c)(2)(ii):** *[The risk assessment] **must** also address National Flood Insurance Program (NFIP) insured structures that have been repetitively damaged floods.*

### Hazard Identification and History

Per The Code of Federal Regulations (CFR) requirements, at the outset of the plan update process, the Sussex County Hazard Mitigation Steering Committee and the Sussex County Hazard Mitigation Working Group identified fourteen (14) natural and three (3) technological hazards and their risks as the focus of the Plan update.

These hazards were identified per the experience of the HMSC and the HMWG and in accordance with other references (e.g., County EOP, State EOP, the Delaware State Hazard Mitigation Plan, etc.). The resulting preliminary hazard list is shown in **Table 3-1**.

**Table 3-1: Preliminary Hazard List, Sussex County**

Hazard	Type (1)	Hazard Rank	County EOP	Delaware EOP	Delaware HMP (2)	Profiled in HMP?
Erosion	N	UR	✓	✓		✓
Dam/Levee Failure	T	UR	✓	✓	✓	✓
Drought	N	4	✓	✓	✓	✓
Earthquake/Geological	N	UR	✓	✓	✓	✓

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Hazard	Type (1)	Hazard Rank	County EOP	Delaware EOP	Delaware HMP (2)	Profiled in HMP?
Extreme Heat/Cold	N	5	✓	✓		
Flood	N	1	✓	✓	✓	
Hail	N	8	✓		✓	
Hazardous Materials Incident	T	UR	✓	✓		
Hurricane Wind– (Straight-Line Winds)	N	2	✓	✓	✓	
Pipeline Failure	T	UR	✓	✓		
Terrorism	T	UR	✓	✓		
Thunderstorm– (Flooding/Straight-Line Winds)	N	2	✓	✓	✓	
Tornado– (High Wind)	N	7	✓	✓	✓	
Tsunami	N	9	✓			
Wildfire	N	UR	✓	✓		
Winter Storm (Severe Weather)	N	6	✓	✓	✓	

**Notes:**

UR Un-Ranked; There was insufficient loss data to generate a ranking but are considered a significant risk to the County and municipalities.

(1) Type Legend: N = Natural; T = Technological/Manmade.

(2) Delaware HMP = State of Delaware Hazard Mitigation Plan, approved by FEMA in January 2014.

The following section profiles the 17 hazards listed above and acted upon during the planning process. The overviews include a description of the hazard, location and extent of the hazard, severity of the hazard, documented impacts on life and property, and past occurrences.

## Hazard Profiles

### Flood

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A flood is an excess of water on land that is normally dry. Floods are usually caused by weather events that deliver more precipitation to a drainage basin than can be easily absorbed or stored within the basin. Flooding is a significant natural hazard throughout the United States. Causes include heavy precipitation, snowmelt, ice jams, dam failures, hurricanes, reservoir overflows, and local thunderstorms. Floodwaters can bring down structures, topple trees, destroy infrastructure, sweep people and vehicles away, and alter landscapes. Floods can occur quickly and without warning, such as flash floods or floods caused by dam breaks, or can build slowly, becoming more significant over time. There may be a lag time between precipitation and the time when the flood peaks, which in some situations may allow for warning and evacuating populations.

Flooding is the most frequent and costly natural hazard within the United States. It is a hazard that has caused more than 10,000 deaths nationwide since 1900. Five years since the 2010 Plan update, there have been 541 flood related deaths nationally, with two deaths within Delaware, and none within Sussex County.

General floods are usually long-term events that may last for several days. The primary types of general flooding include riverine, coastal, and urban flooding. Riverine flooding is a function of excessive precipitation levels and water runoff volumes within the watershed of a stream or river. Coastal flooding is typically a result of storm surge, wind-driven waves, and heavy rainfall produced by hurricanes, tropical storms, nor'easters, and other large coastal storms. Urban flooding occurs where man-made development has obstructed the natural flow of water and decreased the ability of natural groundcover to absorb and retain surface water runoff.

Flash flooding events usually occur from a dam or levee failure within minutes or hours of heavy amounts of rainfall, or from a sudden release of water held by an ice jam. Most flash flooding is caused by slow moving thunderstorms in a local area or by heavy rains associated with hurricanes and tropical storms. Although flash flooding occurs often along mountain streams, it is also common in urbanized areas where much of the ground is covered by impervious surfaces. Flash flood waters move at very high speeds where "walls" of water can reach heights of 10 to 20 feet. Flash flood waters and the accompanying debris can uproot trees, roll boulders, destroy buildings, and obliterate bridges and roads.

The periodic flooding of lands adjacent to rivers, streams, and shorelines (land known as the floodplain) is a natural and inevitable occurrence that can be expected to take place based upon established recurrence intervals. The recurrence interval of a flood is defined as the average time interval, in years, expected between a flood event of a particular magnitude and an equal or larger flood. Flood magnitude increases with increasing recurrence interval.

Floodplains are designated by the frequency of the flood that is large enough to cover them. For example, the 10-year floodplain will be covered by the 10-year flood and the 100-year floodplain by the 100-year flood. Flood frequencies such as the 100-year flood are

determined by plotting a graph of the size of all known floods for an area and determining how often floods of a particular size occur. Another way of expressing the flood frequency is the chance of occurrence in a given year, which is the percentage of the probability of flooding each year. For example, the 100-year flood has a 1 percent chance of occurring in any given year.

**Occurrences and Probability of the Flood Hazard**

According to the National Climate Data Center (NCDC) databases, since 2010 there have been two flood events as shown in **Table 3-2**. Due to the continuous and ongoing nature of the flood hazard threat, it was judged by the HMSC and the HMWG to be of significant danger to the community and thus included as an identified hazard. The generated Calculated Priority Risk Index (CPRI) for Flood is shown in **Table 3-3**.

**Table 3-2: Sussex County Flood Event History**

Location	County/Zone	St.	Date	Time	T.Z.	Type	Mag	Dth	Inj	PrD	CrD
<a href="#">SLAUGHTER BEACH</a>	SUSSEX CO.	DE	08/28/2011	05:00	EST-5	Flood		0	0	0.00K	0.00K
<a href="#">FENWICK IS</a>	SUSSEX CO.	DE	10/29/2012	09:00	EST-5	Flood		0	0	0.00K	0.00K
<b>Totals:</b>								0	0	0.00K	0.00K

Source: NOAA - National Oceanic and Atmospheric Administration - NCDC  
<https://www.ncdc.noaa.gov/stormevents/listevents.jsp?eventTypestatefips=10%2CDELAWARE>

**Table 3-3: CPRI for Degree of Risk for Flood in Sussex County**

Probability	+	Magnitude /Severity	+	Warning Time	+	Duration	=	CPRI
4 x .45	+	2 x .30	+	2 x .15	+	2 x .10	=	2.9

**Thunderstorm Wind**

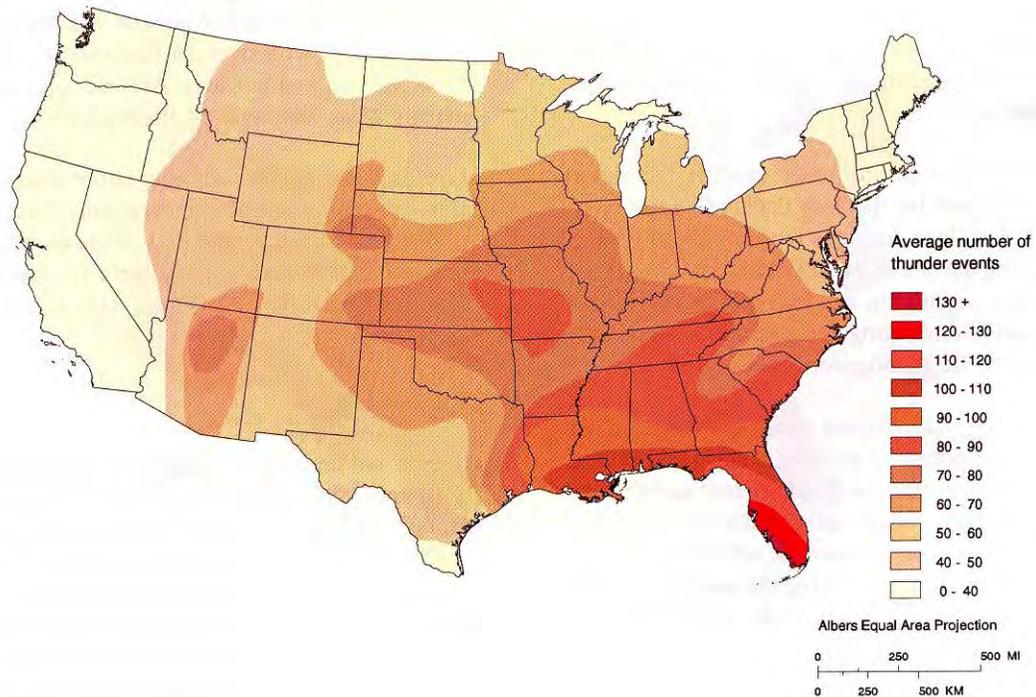
According to the National Weather Service, more than 100,000 thunderstorms occur each year. Only about 10 percent of these storms are classified as “severe.” Although thunderstorms generally affect a small area when they occur, they are very dangerous because of their ability to generate tornadoes, hailstorms, strong winds, flash flooding, and damaging lightning. While thunderstorms can occur in all regions of the United States, they are most common in the central and southern states because atmospheric conditions in those regions are most ideal for generating these powerful storms.

Thunderstorms are caused when air masses of varying temperatures meet. Rapidly rising warm moist air serves as the “engine” for thunderstorms. These storms can occur singularly, in lines, or in clusters. They can move through an area very quickly or linger for several hours.

Lightning is a discharge of electrical energy resulting from the buildup of positive and negative charges within a thunderstorm, creating a “bolt” when the buildup of charges becomes strong enough. This flash of light usually occurs within the clouds or between the

clouds and the ground. A bolt of lightning can reach temperatures approaching 50,000 degrees Fahrenheit. Lightning rapidly heats the sky as it flashes, but the surrounding air cools following the bolt. This rapid heating and cooling of the surrounding air causes thunder. On average, 89 people are killed each year by lightning strikes in the United States.

The National Weather Service collected data for thunder days, number and duration of thunder events, and lightning strike density for the 30-year period from 1948 to 1977. A series of maps were generated showing the annual average thunder event duration, the annual average number of thunder events, and the mean annual density of lightning strikes. **Figure 3-1** illustrates thunderstorm hazard severity based on the annual average number of thunder events from 1948 to 1977.



**Figure 3-1: Annual Average Number of Thunder Events**

Source: Federal Emergency Management Agency

### Occurrences and Probability of the Thunderstorm Hazard

According to the National Climatic Data Center (NCDC) databases, since 2010 there have been significant occurrences of both thunderstorm and lightning events. As a consequence of this activity, there were zero reported injuries, zero deaths and reported damages in the amount of \$973,500 as shown in **Tables 3-4 and 3-5**.

**Table 3-4: Sussex County Thunderstorm Winds Event History**

Location	County/Zone	St.	Date	Time	T.Z.	Type	Mag	Dth	Inj	PrD	CrD
<a href="#">BRIDGEVILLE</a>	SUSSEX CO.	DE	04/05/2011	05:13	EST-5	Thunderstorm Wind	52 kts. EG	0	0	10.00K	0.00K
<a href="#">LAUREL</a>	SUSSEX CO.	DE	04/16/2011	19:45	EST-5	Thunderstorm Wind	50 kts. EG	0	0	0.00K	0.00K
<a href="#">ELLENDALE</a>	SUSSEX CO.	DE	05/28/2011	13:45	EST-5	Thunderstorm Wind	50 kts. EG	0	0	0.00K	0.00K

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Location	County/Zone	St.	Date	Time	T.Z.	Type	Mag	Dth	Inj	PrD	CrD
<a href="#">SEAFORD</a>	SUSSEX CO.	DE	06/10/2011	16:22	EST-5	Thunderstorm Wind	52 kts. EG	0	0	10.00K	1.00K
<a href="#">PILOTTOWN</a>	SUSSEX CO.	DE	07/19/2011	14:25	EST-5	Thunderstorm Wind	50 kts. EG	0	0	0.00K	0.00K
<a href="#">FENWICK IS</a>	SUSSEX CO.	DE	07/19/2011	15:00	EST-5	Thunderstorm Wind	50 kts. EG	0	0	0.00K	0.00K
<a href="#">OAK ORCHARD</a>	SUSSEX CO.	DE	07/24/2011	13:45	EST-5	Thunderstorm Wind	52 kts. EG	0	0	0.00K	0.00K
<a href="#">GEORGETOWN</a>	SUSSEX CO.	DE	07/24/2011	13:57	EST-5	Thunderstorm Wind	50 kts. EG	0	0	10.00K	0.00K
<a href="#">PHILLIPS HILL</a>	SUSSEX CO.	DE	07/24/2011	14:14	EST-5	Thunderstorm Wind	50 kts. EG	0	0	0.00K	0.00K
<a href="#">PILOTTOWN</a>	SUSSEX CO.	DE	08/19/2011	15:43	EST-5	Thunderstorm Wind	50 kts. MG	0	0	0.00K	0.00K
<a href="#">GEORGETOWN</a>	SUSSEX CO.	DE	08/21/2011	18:25	EST-5	Thunderstorm Wind	50 kts. EG	0	0	0.00K	0.00K
<a href="#">BLADES</a>	SUSSEX CO.	DE	02/24/2012	16:15	EST-5	Thunderstorm Wind	55 kts. EG	0	0	25.00K	0.00K
<a href="#">ROSEDALE BEACH</a>	SUSSEX CO.	DE	06/25/2012	07:50	EST-5	Thunderstorm Wind	56 kts. EG	0	0	100.00K	0.00K
<a href="#">MILLSBORO</a>	SUSSEX CO.	DE	06/25/2012	07:55	EST-5	Thunderstorm Wind	50 kts. EG	0	0	0.00K	0.00K
<a href="#">OAK ORCHARD</a>	SUSSEX CO.	DE	06/25/2012	08:04	EST-5	Thunderstorm Wind	52 kts. EG	0	0	25.00K	0.00K
<a href="#">ANGOLA BEACH</a>	SUSSEX CO.	DE	06/25/2012	08:05	EST-5	Thunderstorm Wind	52 kts. EG	0	0	50.00K	0.00K
<a href="#">ANGOLA BEACH</a>	SUSSEX CO.	DE	06/25/2012	08:06	EST-5	Thunderstorm Wind	52 kts. EG	0	0	0.00K	0.00K
<a href="#">DEWEY BEACH</a>	SUSSEX CO.	DE	06/25/2012	08:13	EST-5	Thunderstorm Wind	60 kts. MG	0	0	50.00K	0.00K
<a href="#">WHITESVILLE</a>	SUSSEX CO.	DE	06/25/2012	09:20	EST-5	Thunderstorm Wind	50 kts. EG	0	0	0.00K	0.00K
<a href="#">PILOTTOWN</a>	SUSSEX CO.	DE	06/25/2012	11:47	EST-5	Thunderstorm Wind	59 kts. MG	0	0	0.00K	0.00K
<a href="#">SEAFORD</a>	SUSSEX CO.	DE	06/29/2012	22:57	EST-5	Thunderstorm Wind	61 kts. EG	0	0	100.00K	0.00K
<a href="#">LAUREL</a>	SUSSEX CO.	DE	07/08/2012	19:58	EST-5	Thunderstorm Wind	52 kts. EG	0	0	0.00K	0.00K
<a href="#">LEWES</a>	SUSSEX CO.	DE	08/09/2012	12:55	EST-5	Thunderstorm Wind	52 kts. EG	0	0	0.00K	0.00K
<a href="#">OAK ORCHARD</a>	SUSSEX CO.	DE	08/26/2012	03:40	EST-5	Thunderstorm Wind	61 kts. EG	0	0	25.00K	0.00K
<a href="#">FRANKFORD</a>	SUSSEX CO.	DE	06/13/2013	16:02	EST-5	Thunderstorm Wind	59 kts. MG	0	0	0.00K	0.00K
<a href="#">DEWEY BEACH</a>	SUSSEX CO.	DE	06/13/2013	16:18	EST-5	Thunderstorm Wind	61 kts. MG	0	0	0.00K	0.00K
<a href="#">CHESTNUT KNOLL</a>	SUSSEX CO.	DE	05/22/2014	16:17	EST-5	Thunderstorm Wind	56 kts. EG	0	0	0.00K	0.00K
<a href="#">GEORGETOWN</a>	SUSSEX CO.	DE	05/22/2014	16:45	EST-5	Thunderstorm Wind	56 kts. EG	0	0	0.00K	0.00K
<a href="#">PEPPER</a>	SUSSEX CO.	DE	05/18/2015	13:50	EST-5	Thunderstorm Wind	50 kts. EG	0	0	0.00K	0.00K
<a href="#">GEORGETOWN</a>	SUSSEX CO.	DE	06/20/2015	22:20	EST-5	Thunderstorm Wind	50 kts. EG	0	0	0.00K	0.00K
<a href="#">STOCKLEY</a>	SUSSEX CO.	DE	06/20/2015	22:25	EST-5	Thunderstorm Wind	50 kts. EG	0	0	0.00K	0.00K
<a href="#">FRANKFORD</a>	SUSSEX CO.	DE	06/20/2015	23:50	EST-5	Thunderstorm Wind	55 kts. MG	0	0	0.00K	0.00K
<a href="#">WHITESVILLE</a>	SUSSEX CO.	DE	06/23/2015	19:30	EST-5	Thunderstorm Wind	56 kts. EG	0	0	0.00K	0.00K
<a href="#">LAUREL</a>	SUSSEX CO.	DE	08/04/2015	22:40	EST-5	Thunderstorm Wind	50 kts. EG	0	0	0.00K	0.00K
<b>Totals:</b>								0	0	405.00K	1.00K

Source: NOAA - National Oceanic and Atmospheric Administration - NCDC  
<https://www.ncdc.noaa.gov/stormevents/listevents.jsp?eventTypestatefips=10%2CDELAWARE>

**Table 3-5: Sussex County Lightning Event History**

Location	County/Zone	St.	Date	Time	T.Z.	Type	Mag	Dth	Inj	PrD	CrD
<a href="#">MILTON</a>	SUSSEX CO.	DE	07/24/2011	13:45	EST-5	Lightning		0	0	1.00K	0.00K
<a href="#">GUMBORO</a>	SUSSEX CO.	DE	07/24/2011	14:15	EST-5	Lightning		0	0	1.00K	0.00K

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<a href="#">MILLVILLE</a>	SUSSEX CO.	DE	07/24/2011	14:30	EST-5	Lightning	0	0	1.00K	0.00K
<a href="#">LEWES</a>	SUSSEX CO.	DE	08/15/2011	15:45	EST-5	Lightning	0	0	75.00K	0.00K
<a href="#">GEORGETOWN</a>	SUSSEX CO.	DE	08/21/2011	18:25	EST-5	Lightning	0	0	50.00K	0.00K
<a href="#">MILTON</a>	SUSSEX CO.	DE	08/21/2011	18:35	EST-5	Lightning	0	0	25.00K	0.00K
<a href="#">BLADES</a>	SUSSEX CO.	DE	08/25/2012	15:39	EST-5	Lightning	0	0	25.00K	0.00K
<a href="#">GEORGETOWN ARPT</a>	SUSSEX CO.	DE	08/25/2012	17:01	EST-5	Lightning	0	0	10.00K	0.00K
<a href="#">HARBESON</a>	SUSSEX CO.	DE	08/25/2012	17:30	EST-5	Lightning	0	0	15.00K	0.00K
<a href="#">SELBYVILLE</a>	SUSSEX CO.	DE	08/25/2012	21:11	EST-5	Lightning	0	0	5.00K	0.00K
<a href="#">OCEAN VIEW</a>	SUSSEX CO.	DE	08/25/2012	23:37	EST-5	Lightning	0	0	50.00K	0.00K
<a href="#">DELMAR</a>	SUSSEX CO.	DE	08/26/2012	00:32	EST-5	Lightning	0	0	300.00K	0.00K
<a href="#">MIDWAY</a>	SUSSEX CO.	DE	08/26/2012	03:30	EST-5	Lightning	0	0	5.00K	0.00K
<a href="#">CHESTNUT KNOLL</a>	SUSSEX CO.	DE	07/09/2015	19:45	EST-5	Lightning	0	0	5.00K	0.00K
<b>Totals:</b>							0	0	568.00K	0.00K

Source: NOAA - National Oceanic and Atmospheric Administration - NCDC  
<https://www.ncdc.noaa.gov/stormevents/listevents.jsp?eventTypestatefips=10%2CDELAWARE>

Due to the continuous and ongoing nature of the thunderstorm winds hazard threat, it was judged by the HMSC and the HMWG to be of significant danger to the community and thus included as an identified hazard. The generated **Calculated Priority Risk Index (CPRI)** for Thunderstorm Wind is shown in **Table 3-6** below.

**Table 3-6: CPRI for Degree of Risk for Thunderstorm Wind in Sussex County**

Probability	+	Magnitude /Severity	+	Warning Time	+	Duration	=	CPRI
4 x .45	+	2 x .30	+	2 x .15	+	2 x .10	=	2.9

**Hurricane Wind**

Hurricanes, tropical storms, nor’easters and typhoons, also classified as cyclones, are any closed circulation developing around a low-pressure center in which the winds rotate counter-clockwise in the Northern Hemisphere (or clockwise in the Southern Hemisphere) and whose diameter averages 10 to 30 miles across. Tropical cyclones are formed as a developing center moves over warm water, the pressure drops in the center of the storm and as the pressure drops, the system becomes better organized and the winds begin to rotate around the low pressure, pulling the warm and moist ocean air. Tropical cyclones can evolve from a tropical depression to a tropical storm to a hurricane as they intensify as shown in **Table 3-7**. In the Northern Hemisphere, hurricane winds rotate in a counter-clockwise direction with different wind speeds and characteristics in each quadrant, with the most severe effects in the right-front quadrant.

**Table 3-5: Sussex County Lightning Event History**

Location	County/Zone	St.	Date	Time	T.Z.	Type	Mag	Dth	Inj	PrD	CrD
<a href="#">MILTON</a>	SUSSEX CO.	DE	07/24/2011	13:45	EST-5	Lightning	0	0	1.00K	0.00K	
<a href="#">GUMBORO</a>	SUSSEX CO.	DE	07/24/2011	14:15	EST-5	Lightning	0	0	1.00K	0.00K	

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Location	County/Zone	St.	Date	Time	T.Z.	Type	Mag	Dth	Inj	PrD	CrD
<a href="#">MILLVILLE</a>	SUSSEX CO.	DE	07/24/2011	14:30	EST-5	Lightning		0	0	1.00K	0.00K
<a href="#">LEWES</a>	SUSSEX CO.	DE	08/15/2011	15:45	EST-5	Lightning		0	0	75.00K	0.00K
<a href="#">GEORGETOWN</a>	SUSSEX CO.	DE	08/21/2011	18:25	EST-5	Lightning		0	0	50.00K	0.00K
<a href="#">MILTON</a>	SUSSEX CO.	DE	08/21/2011	18:35	EST-5	Lightning		0	0	25.00K	0.00K
<a href="#">BLADES</a>	SUSSEX CO.	DE	08/25/2012	15:39	EST-5	Lightning		0	0	25.00K	0.00K
<a href="#">GEORGETOWN ARPT</a>	SUSSEX CO.	DE	08/25/2012	17:01	EST-5	Lightning		0	0	10.00K	0.00K
<a href="#">HARBESON</a>	SUSSEX CO.	DE	08/25/2012	17:30	EST-5	Lightning		0	0	15.00K	0.00K
<a href="#">SELBYVILLE</a>	SUSSEX CO.	DE	08/25/2012	21:11	EST-5	Lightning		0	0	5.00K	0.00K
<a href="#">OCEAN VIEW</a>	SUSSEX CO.	DE	08/25/2012	23:37	EST-5	Lightning		0	0	50.00K	0.00K
<a href="#">DELMAR</a>	SUSSEX CO.	DE	08/26/2012	00:32	EST-5	Lightning		0	0	300.00K	0.00K
<a href="#">MIDWAY</a>	SUSSEX CO.	DE	08/26/2012	03:30	EST-5	Lightning		0	0	5.00K	0.00K
<a href="#">CHESTNUT KNOLL</a>	SUSSEX CO.	DE	07/09/2015	19:45	EST-5	Lightning		0	0	5.00K	0.00K
<b>Totals:</b>								0	0	568.00K	0.00K

Source: NOAA - National Oceanic and Atmospheric Administration - NCDC  
<https://www.ncdc.noaa.gov/stormevents/listevents.jsp?eventTypestatefips=10%2CDELAWARE>

Due to the continuous and ongoing nature of the thunderstorm winds hazard threat, it was judged by the HMSC and the HMWG to be of significant danger to the community and thus included as an identified hazard. The generated **Calculated Priority Risk Index (CPRI)** for Thunderstorm Wind is shown in **Table 3-6** below.

**Table 3-6: CPRI for Degree of Risk for Thunderstorm Wind in Sussex County**

Probability	+	Magnitude /Severity	+	Warning Time	+	Duration	=	CPRI
4 x .45	+	2 x .30	+	2 x .15	+	2 x .10	=	2.9

**Hurricane Wind**

Hurricanes, tropical storms, nor’easters and typhoons, also classified as cyclones, are any closed circulation developing around a low-pressure center in which the winds rotate counter-clockwise in the Northern Hemisphere (or clockwise in the Southern Hemisphere) and whose diameter averages 10 to 30 miles across. Tropical cyclones are formed as a developing center moves over warm water, the pressure drops in the center of the storm and as the pressure drops, the system becomes better organized and the winds begin to rotate around the low pressure, pulling the warm and moist ocean air. Tropical cyclones can evolve from a tropical depression to a tropical storm to a hurricane as they intensify as shown in **Table 3-7**. In the Northern Hemisphere, hurricane winds rotate in a counter-clockwise direction with different wind speeds and characteristics in each quadrant, with the most severe effects in the right-front quadrant.

**Table 3-7: Types of Tropical Cyclones**

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Name	Maximum Sustained Surface Wind Speed (Using the U.S. 1-minute average)		
	Tropical Depression	33 kt or less	38 mph or less
Tropical Storm	34kt to 63 kt	39 mph to 73 mph	63 km/hr to 118 km/hr
Hurricane	64 kt or more	74 mph or more	119 km/hr or more

Source: NOAA - National Oceanic and Atmospheric Administration, NHC - National Hurricane Center NHC.  
<http://www.nhc.noaa.gov/aboutgloss.shtml#h>

The Saffir-Simpson Hurricane Scale (**Table 3-8**) defines hurricane strength by categories, with a Category 1 storm being the weakest and Category 5 being the strongest. Depending on where and how hurricanes strike, it is possible for a lower category storm to inflict greater damage than a higher category storm.

**Table 3-8: Saffir-Simpson Hurricane Scale**

Category	Wind Speeds	Likely Effects
1	74 to 95 mph	No real damage to building structures. Damage primarily to unanchored mobile homes, shrubbery, and trees. Also some coastal road flooding and minor pier damage.
2	96 to 110 mph	Some roofing material, door, and window damage to buildings. Considerable damage to vegetation, mobile homes, and piers. Small craft in unprotected anchorages break moorings.
3	111 to 130 mph	Some structural damage to small residences and utility buildings with a minor amount of curtainwall failures, mobile homes are destroyed. Flooding near the coast destroys smaller structures with larger structures damaged by floating debris. Terrain may be flooded well inland.
4	131 to 155 mph	More extensive curtainwall failures with some complete roof structure failure on small residences. Major erosion of beach areas. Major damage to lower floors of structures near the shore. Terrain may be flooded well inland.
5	155 mph or more	Complete roof failure on many residences and industrial buildings. Some complete building failures with small utility buildings blown over or away. Major damage to lower floors of all structures located near the shoreline. Massive evacuation of residential areas may be required.

Source: NOAA, National Hurricane Center (NHC).  
<http://www.nhc.noaa.gov/>

A nor'easter is a cyclonic storm that moves along the East Coast of North America with winds that blow from a northeasterly direction. They may occur at any time of the year, but are most common and strongest in the winter months. These storms are usually most intense near New England and Canada. Nor'easters can produce heavy snow and rain, and may bring gale force winds greater than 58 miles per hour and can cause rough seas, coastal flooding, and beach

erosion.<sup>1</sup> **Table 3-9** below shows an intensity scale proposed for nor’easters that is based upon levels of coastal degradation.

**Table 3-9: Dolan-Davis Nor'easter Intensity Scale**

Storm Class	Beach Erosion	Dune Erosion	Overwash	Property Damage
1 (Weak)	Minor changes	None	No	No
2 (Moderate)	Modest; mostly to lower beach	Minor	No	Modest
3 (Significant)	Erosion extends across beach	Can be significant	No	Loss of many structures at local level
4 (Severe)	Severe beach erosion and recession	Severe dune erosion or destruction	On low beaches	Loss of structures at community-scale
5 (Extreme)	Extreme beach erosion	Dunes destroyed over extensive areas	Massive in sheets and channels	Extensive at regional-scale; millions of dollars

Source: North Carolina Division of Emergency Management

**Occurrences and Probability of the Hurricane Hazard – (High Winds)**

According to the National Climatic Data Center (NCDC) databases, since completion of the 2010 Plan update, there have been two Hurricane events that have affected the region, Hurricane Irene in 2011 and Hurricane Sandy in 2012. As a consequence of the two hurricane events, there were zero reported injuries, zero deaths and reported damages in the amount of \$2 million plus. Due to the continuous and ongoing nature of the hurricane hazard threat, it was judged by the HMSC and the HMWG to be of significant danger to the community and thus included as an identified hazard. The generated CPRI for Hurricane Wind is shown in **Table 3-10** below.

**Table 3-10: CPRI for Degree of Risk for Hurricane in Sussex County**

Probability	+	Magnitude /Severity	+	Warning Time	+	Duration	=	CPRI
4 x .45	+	2 x .30	+	2 x .15	+	2 x .10	=	2.9

**Drought**

A drought is defined as “a period of abnormally dry weather sufficiently prolonged for the lack of water to cause serious hydrologic imbalance in the affected area.”<sup>2</sup> Droughts are extended periods of dry weather that cause problems such as crop damage, affects water supplies, and/or increased fire danger. Droughts are often brought on by lack of rainfall or snow over a long period of time, although the amount of time that low precipitation amounts take to impact an area varies in different geographic locations. The Palmer Drought Severity Index

<sup>1</sup> NOAA, from [http://www.noaa.gov/features/03\\_protecting/noreasters.html](http://www.noaa.gov/features/03_protecting/noreasters.html)

<sup>2</sup> Glossary of Meteorology (1959)

(PDSI) (**Table 3-11**) is the main classification system used for droughts in the United States and is based on supply and demand. The PDSI assesses total moisture by using temperature and precipitation to compute water supply and demand and soil moisture, and is most effective for long-term predictions. PSDI is also used to describe extended wet conditions using corresponding numbers, with zero representing near normal conditions. NOAA publishes weekly national and regional Palmer Drought maps. There are other indices that can be used for specific situations, ecosystems, or terrain.

**Table 3-11: Palmer Drought Severity Index**

PDSI	Description
4.0 or more	Extremely wet
3.0 to 3.99	Very wet
2.0 to 2.99	Moderately wet
1.0 to 1.99	Slightly wet
0.5 to 0.99	Incipient wet spell
0.49 to -0.49	Near normal
-0.5 to -0.99	Incipient dry spell
-1.0 to -1.99	Mild drought
-2.0 to -2.99	Moderate drought
-3.0 to -3.99	Severe drought
-4.0 or less	Extreme drought

Source: NOAA - National Oceanic and Atmospheric Administration

Droughts are frequently classified as one of following four types: Meteorological, Agricultural, Hydrological, and Socio-economic.

*Meteorological droughts* are typically defined by the level of “dryness” when compared to an average, or normal amount of precipitation over a given period of time.

*Agricultural droughts* relate common characteristics of drought to their specific agricultural-related impacts. Emphasis tends to be placed on factors such as soil water deficits, water needs based on differing stages of crop development, and water reservoir levels.

*Hydrological drought* is directly related to the effect of precipitation shortfalls on surface and groundwater supplies. Human factors, particularly changes in land use, can alter the hydrologic characteristics of a basin.

*Socio-economic drought* is the result of water shortages that limit the ability to supply water- dependent products in the marketplace.

**Occurrences and Probability of the Drought Hazard**

According to the NCDC databases, since 2010 there has been one seven-month period of drought in 2012 that produced zero reported injuries, zero deaths and no reported damages as shown in **Table 3-12**.

**Table 3-12: Sussex County Drought Event History**

Location	County/Zone	St.	Date	Time	T.Z.	Type	Mag	Dth	Inj	PrD	CrD
<a href="#">INLAND SUSSEX (ZONE)</a>	INLAND SUSSEX (ZONE)	DE	04/10/2012	00:00	EST-5	Drought		0	0	0.00K	0.00K
<a href="#">DELAWARE BEACHES (ZONE)</a>	DELAWARE BEACHES (ZONE)	DE	04/10/2012	00:00	EST-5	Drought		0	0	0.00K	0.00K
<a href="#">DELAWARE BEACHES (ZONE)</a>	DELAWARE BEACHES (ZONE)	DE	05/01/2012	00:00	EST-5	Drought		0	0	0.00K	0.00K
<a href="#">INLAND SUSSEX (ZONE)</a>	INLAND SUSSEX (ZONE)	DE	05/01/2012	00:00	EST-5	Drought		0	0	0.00K	0.00K
<a href="#">INLAND SUSSEX (ZONE)</a>	INLAND SUSSEX (ZONE)	DE	06/01/2012	00:00	EST-5	Drought		0	0	0.00K	0.00K
<a href="#">DELAWARE BEACHES (ZONE)</a>	DELAWARE BEACHES (ZONE)	DE	06/01/2012	00:00	EST-5	Drought		0	0	0.00K	0.00K
<a href="#">DELAWARE BEACHES (ZONE)</a>	DELAWARE BEACHES (ZONE)	DE	07/01/2012	00:00	EST-5	Drought		0	0	0.00K	0.00K
<a href="#">INLAND SUSSEX (ZONE)</a>	INLAND SUSSEX (ZONE)	DE	07/01/2012	00:00	EST-5	Drought		0	0	0.00K	0.00K
<a href="#">INLAND SUSSEX (ZONE)</a>	INLAND SUSSEX (ZONE)	DE	08/01/2012	00:00	EST-5	Drought		0	0	0.00K	0.00K
<a href="#">DELAWARE BEACHES (ZONE)</a>	DELAWARE BEACHES (ZONE)	DE	08/01/2012	00:00	EST-5	Drought		0	0	0.00K	0.00K
<a href="#">INLAND SUSSEX (ZONE)</a>	INLAND SUSSEX (ZONE)	DE	09/01/2012	00:00	EST-5	Drought		0	0	0.00K	0.00K
<a href="#">DELAWARE BEACHES (ZONE)</a>	DELAWARE BEACHES (ZONE)	DE	09/01/2012	00:00	EST-5	Drought		0	0	0.00K	0.00K
<a href="#">INLAND SUSSEX (ZONE)</a>	INLAND SUSSEX (ZONE)	DE	10/01/2012	00:00	EST-5	Drought		0	0	0.00K	0.00K
<a href="#">DELAWARE BEACHES (ZONE)</a>	DELAWARE BEACHES (ZONE)	DE	10/01/2012	00:00	EST-5	Drought		0	0	0.00K	0.00K

Source: NOAA - National Oceanic and Atmospheric Administration - NCDC  
<https://www.ncdc.noaa.gov/stormevents/listevents.jsp?eventTypestatefips=10%2CDELAWARE>

Due to the continuous and ongoing nature of the drought hazard threat, it was judged by the HMSC and the HMWG to be of significant danger to the community and thus included as an identified hazard. The generated CPRI for Drought is shown in **Table 3-13** below.

**Table 3-13: CPRI for Degree of Risk for Drought in Sussex County**

Probability	+	Magnitude /Severity	+	Warning Time	+	Duration	=	CPRI
3 x .45	+	2 x .30	+	1 x .15	+	4 x .10	=	2.05

**Extreme Heat/Cold**

Extreme heat can be defined as temperatures that hover 10 degrees or more above the average high temperature for the region, last for prolonged periods of time, and are often accompanied by high humidity. Under normal conditions, the human body’s internal thermostat produces perspiration that evaporates and cools the body. However, in extreme heat and high humidity, evaporation is slowed and the body must work much harder to maintain a normal temperature. Elderly persons, young children, persons with respiratory difficulties, and those who are sick or overweight are more likely to become victims of extreme heat. Because men sweat more than women, they are more susceptible to heat-related illness because they become more quickly dehydrated. Studies have shown that a significant rise in heat-related illness occur when excessive heat persists for more than two days. Heat related disorder probabilities are shown in **Figure 3-2**, with **Table 3-14** showing the history of extreme heat events in Sussex County. Spending at least two hours per day in air conditioning can significantly reduce the number of heat-related illnesses.

Extreme heat in urban areas can create health concerns when stagnant atmospheric conditions trap pollutants, thus adding unhealthy air to excessively hot temperatures. In addition, the “urban heat island effect” can produce significantly higher nighttime temperatures because asphalt and concrete (which store heat longer) gradually release heat at night.

Along the eastern seaboard of the United States, periods of hotter than normal temperatures, often with high levels of humidity, can occur in the summer. These extreme temperature events can last a day to a week or longer. It is usually considered a heat wave in this area when the temperature rises above 90 degrees Fahrenheit, accompanied by high humidity. NOAA states that a *heat wave* is a period of abnormally and uncomfortably hot and unusually humid weather. Typically, a heat wave lasts two or more days<sup>3</sup>. NOAA’s National Weather Service has created the Heat Index (HI) that combines relative humidity and actual air temperature to try to accurately measure how hot the air feels to the human body, and then demonstrate the potential health effects.

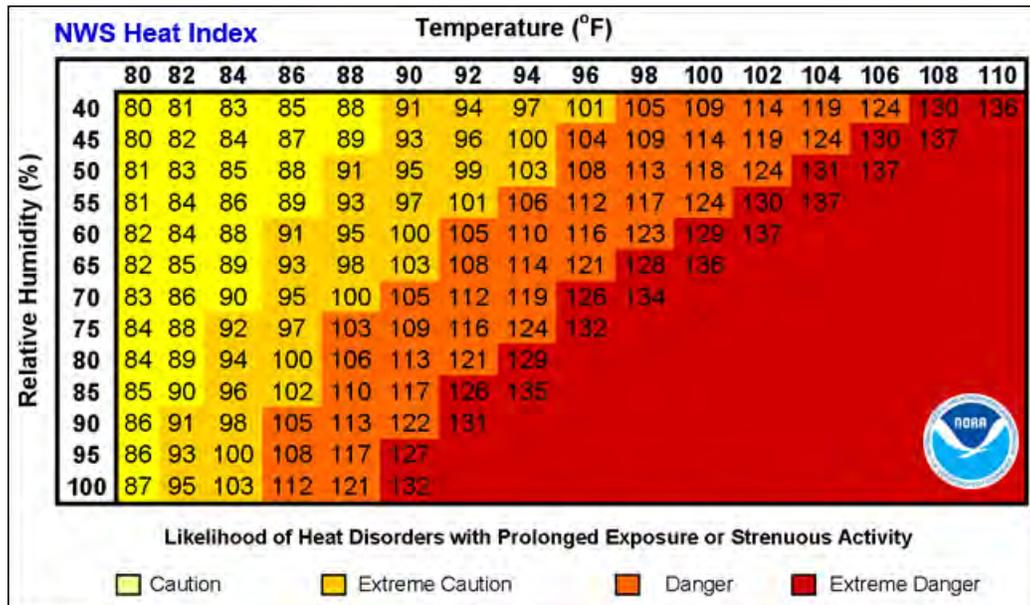


Figure 3-1: NOAA’s National Weather Heat Index

Source: Source: NOAA - National Oceanic and Atmospheric Administration  
<http://www.weather.gov/om/heat/heatindex.shtml>

<sup>3</sup> NOAA- <http://w1.weather.gov/glossary/index.php?letter=h>

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**Table 3-14: Sussex County Extreme Heat Event History**

Location	County/Zone	St.	Date	Time	T.Z.	Type	Mag	Dth	Inj	PrD	CrD
<a href="#">INLAND SUSSEX (ZONE)</a>	INLAND SUSSEX (ZONE)	DE	07/21/2011	09:00	EST-5	Excessive Heat		0	0	0.00K	0.00K
<a href="#">DELAWARE BEACHES (ZONE)</a>	DELAWARE BEACHES (ZONE)	DE	07/21/2011	09:00	EST-5	Excessive Heat		0	0	0.00K	0.00K
<a href="#">INLAND SUSSEX (ZONE)</a>	INLAND SUSSEX (ZONE)	DE	07/18/2013	09:00	EST-5	Excessive Heat		0	0	0.00K	0.00K
<b>Totals:</b>								0	0	0.00K	0.00K

Source: NOAA - National Oceanic and Atmospheric Administration - NCDC  
<https://www.ncdc.noaa.gov/stormevents/listevents.jsp?eventTypestatefips=10%2CDELAWARE>

Severe winter weather may include one or more of the following: snowstorms, blizzards, sleet, freezing rain, ice storms, and extreme cold temperatures. Extreme cold temperatures are characterized by the ambient air temperature dropping to approximately 0 degrees Fahrenheit or below.

Significant snowstorms are characterized by a rapid accumulation of snow, while a blizzard is categorized as a snowstorm with winds of 35 miles per hour or greater and/or visibility of less than ¼ mile for three or more hours. Many of these types of storms can immobilize a region, cause treacherous roadways, power outages, and property damage or collapse.

Although there is no widely used scale to classify snowstorms, the National Weather Service (NWS) developed the Northeast Snowfall Impact Scale (NESIS). NESIS classifies high impact Northeast snowstorms that have large areas of 10-inch snowfall accumulations or more. The index utilizes population information in addition to meteorological measurements for an indication of the storm’s impacts on society. The five categories are: Extreme (5), Crippling (4), Major (3), Significant (2), and Notable (1). NOAA’s National Weather Service (NWS) in cooperation with a team of universities and other agencies developed the current wind chill temperature index (WCT) formula in 2001.<sup>4</sup> WCT uses wind speed at 5 feet (the average height of a human’s face), incorporates heat loss from the body, is based on a human face model, utilizes 3 miles per hour as the calm wind threshold, uses a consistent standard for skin tissue resistance and assumes a clear night sky for solar radiation. The history of extreme cold events in Sussex County is shown in **Table 3-15**.

**Table 3-15: Sussex County Extreme Cold Event History**

Location	County/Zone	St.	Date	Time	T.Z.	Type	Mag	Dth	Inj	PrD	CrD
<a href="#">INLAND SUSSEX (ZONE)</a>	INLAND SUSSEX (ZONE)	DE	01/04/2014	01:00	EST-5	Extreme Cold/wind Chill		0	0	0.00K	0.00K
<a href="#">DELAWARE BEACHES (ZONE)</a>	DELAWARE BEACHES (ZONE)	DE	01/04/2014	01:00	EST-5	Extreme Cold/wind Chill		0	0	0.00K	0.00K
<a href="#">DELAWARE BEACHES (ZONE)</a>	DELAWARE BEACHES (ZONE)	DE	01/22/2014	00:00	EST-5	Extreme Cold/wind Chill		0	0	0.00K	0.00K

<sup>4</sup> NOAA. Retrieved from <http://www.crh.noaa.gov/lxh/?n=winterday>

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Location	County/Zone	St.	Date	Time	T.Z.	Type	Mag	Dth	Inj	PrD	CrD
<a href="#">INLAND SUSSEX (ZONE)</a>	INLAND SUSSEX (ZONE)	DE	01/22/2014	00:00	EST-5	Extreme Cold/wind Chill	0	0	0.00K	0.00K	
<b>Totals:</b>							0	0	0.00K	0.00K	

Source: NOAA - National Oceanic and Atmospheric Administration - NCDC  
<https://www.ncdc.noaa.gov/stormevents/listevents.jsp?eventTypestatefips=10%2CDELAWARE>

Although there have been no recorded deaths, injuries, or damage from extreme heat/cold events in Sussex County since the plan update in 2010 as shown in **Table 3-14 and 3-15**, this hazard was judged by the HMSC and the HMWG to be of significant danger to the community and thus included as an identified hazard. The generated CPRI for Extreme Heat/Cold is shown in **Table 3-16** below.

**Table 3-16: CPRI for Degree of Risk for Extreme Heat/Cold in Sussex County**

Probability	+	Magnitude /Severity	+	Warning Time	+	Duration	=	CPRI
3 x .45	+	1 x .30	+	1 x .15	+	3 x .10	=	2.1

**Winter Storm**

A winter storm can range from a moderate snow over a period of a few hours to blizzard conditions with blinding wind-driven snow that lasts for several days. Some winter storms may be large enough to affect several states, while others may affect only a single community. Many winter storms are accompanied by low temperatures and heavy and/or blowing snow, which can severely impair visibility.

Winter storms may include snow, sleet, freezing rain, or a mix of these wintry forms of precipitation. Sleet, raindrops that freeze into ice pellets before reaching the ground, usually bounce when hitting a surface and do not stick to objects. However, sleet can accumulate like snow and cause a hazard to motorists. Freezing rain is rain that falls onto a surface with a temperature below freezing, forming a glaze of ice. Even small accumulations of ice can cause a significant hazard, especially on power lines and trees. An ice storm occurs when freezing rain falls and freezes immediately upon impact. Communications and power can be disrupted for days, and even small accumulations of ice may cause extreme hazards to motorists and pedestrians.

Although there have been no recorded deaths, injuries, or recorded damage from winter storm events in Sussex County since the plan update in 2010 as shown in **Table 3-17**, this hazard was judged by the HMSC and the HMWG to be of significant danger to the community and thus included as an identified hazard. The generated CPRI for Winter Storm is shown in **Table 3-18**.

**Table 3-17: Sussex County Winter Storm Event History**

Location	County/Zone	St.	Date	Time	T.Z.	Type	Mag	Dth	Inj	PrD	CrD
<a href="#">INLAND SUSSEX (ZONE)</a>	INLAND SUSSEX (ZONE)	DE	01/02/2014	20:00	EST-5	Winter Storm	0	0	0.00K	0.00K	
<a href="#">DELAWARE BEACHES (ZONE)</a>	DELAWARE BEACHES (ZONE)	DE	01/02/2014	21:00	EST-5	Winter Storm	0	0	0.00K	0.00K	
<a href="#">INLAND SUSSEX (ZONE)</a>	INLAND SUSSEX (ZONE)	DE	03/03/2014	04:00	EST-5	Winter Storm	0	0	0.00K	0.00K	
<a href="#">DELAWARE BEACHES (ZONE)</a>	DELAWARE BEACHES (ZONE)	DE	03/03/2014	06:00	EST-5	Winter Storm	0	0	0.00K	0.00K	
<a href="#">INLAND SUSSEX (ZONE)</a>	INLAND SUSSEX (ZONE)	DE	03/01/2015	09:00	EST-5	Winter Storm	0	0	0.00K	0.00K	
<a href="#">INLAND SUSSEX (ZONE)</a>	INLAND SUSSEX (ZONE)	DE	03/05/2015	11:00	EST-5	Winter Storm	0	0	0.00K	0.00K	
<b>Totals:</b>							0	0	0.00K	0.00K	

Source: NOAA - National Oceanic and Atmospheric Administration - NCDC  
<https://www.ncdc.noaa.gov/stormevents/listevents.jsp?eventTypestatefips=10%2CDELAWARE>

**Table 3-18: CPRI for Degree of Risk for Winter Storm in Sussex County**

Probability	+	Magnitude /Severity	+	Warning Time	+	Duration	=	CPRI
3 x .45	+	1 x .30	+	1 x .15	+	2 x .10	=	2

## Tornado

Tornadoes are defined as violently rotating columns of air extending from thunderstorms down to the ground. Tornadoes are unpredictable and can occur at any time of day or night, and at any season throughout the year. The Fujita Tornado Scale (F-Scale) was introduced in 1971, and is a damage scale (not a wind speed scale) that categorizes each tornado by intensity and area.<sup>5</sup> The F-Scale categories range from low intensity F0 with estimated wind speeds of 40 to 72 miles per hour up to F5, with estimated wind speeds of over 260 miles per hour. In 2007, the Enhanced Fujita Scale (EF-Scale) was introduced, and although it relates to the original Fujita Scale, it is more complex and has different wind speed ranges associated with the classifications.<sup>6</sup> **Table 3-19** on the following page illustrates the comparison in wind speed range between the two scales.

<sup>5</sup> “Proposed Characterization of Tornadoes and Hurricanes by Area and Intensity” (Feb, 1971). Dr. T. Fujita

<sup>6</sup> NOAA from <http://www.spc.noaa.gov/efscale/>

Table 3-19: F-Scale and EF-Scale Wind Speed Range Comparison

F-Scale			EF-Scale	
F-Scale	Fastest ¼-mile Wind Speeds (mph)	3-Second Gust Speed (mph)	EF-Scale	3-Second Gust Speed (mph)
F0	40 - 72	45 - 78	EF0	65 - 85
F1	73 - 112	79 - 117	EF1	86 - 109
F2	113 – 157	118 – 161	EF2	110 – 137
F3	158 207	162 – 209	EF3	138 – 167
F4	208 – 260	210 – 261	EF4	168 – 199
F5	261 – 318	262 – 317	EF5	200 - 234

Source: Wind Science and Engineering Center at Texas Tech University and NOAA/National Weather Service.

**Occurrences and Probability of the Tornado Hazard – (High Winds)**

Since 1955 there have been two F2 tornados, eight F1 tornados and eight F0 tornados according to the NCDRC databases. As a consequence of the 19 tornado events, there were 11 reported injuries, zero deaths and reported damages in the amount of \$593,500 as shown in **Table 3-20**. Since completion of the 2010 Multi-Jurisdictional All Hazard Mitigation Plan there has been one occurrence of a tornado within the County. In 2011, Sussex County experienced an EF 1 near Nassau that resulted in no human casualties or reported property damages as shown in **Table 3-21**. The calculated CPRI degree of risk for Sussex County is shown in **Table 3-22**.

Table 3-20: Sussex County Tornado Event History

Location	County/Zone	St.	Date	Time	T.Z.	Type	Mag	Dth	Inj	PrD	CrD
<a href="#">SUSSEX CO.</a>	SUSSEX CO.	DE	08/12/1955	15:26	CST	Tornado	F2	0	1	2.50K	0.00K
<a href="#">SUSSEX CO.</a>	SUSSEX CO.	DE	07/05/1957	16:00	CST	Tornado	F1	0	0	2.50K	0.00K
<a href="#">SUSSEX CO.</a>	SUSSEX CO.	DE	09/10/1957	16:24	CST	Tornado	F1	0	0	2.50K	0.00K
<a href="#">SUSSEX CO.</a>	SUSSEX CO.	DE	06/24/1962	17:00	CST	Tornado	F1	0	0	25.00K	0.00K
<a href="#">SUSSEX CO.</a>	SUSSEX CO.	DE	03/19/1975	10:15	CST	Tornado	F1	0	0	2.50K	0.00K
<a href="#">SUSSEX CO.</a>	SUSSEX CO.	DE	08/04/1975	12:30	CST	Tornado	F0	0	0	2.50K	0.00K
<a href="#">SUSSEX CO.</a>	SUSSEX CO.	DE	06/30/1976	12:30	CST	Tornado	F0	0	0	0.00K	0.00K
<a href="#">SUSSEX CO.</a>	SUSSEX CO.	DE	05/08/1984	16:30	CST	Tornado	F1	0	8	250.00K	0.00K
<a href="#">SUSSEX CO.</a>	SUSSEX CO.	DE	05/08/1984	16:30	CST	Tornado	F1	0	2	250.00K	0.00K
<a href="#">SUSSEX CO.</a>	SUSSEX CO.	DE	07/18/1984	07:30	CST	Tornado	F2	0	0	25.00K	0.00K
<a href="#">SUSSEX CO.</a>	SUSSEX CO.	DE	08/15/1989	13:09	EST	Tornado	F1	0	0	0.00K	0.00K
<a href="#">SUSSEX CO.</a>	SUSSEX CO.	DE	07/15/1992	18:00	EST	Tornado	F1	0	0	25.00K	0.00K
<a href="#">SUSSEX CO.</a>	SUSSEX CO.	DE	07/15/1992	18:00	EST	Tornado	F0	0	0	0.00K	0.00K
<a href="#">SUSSEX CO.</a>	SUSSEX CO.	DE	07/15/1992	18:00	EST	Tornado	F0	0	0	0.00K	0.00K
<a href="#">SUSSEX CO.</a>	SUSSEX CO.	DE	08/28/1992	16:20	CST	Tornado	F0	0	0	0.00K	0.00K
<a href="#">to 1 S Bridgeville</a>	SUSSEX CO.	DE	04/01/1993	19:15	EST	Tornado	F0	0	0	5.00K	0.00K
<a href="#">Bridgeville</a>	SUSSEX CO.	DE	06/26/1995	13:15	EST	Tornado	F0	0	0	1.00K	0.00K

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Location	County/Zone	St.	Date	Time	T.Z.	Type	Mag	Dth	Inj	PrD	CrD
<a href="#">DEWEY BEACH</a>	SUSSEX CO.	DE	08/13/1998	12:33	EST	Tornado	F0	0	0	0.00K	0.00K
<a href="#">NASSAU</a>	SUSSEX CO.	DE	08/27/2011	17:38	EST-5	Tornado	EF1	0	0	0.00K	0.00K
<b>Totals:</b>								0	11	593.50K	0.00K

Source: NOAA - National Oceanic and Atmospheric Administration - NCDC  
<https://www.ncdc.noaa.gov/stormevents/choosedates.jsp?statefips=10,DELAWARE>

**Table 3-21: Sussex County 2011 Tornado Event**

Location	County/Zone	St.	Date	Time	T.Z.	Type	Mag	Dth	Inj	PrD	C
<a href="#">NASSAU</a>	SUSSEX CO.	DE	08/27/2011	17:38	EST-5	Tornado	EF1	0	0	0.00K	0.00K
<b>Totals:</b>								0	0	0.00K	0.00K

Source: NOAA - National Oceanic and Atmospheric Administration - NCDC  
<https://www.ncdc.noaa.gov/stormevents/listevents.jsp?eventTypestatefips=10%2CDELAWARE>

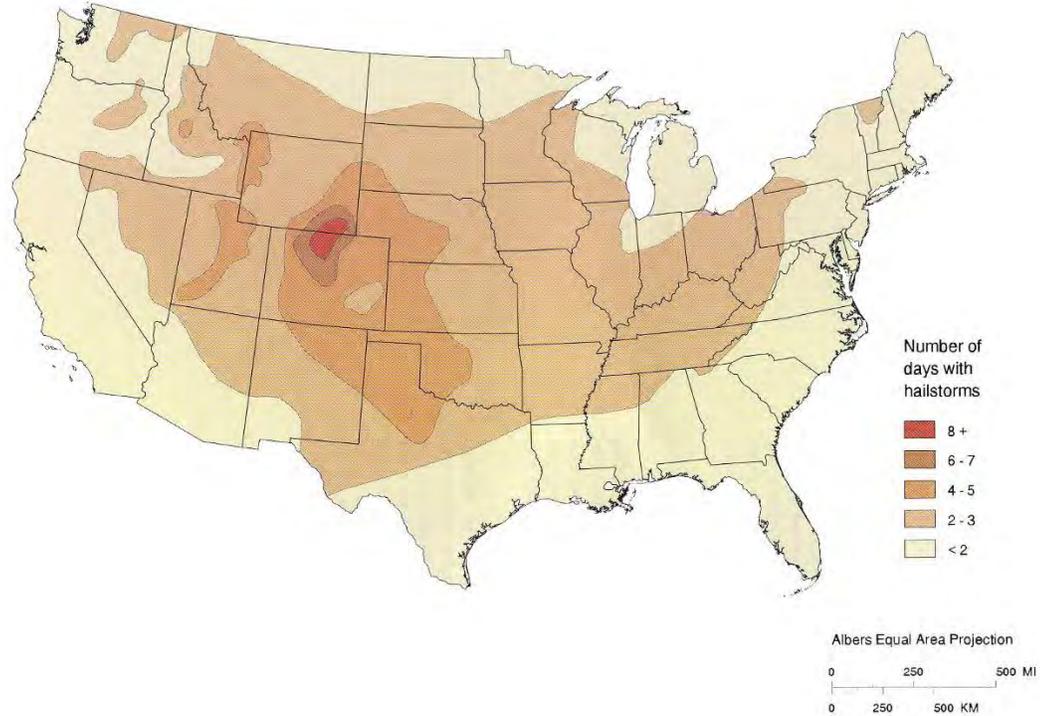
**Table 3-22: CPRI for Degree of Risk for Tornadoes in Sussex County**

Probability	+	Magnitude /Severity	+	Warning Time	+	Duration	=	CPRI
0 x .45	+	0 x .30	+	0 x .15	+	0 x .10	=	0

**Hail**

Hailstorms are an outgrowth of severe thunderstorms. Early in the developmental stages of a hailstorm, ice crystals form within a low-pressure front due to the rapid rising of warm air into the upper atmosphere and the subsequent cooling of the air mass. Frozen droplets gradually accumulate on the ice crystals until, having developed sufficient weight, they fall as precipitation—as balls or irregularly shaped masses of ice greater than 0.75 in. (1.91 cm) in diameter.

The size of hailstones is a direct function of the size and severity of the storm. High velocity updraft winds are required to keep hail in suspension in thunderclouds. The strength of the updraft is a function of the intensity of heating at the Earth’s surface. Higher temperature gradients relative to elevation above the surface result in increased suspension time and hailstone size. **Figure 3-3** on the following page shows the annual frequency of hailstorms in the United States.



**Figure 3-3: Annual Frequency of Hailstorms in the United States**

Source: Federal Emergency Management Agency

During the intervening years covered by this hazard mitigation plan update, Sussex County has experienced four additional hail storms of note as depicted by the NCDC records in **Table 3-23** below.

**Table 3-23: Sussex County Tsunami Event**

Location	County/Zone	St.	Date	Time	T.Z.	Type	Mag	Dth	Inj	PrD	CrD
<b>Totals:</b>								0	0	0.00K	0.00K
<a href="#">DELMAR</a>	SUSSEX CO.	DE	08/19/2011	14:12	EST-5	Hail	0.75 in.	0	0	0.00K	0.00K
<a href="#">BLADES</a>	SUSSEX CO.	DE	02/24/2012	16:15	EST-5	Hail	1.00 in.	0	0	0.00K	0.00K
<a href="#">MILLSBORO</a>	SUSSEX CO.	DE	07/08/2012	19:47	EST-5	Hail	0.75 in.	0	0	0.00K	0.00K
<a href="#">ELLENDALE</a>	SUSSEX CO.	DE	05/22/2014	16:30	EST-5	Hail	1.25 in.	0	0	0.00K	0.00K
<b>Totals:</b>								0	0	0.00K	0.00K

Source: NOAA - National Oceanic and Atmospheric Administration - NCDC  
<https://www.ncdc.noaa.gov/stormevents/listevents.jsp?eventTypestatefips=10%2CDELAWARE>

### Occurrence and Future Probability of Hail Hazard

According to NCDC databases, since 2010 there have been four hail events within Sussex County that resulted in no losses. Hail was judged by the HMSC and the HMWG to be of significant danger to the community and thus included as an identified hazard. The generated CPRI for hail is shown in **Table 3-24** on the following page.

**Table 3-24: CPRI for Degree of Risk for Hail in Sussex County**

Probability	+	Magnitude /Severity	+	Warning Time	+	Duration	=	CPRI
2 x .45	+	1 x .30	+	3 x .15	+	1 x .10	=	1.75

**Tsunami**

The word tsunami is Japanese and means “harbor wave.” A tsunami is a series of great waves that are created by undersea disturbances such as earthquakes or volcanic eruptions. From the area of disturbance, tsunami waves will travel outward in all directions. Tsunamis can originate hundreds or even thousands of miles away from coastal areas.

The time between wave crests may be five to 90 minutes and the open ocean wave speed may average 450 miles per hour. As tsunami waves approach shallow coastal waters, they appear normal size and the speed decreases until the waves near the shoreline, where it may grow to great height and crash into the shore. Areas at greatest risk are less than 50 feet above sea level and within one mile of the shoreline. Rapid changes in the ocean water level may indicate that a tsunami is approaching. Most deaths during a tsunami are the result of drowning. Associated risks include flooding, polluted water supplies, and damaged gas lines.

In the United States, tsunamis have historically affected the West Coast, but the threat of tsunami inundation is also possible on the Atlantic Coast. Pacific Ocean tsunamis are classified as local, regional, or Pacific-wide. Regional tsunamis are most common. In 1949, the Pacific Tsunami Warning Center was established at Ewa Beach, Hawaii to monitor conditions in the Pacific Ocean and to provide warnings in case of tsunamis. According to the Pacific Tsunami Warning Center, 796 tsunamis were observed or recorded in the Pacific Ocean between 1900 and 2001. Approximately 117 caused casualties and damage and at least nine caused widespread destruction throughout the Pacific. The greatest number of tsunamis during any one-year was 19 in 1938, but all were minor and caused no damage. There was no single year of the period that was free of tsunamis.

Sussex County was subjected to a tsunamis strike on June 13, 2013. There was no recorded damage, as illustrated in **Table 3-25** on the following page. In fact, it is not widely known that a tsunami actually occurred.

**Table 3-25: Sussex County Tsunami Event** <sup>7</sup>

Location	County/Zone	St.	Date	Time	T.Z.	Type	Mag	Dt h	i n j	PrD	CrD
<a href="#">DELAWARE BEACHES (ZONE)</a>	DELAWARE BEACHES (ZONE)	DE	06/13/2013	10:00	EST-5	Tsunami		0	0	0.00K	0.00K
<b>Totals:</b>								0	0	0.00K	0.00K

Source: NOAA - National Oceanic and Atmospheric Administration - NCDC  
<https://www.ncdc.noaa.gov/stormevents/listevents.jsp?eventTypestatefips=10%2CDELAWARE>

**Prioritization and Rationale of the Tsunami Hazard**

Although there have been no previously recorded deaths, injuries, or damage from tsunami in Sussex County, there has been an event and was judged by the HMSC and the HMWG to be of significant danger to the community and thus included as an identified hazard. The generated CPRI for tsunami is shown in **Table 3-26** below.

**Table 3-26: CPRI for Degree of Risk for Tsunami in Sussex County**

Probability	+	Magnitude /Severity	+	Warning Time	+	Duration	=	CPRI
1 x .45	+	1 x .30	+	1 x .15	+	1 x .10	=	1

**Earthquake**

An earthquake is a sudden, rapid movement of the earth caused by the breaking and shifting of rock beneath the earth’s surface. The earth’s surface is broken into shifting slabs or tectonic plates, which continents move along with. At the plate boundaries, the plates interact by sliding past one another, running into one another, or moving away from one another. Sometimes these movements are slow and gradual, at other times the plates are locked together unable to release the accumulating energy. Most active faults are located along or near boundaries between shifting plates, although some are located in the interior of plates (intra-plate earthquakes, such as the New Madrid Fault).

Earthquakes occur when rock suddenly moves, or slips, along these faults and accumulated energy is then released. This energy causes seismic waves that when strong enough, may be experienced as ground shaking. The amount of energy released, combined with the physical environment, will impact the amount of damage to buildings and infrastructure. Smaller magnitude earthquakes, called aftershocks, often follow the main earthquake. Earthquakes may also cause additional hazards such as ground rupture, landslides, avalanches, fires, soil liquefaction, tsunamis, floods, and tidal forces. There are two main types of scales for measuring earthquakes: intensity and magnitude.

Intensity scales measure the amount of shaking at a particular location, so the intensity of an earthquake will vary depending on the location, although people tend to use the maximum intensity level produced when referring to a particular earthquake. Intensity is determined from effects on people, structures, and the natural environment. Intensity scales include the

<sup>7</sup> <http://www.ncdc.noaa.gov/stormevents/listevents.jsp?eventType>

Modified Mercalli Scale, shown in **Table 3-27** on the following page. The Richter scale was succeeded in the 1970s by the moment magnitude scale (Modified Mercalli Scale).

Magnitude scales measure the energy released or size of the earthquake at its source, so it will not vary based on location. Magnitude is determined from measurements on seismographs. Magnitude scales include the Richter Magnitude (Local Magnitude) and Moment Magnitude. Moment Magnitude Scale is newer and more precise, but more complex to calculate.

**Table 3-27: Abbreviated Modified Mercalli Intensity Scale**

Mercalli Intensity	Description
I	Not felt except by a very few under especially favorable conditions.
II	Felt only by a few persons at rest, especially on upper floors of buildings.
III	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.
IV	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.
V	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
VI	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
VII	Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
VIII	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
IX	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
X	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.
XI	Few, if any (masonry) structures remain standing. Bridges destroyed. Rails bent greatly.
XII	Damage total. Lines of sight and level are distorted. Objects thrown into the air.

Source: US Geological Survey (USGS). Retrieved from <http://earthquake.usgs.gov/learn/topics/mercalli.php>

Magnitude is measured using the Richter Scale. The Richter Scale is an open-ended logarithmic scale that describes the energy release of an earthquake through a measure of shock wave amplitude. Each unit increase in magnitude on the Richter Scale corresponds to a ten-fold increase in wave amplitude, or a 32-fold increase in energy. Intensity is most commonly measured using the Modified Mercalli Intensity Scale based on direct and indirect measurements of seismic effects. A description of the Modified Mercalli Intensity Scale of earthquake intensity and its correspondence to the Richter Scale is shown in **Table 3-28** on the following page.

**Table 3-28: Modified Mercalli Intensity Scale for Earthquakes**

Scale	Intensity	Description of Effects	Corresponding Richter Scale Magnitude
I	Instrumental	Detected only on seismographs	
II	Feeble	Some people feel it	<4.2
III	Slight	Felt by people resting; like a truck rumbling by	
IV	Moderate	Felt by people walking	
V	Slightly Strong	Sleepers awake; church bells ring	<4.8
VI	Strong	Trees sway; suspended objects swing, objects fall off shelves	<5.4
VII	Very Strong	Mild Alarm; walls crack; plaster falls	<6.1
VIII	Destructive	Moving cars uncontrollable; masonry fractures, poorly constructed buildings damaged	
IX	Ruinous	Some houses collapse; ground cracks; pipes break open	<6.9
X	Disastrous	Ground cracks profusely; many buildings destroyed; liquefaction and landslides widespread	<7.3
XI	Very Disastrous	Most buildings and bridges collapse; roads, railways, pipes and cables destroyed; general triggering of other hazards	<8.1
XII	Catastrophic	Total destruction; trees fall; ground rises and falls in waves	>8.1

The most recent earthquake "felt" in Delaware occurred in southern New Jersey in December 1968. Wilmington residents noted slight effects of the Richter magnitude 2.5 tremor, which caused no damage as it rumbled through New Jersey, Pennsylvania, and Delaware. Seismic activity within the state of Delaware is depicted in **Figure 3-4** on the following page.

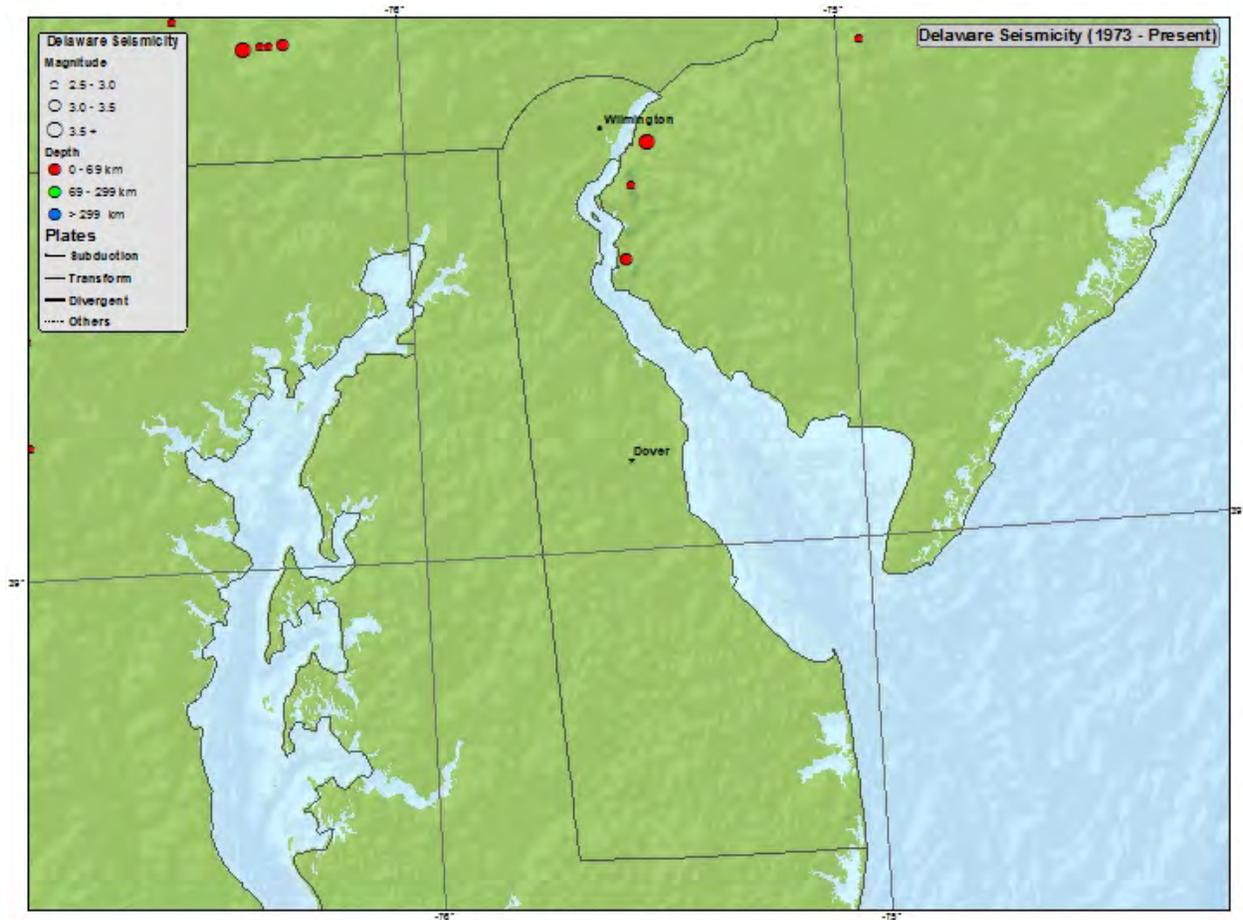


Figure3-4: Delaware Seismicity Activity Map - 1973 to March 2012

Source: USGS - United States Geologic Service  
 USGS - <http://earthquake.usgs.gov/earthquakes/states/delaware/seismicity.php>

### Prioritization and Rationale of the Earthquake Hazard

Although there have been no previously recorded deaths, injuries, or damage from earthquakes in Sussex County, the hazard was judged by the HMSC and the HMWG to be of significant danger to the community and thus included as an identified hazard. There has been no event occurrence since the last hazard mitigation update, thus no measurable data to generate a CPRI rating for earthquake. Thus earthquake remains unranked as show in **Table 3-29**.

Table 3-29: CPRI for Degree of Risk for Earthquake in Sussex County

Probability	+	Magnitude /Severity	+	Warning Time	+	Duration	=	CPRI
0 x .45	+	0 x .30	+	0 x .15	+	0 x .10	=	0

**Wildfire**

A wildfire is any fire that burns out of control and typically occurs in grasslands, forest, brush land, etc. Wildfire is a natural process that is important to ecosystems, and fire suppression can lead to more severe fires due to the buildup of vegetation, which creates more fuel. However, wildfires can also endanger the lives of people and destroy property when out of control. Wildfires can also cause secondary effects including erosion, landslides, introduction of invasive species, and changes in water quality. Wildfires can be caused by lightning strikes, but are most often the intentional or unintentional result of humans.

According to the NCDC databases, there have been 10 wildfire events within Sussex County between 2000 and 2006 that have resulted in losses as shown in Figure 45: Sussex County Wildfire Event History. Two different wildfires caused one injury and \$5,000 in reported damages. There have been no reported wildfires within Sussex County since 2006.

**Table 3-30: Sussex County Wildfire Event History**

Location	County/Zone	St.	Date	Time	T.Z.	Type	Mag	Dth	Inj	PrD	CrD
<a href="#">DAGSBORO</a>	SUSSEX CO.	DE	05/18/2000	17:00	EST	Wildfire	0	0	0.00K	0.00K	
<a href="#">GEORGETOWN</a>	SUSSEX CO.	DE	02/24/2002	07:00	EST	Wildfire	0	0	0.00K	0.00K	
<a href="#">INLAND SUSSEX (ZONE)</a>	INLAND SUSSEX (ZONE)	DE	07/06/2002	12:00	EST	Wildfire	0	0	0.00K	0.00K	
<a href="#">DELAWARE BEACHES / X E SUSSEX ...</a>	DELAWARE BEACHES / X E SUSSEX ...	DE	07/06/2002	12:00	EST	Wildfire	0	0	0.00K	0.00K	
<a href="#">INLAND SUSSEX (ZONE)</a>	INLAND SUSSEX (ZONE)	DE	07/09/2004	18:00	EST	Wildfire	0	0	0.00K	0.00K	
<a href="#">INLAND SUSSEX (ZONE)</a>	INLAND SUSSEX (ZONE)	DE	04/06/2005	15:09	EST	Wildfire	0	0	0.00K	0.00K	
<a href="#">INLAND SUSSEX (ZONE)</a>	INLAND SUSSEX (ZONE)	DE	04/13/2005	13:30	EST	Wildfire	0	0	0.00K	0.00K	
<a href="#">INLAND SUSSEX (ZONE)</a>	INLAND SUSSEX (ZONE)	DE	03/14/2006	12:00	EST	Wildfire	0	0	5.00K	0.00K	
<a href="#">INLAND SUSSEX (ZONE)</a>	INLAND SUSSEX (ZONE)	DE	03/22/2006	12:00	EST	Wildfire	0	0	0.00K	0.00K	
<a href="#">INLAND SUSSEX (ZONE)</a>	INLAND SUSSEX (ZONE)	DE	04/27/2006	15:00	EST	Wildfire	0	1	0.00K	0.00K	
<b>Totals:</b>							0	1	5.00K	0.00K	

Source: NOAA - National Oceanic and Atmospheric Administration - NCDC  
<https://www.ncdc.noaa.gov/stormevents/listevents.jsp?eventTypestatefips=10%2CDELAWARE>

**Prioritization and Rationale of the Wildfire Hazard**

Although there have been no previously recorded deaths, only one injury, and minimal damage from wildfire in Sussex County, there have been enough events for the HMSC and the HMWG to consider wildfire to be of significant danger to the community and thus included as an identified hazard. There has been no event occurrence since the last hazard mitigation update, thus no measurable data to generate a CPRI rating for wildfire. Thus wildfire remains unranked as show in **Table 3-31** on the following page.

## Hazard Identification

**Table 3-31: CPRI for Degree of Risk for Wildfire in Sussex County**

Probability	+	Magnitude /Severity	+	Warning Time	+	Duration	=	CPRI
0 x .45	+	0 x .30	+	0 x .15	+	0 x .10	=	0

### Erosion

Coastal erosion is the process of wearing away material from a coastal profile due to imbalance in the supply and export of material from a certain section. It takes place in the form of scouring in the foot of the cliffs or dunes or at the sub-tidal foreshore. Coastal erosion takes place mainly during strong winds, high waves and high tides and storm surge conditions, and results in coastline retreat and loss of land.

This is a simplification of the processes involved and these will vary according to the types of coast in question, cliff, coarse gravel or sandy beaches, etc. What is clear from this description is that coastal erosion is a dynamic process. It is often event-driven (a storm) and its consequences may be at least partially reversed during calmer periods. Such events are superimposed on the long-term coastal evolution. Coastal behavior also has a spatial dimension: the long-shore currents may permanently remove sediment from the shore, but they also may bring new sediments from elsewhere. Therefore, it is important to describe these processes in relation to the concept of the coastal cell.<sup>8</sup>

There are two types of soil erosion: wind erosion and water erosion. Wind erosion can cause significant soil loss. Winds blowing across sparsely vegetated or disturbed land can pick up soil particles and carry them through the air, thus displacing them. Water erosion can occur over land or in streams and channels. Water erosion that takes place over land may result from raindrops, shallow sheets of water flowing off the land, or shallow surface flow, which is concentrated in low spots. Stream channel erosion may occur as the volume and velocity of water flow increases enough to cause movement of the streambed and bank soils. Major storms such as hurricanes may cause significant erosion by combining high winds with heavy surf and storm surge to significantly impact the shoreline.

An area's potential for erosion is determined by four factors: soil characteristics, vegetative cover, topography climate or rainfall, and topography. Soils composed of a large percentage of silt and fine sand are most susceptible to erosion. As the content of these soils increases in the level of clay and organic material, the potential for erosion decreases. Well-drained and well-graded gravels and gravel sand mixtures are the least likely to erode. Coarse gravel soils are highly permeable and have a good capacity for absorption, which can prevent or delay the amount of surface runoff. Vegetative cover can be very helpful in controlling erosion by shielding the soil surface from falling rain, absorbing water from the soil, and slowing the velocity of runoff. Runoff is also affected by the topography of the area including size, shape and slope. The greater the slope length and gradient, the more

<sup>8</sup> Concepts & Science for Coastal Management:-  
[http://www.conscience-eu.net/what\\_is\\_coastal\\_erosion\\_and\\_when\\_is\\_it\\_a\\_problem/index.htm](http://www.conscience-eu.net/what_is_coastal_erosion_and_when_is_it_a_problem/index.htm)

## Hazard Identification

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potential an area has for erosion. Climate can affect the amount of runoff, especially the frequency, intensity and duration of rainfall and storms. When rainstorms are frequent, intense, or of long duration, erosion risks are high. Seasonal changes in temperature and rainfall amounts define the period of highest erosion risk of the year.

During the past 20 years, the importance of erosion control has gained the increased attention of the public. Implementation of erosion control measures consistent with sound agricultural and construction operations is needed to minimize the adverse effects associated with increasing settling out of the soil particles due to water or wind. The increase in government regulatory programs and public concern has resulted in a wide range of erosion control products, techniques, and analytical methodologies in the United States. The preferred method of erosion control in recent years has been the restoration of vegetation.

### Prioritization and Rationale of the Erosion Hazard

Although there have been no previously recorded deaths, injuries, and quantifiable damage from erosion in Sussex County, there have been events along areas of waterway currently not utilized or owned and was judged by the HMSC and the HMWG to be of significant danger to the future of the community and thus included as an identified hazard. There has been no measurable loss data to generate a CPRI rating for erosion. Thus erosion remains unranked as show in **Table 3-32** below.

**Table 3-32: CPRI for Degree of Risk for Erosion in Sussex County**

Probability	+	Magnitude /Severity	+	Warning Time	+	Duration	=	CPRI
0 x .45	+	0 x .30	+	0 x .15	+	0 x .10	=	0

### Dam/Levee Failure

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*[NOTE to Reviewers: Data for this section was retrieved from State sources. However, there seems to be questions regarding the accuracy of data as compared to the National Inventory of Dams. Review is needed to clarify and validate the data. Review and if incorrect or incomplete, please provide updated information.]*

Dams are manmade structures that serve a variety of uses such as flood protection, power production, agricultural, water supply, and to form recreational areas. They are typically constructed of earth, rock, or concrete, and come in all shapes and sizes. Dam failure is the uncontrolled release of impounded water resulting in downstream flooding, and other impacts that can affect lives and property. Dams can fail because water heights or flows are above the capacity the structure was designed for (including flooding), or because the structure failed in some way. Structures fail for many reasons, including lack of maintenance, erosion, seismic events, insufficient design, development or alteration of the floodplain, or improper construction. Concrete/masonry dams usually fail from loss of a section or undermining, while the primary causes of earthen dam failure are overtopping, followed by piping failure, and

## Hazard Identification

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then foundation failure. Concrete or masonry dams tend to fail suddenly, while earthen dams usually take longer to fail.

### Dam Hazard Potential Classifications

Dam safety inspections and monitoring have become important tools in evaluating dam failure risk, ensuring proper maintenance, and prioritizing actions. The ranking of inspections is often based on a classification system according to the potential impact a dam failure or misoperation would have on nearby populations and property. FEMA utilizes a Hazard Potential Classification System for Dams that categorizes them as Low, Significant, or High as described in **Table 3-33**.

**Table 3-34: Dam Hazard Potential Classification System**

Hazard Potential Classification	Loss of Human Life	Economic, Environmental, Lifeline Losses
Low (L)	None Expected	Low and Generally Limited to Owner
Significant (S)	None Expected	Yes
High (H)	Probable; One or More Expected	Yes

*Source: FEMA*

**Low Hazard Potential Dam:** Any dam whose failure or misoperation is **unlikely to cause** loss of human life but may cause minor economic and or environmental losses.

**Significant Hazard Potential Dam:** Any dam whose failure or misoperation will cause **possible** loss of human life, economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns.

**High Hazard Potential Dam:** Any dam whose failure or misoperation will cause **probable** loss of human life<sup>9</sup>.

### Occurrences of the Dam Failure Hazard

Dam failure can result from natural events, human-induced events, or a combination of the two. Failures due to natural events such as hurricanes, earthquakes or landslides are significant because there is generally little or no advance warning. The most common cause of dam failure is prolonged rainfall that produces flooding. Sussex County has experienced no dam failures within the last five years. The at risk inventory within the state and County are listed in **Table 3-35 and 3-36** on the following page.

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<sup>9</sup> [http://www.dnrec.delaware.gov/swc/Documents/SoilPPT/damsafety\\_files\\_/frame.htm](http://www.dnrec.delaware.gov/swc/Documents/SoilPPT/damsafety_files_/frame.htm)

## Hazard Identification

**Table 3-35: Delaware State Dam Inventory**

Delaware State Dam Inventory	
<b>Overview</b>	172 dams on the inventory 61 dams on the NID
<b>Ownership</b>	72 publicly owned 49 privately owned 52 ownership not determined
<b>Hazard Classification</b>	9 high hazard potential 27 significant hazard potential 52 low hazard potential 83 hazard potential not determined

**Table 3-36: Sussex County High & Significant Potential Dam Inventory**

Sussex County High & Significant Potential Dam Inventory			
<b>High Hazard Potential</b>	<ul style="list-style-type: none"> <li>Millsboro Pond Dam</li> <li>Records Pond Dam</li> <li>Wagamons Pond Dam</li> </ul>		
<b>Low Hazard Potential</b>	<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none;"> <ul style="list-style-type: none"> <li>Abbotts Pond Dam</li> <li>Betts Pond Route 113 Dam</li> <li>Chipmans Pond Dam</li> <li>Clendaniel Pond Dam</li> <li>Concord Pond Dam</li> <li>Cabbage Pond Dam</li> <li>DEnoname 3 (Laurel Lagoon)</li> <li>DEnoname 4 (Laurel Lagoon)</li> </ul> </td> <td style="width: 50%; border: none;"> <ul style="list-style-type: none"> <li>DEnoname 5 (Laurel Lagoon)</li> <li>Fleetwood Pond Dam</li> <li>Goslee Mill Pond Dam</li> <li>Hearns Pond Dam</li> <li>Horseys Pond Dam</li> <li>Marshall Millpond Dam</li> <li>Morris Mill Pond Dam</li> <li>Red Mill Pond Dam</li> <li>Swiggets Pond Dam</li> <li>Waples Pond Dam</li> </ul> </td> </tr> </table>	<ul style="list-style-type: none"> <li>Abbotts Pond Dam</li> <li>Betts Pond Route 113 Dam</li> <li>Chipmans Pond Dam</li> <li>Clendaniel Pond Dam</li> <li>Concord Pond Dam</li> <li>Cabbage Pond Dam</li> <li>DEnoname 3 (Laurel Lagoon)</li> <li>DEnoname 4 (Laurel Lagoon)</li> </ul>	<ul style="list-style-type: none"> <li>DEnoname 5 (Laurel Lagoon)</li> <li>Fleetwood Pond Dam</li> <li>Goslee Mill Pond Dam</li> <li>Hearns Pond Dam</li> <li>Horseys Pond Dam</li> <li>Marshall Millpond Dam</li> <li>Morris Mill Pond Dam</li> <li>Red Mill Pond Dam</li> <li>Swiggets Pond Dam</li> <li>Waples Pond Dam</li> </ul>
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### **Prioritization and Rationale of the Dam Failure Hazard**

There have been no dam failures within Sussex County thus there are no recorded deaths, injuries, or damage. The HMSC and the HMWG find the potential impacts from dam failure to be of significant danger to the community and thus included as an identified hazard. The generated CPRI for dam failure is shown in **Table 3-37** on the following page. Dam failure remains an unranked hazard.

## Hazard Identification

**Table 3-37: CPRI for Degree of Risk for Dam Failure in Sussex County**

Probability	+	Magnitude /Severity	+	Warning Time	+	Duration	=	CPRI
0 x .45	+	0 x .30	+	0 x .15	+	0 x .10	=	0

### Terrorism

The Federal Emergency Management Agency, in its guidance on integrating human-caused hazards into State and local hazard mitigation plans (FEMA Publication 386-7), has established a set of categories that can be applied to the profiling of intentional acts of terrorism. These categories are: contamination; energy release (i.e., explosives, arson, etc.), and disruption of a service.

Contamination, as it relates to terrorist activity, refers to the intentional release of chemical, biological or radiological agents, as well as nuclear hazards. Contamination can apply to human and animal life, a geographic area, agriculture/food supplies (as in agro-terrorism”), and even the electronic world of computers and information via the Internet and e-mail (as in “cyber terrorism.”)

According to Jane’s Chem-Bio Handbook, chemical agents are liquid or aerosol contaminants that can be dispersed using sprayers or other aerosol generators, by liquids vaporizing from puddles or containers, or munitions. Chemical agents may pose viable threats for hours to weeks depending on the agent used and the conditions that exist at the exposed area. This type of hazard is especially volatile because persons, vehicles, water and even the wind can carry contamination beyond the initial target zone.

Chemicals may also be corrosive or otherwise damaging *over time*, if not dealt with appropriately. Biological agents are liquid or solid contaminants that can be dispersed using sprayers or aerosol generators, or by point or line sources such as munitions, covert deposits or moving sprayers. Biological hazards may pose a danger for a period of hours to years, depending on the type of agent used and the conditions in which it exists. Contamination can be spread via water and/or wind, and infection can be spread via humans and/or animals.

FEMA’s Radiological Emergency Management Course states that radiological agents can also be dispersed using sprayers or aerosol generators, or by point or line sources such as munitions, covert deposits and moving sprayers. Radiological contaminants can be hazardous for seconds and as long as years depending on the material used. The initial effects of a radiological attack are likely to be localized to the site of the attack. However, depending on meteorological conditions, the subsequent behavior of contaminants may become more dynamic. Nuclear hazards include the detonation of a nuclear device underground, on the Earth’s surface, in the air, or at a high altitude. Heat flashes and blast waves resulting from a detonation would last for seconds, however nuclear radiation and fallout hazards can continue on for years. In addition, an electromagnetic pulse, resulting from a high-altitude detonation and lasting for a few seconds, can affect unprotected electronic systems. The initial light, heat and blast effects of a subsurface,

## Hazard Identification

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ground or airburst are static and are determined by the device's characteristics. The fallout of radioactive contaminants may be dynamic depending on meteorological conditions.

### **Cyber Terrorism**

Cyber-terrorism is a relatively new concept. According to the National Strategy for Homeland Security, terrorists may seek to cause widespread disruption and damage, including casualties, by attacking electronic and computer networks which are linked to critical infrastructures such as energy, financial and securities networks. In addition, terrorist groups are known to exploit information technology and the Internet to plan attacks, raise funds, circulate propaganda, gather information and communicate. In terms of hazard mitigation, cyber terrorism is often explored as a component in business continuity planning.

### **Energy Release**

Energy release refers primarily to the use of explosive devices, such as conventional bombs, and incendiary operations such as arson attacks. The detonation of an explosive device whether on or near a target has an instantaneous effect, which can be compounded and/or prolonged by the use of multiple devices. The extent of damage caused by an explosion is, of course, determined by the type and quantity of explosive used. It should be noted that explosive incidents could result in cascading effects, such as the incremental failure of a structure or system.

Arson and other incendiary attacks refer to the initiation of fire (which can be of an explosive nature) on or near a target. This type of event can last for minutes or hours, and possibly longer depending on the type and quantity of device or accelerant used and the materials (fuels) present at the location of the attack. This type of attack can also result in cascading failures of structures or systems.

### **Disruption of Service**

Disruption of service refers to the interruption, failure or denial of a service due to terrorist attack, such as the sabotage or designed breakdown of infrastructure as with an attack on transportation facilities, utilities and other public services. While the Federal Bureau of Investigation found no evidence of terrorism or criminal activity in its investigation of the August 2003 blackout in the Northeast United States, it is clear to see the potential damage and disruption that could be caused by intentional terrorist attack on a nation's power grids.

### **Weapons of Mass Destruction**

The term "Weapons of Mass Destruction" (WMD) has various definitions; however, common to all is the assumption that WMDs may consist of any of the agents discussed above: chemical, biological, radiological, nuclear, explosive or incendiary. The purpose of a WMD is to cause death or serious injury to persons or significant damage to property, typically assumed to be of a scale, which has the potential to overwhelm the capabilities of many local and State governments.

## Hazard Identification

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### Prioritization and Rationale of the Terrorism Hazard

Although there have been no previously recorded deaths, injuries, or damage from terrorism in Sussex County, this hazard was judged by the HMSC and the HMWG to be of significant danger to the community and thus included as an identified hazard. The generated CPRI for terrorism is shown in **Table 3-38** below. Terrorism remains an un-ranked hazard.

**Table 3-38: CPRI for Degree of Risk for Terrorism in Sussex County**

Probability	+	Magnitude /Severity	+	Warning Time	+	Duration	=	CPRI
0 x .45	+	0 x .30	+	0 x .15	+	0 x .10	=	0

### HazMat Incident

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Hazardous materials (HazMat) incidents can apply to fixed facilities as well as mobile, transportation-related accidents in the air, by rail, on the Nation’s highways and on the water. In essence, HazMat incidents consist of solid, liquid and/or gaseous contaminants that are released from fixed or mobile containers, whether by accident or by design as with an intentional terrorist attack. A HazMat incident can last hours to days, while some chemicals can be corrosive or otherwise damaging over longer periods of time. In addition to the primary release, explosions and/or fires can result from a release, and persons, vehicles, water, wind and possibly wildlife can extend contaminants beyond the initial area as well.

HazMat incidents can also occur as a result of or in tandem with natural hazard events, such as floods, hurricanes, tornadoes and earthquakes, which in addition to causing incidents, may also hinder response efforts. In the case of Hurricane Floyd in September 1999, communities along the Eastern United States were faced with flooded junkyards, disturbed cemeteries, deceased livestock, floating propane tanks, uncontrolled fertilizer spills and a variety of other environmental pollutants that caused widespread toxological concern.

According to the Pipeline and Hazardous Materials Administration, there were approximately 149 hazardous material incidents in the State since 2007. None of these incidents are reported to have an associated death or major injury associated with the incident. And only two incidents resulted in non-hospitalized injuries.

According to data from Sussex County EOC, the County responded to 11 hazardous materials incidents from 2011 through July 2016. Incidents have included release of Ammonia, Anhydrous Ammonia, Diesel Fuel and Fuel Oils, Hexamethylene Diamine, Mineral Oil and Propane Gas.

### Pipeline Failure

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The energy infrastructure of the United States is comprised of many components, including the physical network of pipes for oil and natural gas, electricity transmission lines, and other means for transporting energy to the Nation’s consumers. This infrastructure also includes facilities that convert raw natural resources into energy products, as well as the rail network, trucking lines and marine transportation. (U.S. Department of Energy, 2003)

## Hazard Identification

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Much of this infrastructure is aging, and in addition to the challenges of keeping the infrastructure up-to-date with the latest technological advances and consumer needs, the potential for an energy pipeline failure to become a hazard in-and-of-itself must be considered.

The two million miles of oil pipelines in the United States are the principal mode for transporting oil and petroleum products such as gasoline, and virtually all natural gas in the United States is moved via pipeline as well (DOE, 2003). Much of this oil pipeline infrastructure is old, requiring regular safety and environmental reviews to ensure its safety and reliability. The potential risk of pipeline accidents is a significant national concern.

The energy infrastructure is vulnerable to physical and cyber disruption, either of which could threaten its integrity and safety (DOE, 2003). Disruptions could originate with natural events such as geomagnetic storms and earthquakes, or could result from accidents, equipment failures or deliberate interference. In addition, the Nation’s transportation and power infrastructures have grown increasingly complex and interdependent; consequently, any disruption could have far-reaching consequences.

### Prioritization and Rationale of the Pipeline Failure Hazard

There have been no pipeline failures within Sussex County. Although there have been no previously recorded deaths, injuries, or damage from pipeline failure in Sussex County, this hazard was judged by the HMSC and the HMWG to be of significant danger to the community and thus included as an identified hazard. The generated CPRI for pipeline failure is shown in **Table 3-39** below. Pipeline failure remains an un-ranked hazard.

**Table 3-39: CPRI for Degree of Risk for Terrorism in Sussex County**

Probability	+	Magnitude /Severity	+	Warning Time	+	Duration	=	CPRI
0 x .45	+	0 x .30	+	0 x .15	+	0 x .10	=	0

## Hazard Prioritization

### Prioritization and Rationale of the Hazard

In order to summarize the massive amounts of information and provide a level playing field for comparing hazards, analysis is performed for each hazard, and the risk to the County is evaluated based on the Calculated Priority Risk Index (CPRI). The purpose of the CPRI is not to replace scientific or local knowledge or to have the final say on a hazard, but to provide the County with a means for looking at the hazards for further vulnerability analysis. Each CPRI is accompanied by a rationale for why that particular hazard will be included or excluded.

CPRI values are based upon previous event history and hazard definitions, and combine the hazard’s probability of future occurrence, magnitude or severity of the hazard’s impacts, warning time before an event occurs, and the duration of the event. The categories are shown in **Tables 3-40 through 3-42**.

## Hazard Identification

**Table 3-40: Probability of Future Occurrence Based on Previous Hazard Events**

Probability	Index Value	Description
Highly Likely	4	<ul style="list-style-type: none"> <li>Frequent significant events with a well documented history of occurrence.</li> <li>Event has up to 1 in 1 year chance of occurring. (1/1 = 100%)</li> <li>History of events is 33%-100% likely per year.</li> </ul>
Likely	3	<ul style="list-style-type: none"> <li>Occasional significant occurrences with at least two or more documented historic significant events.</li> <li>Event has up to 1 in 3 year's chance of occurring. (1/3 = 33%)</li> <li>History of events is 20%-33% likely per year.</li> </ul>
Possibly	2	<ul style="list-style-type: none"> <li>Rare significant occurrences with at least one documented or anecdotal historic significant event</li> <li>Event has up to 1 in 5 year's chance of occurring. (1/5=20%)</li> <li>History of events is 10%-20% likely per year.</li> </ul>
Unlikely	1	<ul style="list-style-type: none"> <li>Extremely rare with no documented history of significant events occurring.</li> <li>Event has up to 1 in 10 year's chance of occurring. (1/10=10%)</li> <li>History of events is 0%-10% likely per year.</li> </ul>

**Table 3-41: Magnitude/Severity of Potential Impacts Based on Previous Hazard Events**

Magnitude/Severity	Index Value	Description
Catastrophic	4	<ul style="list-style-type: none"> <li>Multiple deaths</li> <li>More than 50% of property is severely damaged</li> <li>Complete shutdown of facilities for more than 1 month</li> </ul>
Critical	3	<ul style="list-style-type: none"> <li>Injuries and/or illnesses result in permanent disability</li> <li>More than 25% of property is severely damaged</li> <li>Complete shutdown of critical facilities for at least 14 days</li> </ul>
Limited	2	<ul style="list-style-type: none"> <li>Injuries and/or illnesses do no result in permanent disability</li> <li>More than 10% of property is severely damaged</li> <li>Complete shutdown of critical facilities for at least 1 day</li> </ul>
Negligible	1	<ul style="list-style-type: none"> <li>Injuries and/or illnesses are treatable with first aid</li> <li>Less than 25% of property is severely damaged</li> <li>Shutdown of critical facilities for 24 hours or less</li> </ul>

## Hazard Identification

**Table 3-42: 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 3-43: Duration of Hazard Event Based on Hazard Definition**

Warning Time	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

The HMSC and HMWG identified 14 natural and 3 manmade/technological hazards for consideration within this hazard mitigation plan update. Having applied the CPRI values in assessing the hazards, the prioritization of the hazards under consideration are displayed in **Table 3-44**. The CPRI generated values are found following in **Table 3-45** on the following page.

**Table 3-44: Overall Hazard Ranking**

Identified Hazards to be Updated	
Flood	1
Thunderstorm	2
Hurricane Wind	2
Drought	4
Extreme Heat/Cold	5
Winter Storm	6
Tornado	7
Hail	8
Tsunami	9
Earthquake	Unranked
Wildfire	Unranked
Erosion	Unranked
Dam/Levee Failure	Unranked
Terrorism	Unranked
HazMat Incident	Unranked
Pipeline Failure	Unranked

## Hazard Identification

**Table 3-45: CPRI Hazard Ranking Index**

CALCULATED PRIORITY RANKING INDEX SUMMARY						
Hazard	Probability	Magnitude and/or Severity	Warning Time	Duration	CPRI Score	Hazard Ranking
Flood	1.8	.60	.30	.30	3	1
Drought	.90	.60	.15	.40	2.05	4
Winter Storm	1.35	.30	.15	.20	2	6
Thunderstorm	1.8	.60	.30	.20	2.9	2
Extreme Heat/Cold	1.35	.30	.15	.30	2.1	5
Tornado	.45	.60	.60	.10	1.75	7
Hurricane Wind	1.8	.60	.30	.20	2.9	2
Hail	.90	.30	.45	.10	1.75	8
Tsunami	.45	.30	.15	.10	1	9
Earthquake	--	--	--	--	--	10
Wildfire	--	--	--	--	--	Unranked
Erosion	--	--	--	--	--	Unranked
Dam/Levee Failure	--	--	--	--	--	Unranked
Terrorism	--	--	--	--	--	Unranked
HazMat Incident	--	--	--	--	--	Unranked
Pipeline Failure	--	--	--	--	--	Unranked

## SECTION 4: HAZARD AND VULNERABILITY AND RISK ASSESSMENT

### Contents of this Section

- Requirement for Hazard Identification
- Overview of Sussex County's Risk and Vulnerability Process
- Overview of Sussex County's Assets and Development Trends
  - Population and Demographics
  - General Building Stock
  - Critical Facilities
  - Future Land Use and Development
- Estimate of Potential Losses
  - Flood
  - Thunderstorm
  - Hurricane Wind
  - Drought
  - Extreme Heat/Cold
  - Winter Storm
  - Tornado
  - Hail
  - Tsunami
  - Earthquake
  - Wildfire
  - Dam/Levee Failure
  - Terrorism
  - HazMat Incident
  - Pipeline Failure
- Summary of Risk Assessment

### Requirement for the Risk and Vulnerability Assessment

**Requirement §201.6(c)(2)(i):** *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)(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)(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 planning area.

### Overview of Sussex County's Risk and Vulnerability Assessment Process

A high-level, detailed risk and vulnerability assessment was completed for Sussex County for flood (riverine and coastal), severe winds (hurricanes, coastal storms, and tornados), thunderstorms, drought, extreme weather (hot/cold), winter storms, hail, earthquakes, terrorism, hazardous materials and energy pipeline failures, due to the higher level of vulnerability for these hazards compared to others. It is important to note that this risk and vulnerability assessment is based on best available data and represents a base-level assessment for the planning area.

The loss estimates provided in this section have resulted in an *approximation* of vulnerability. These estimates should be used to understand relative vulnerability from hazards and potential losses. However, it is important to understand that uncertainties are inherent in any loss estimation methodology, arising in part from incomplete scientific knowledge concerning natural hazards and their effects on the built environment. Uncertainties also result from approximations and simplifications that are necessary for a comprehensive analysis (such as abbreviated inventories, demographics or economic parameters).

To conduct the risk and vulnerability assessment effort, two distinct hazard vulnerability assessment methodologies were applied; utilizing both HAZUS-MH (FEMA's loss estimation software) and a statistical vulnerability assessment methodology. Both approaches provide estimates for the potential impact by using a common, systematic framework for evaluation.

The HAZUS-MH vulnerability assessment methodology is parametric, in that distinct hazard and inventory parameters (for example, wind speed and building types) were modeled using the HAZUS-MH software to determine the impact (damages and losses) on the built environment. The HAZUS-MH software was used to estimate losses from wind (hurricane and tornado), earthquake and flood hazards.

The second methodology, a statistical vulnerability assessment methodology, was applied to analyze hazards of concern that are outside the scope of the HAZUS-MH software. The methodology uses a statistical approach and mathematical modeling of vulnerability to predict a hazard's frequency of occurrence and estimated impacts based on recorded or historic damage information.

For the 2015 Plan Update, this risk and vulnerability assessment was recalculated to take advantage of improvements to the HAZUS-MH software algorithms, better and more accurate input data, and a more transparent and statistically sound loss estimation method for non-spatially specific hazards.

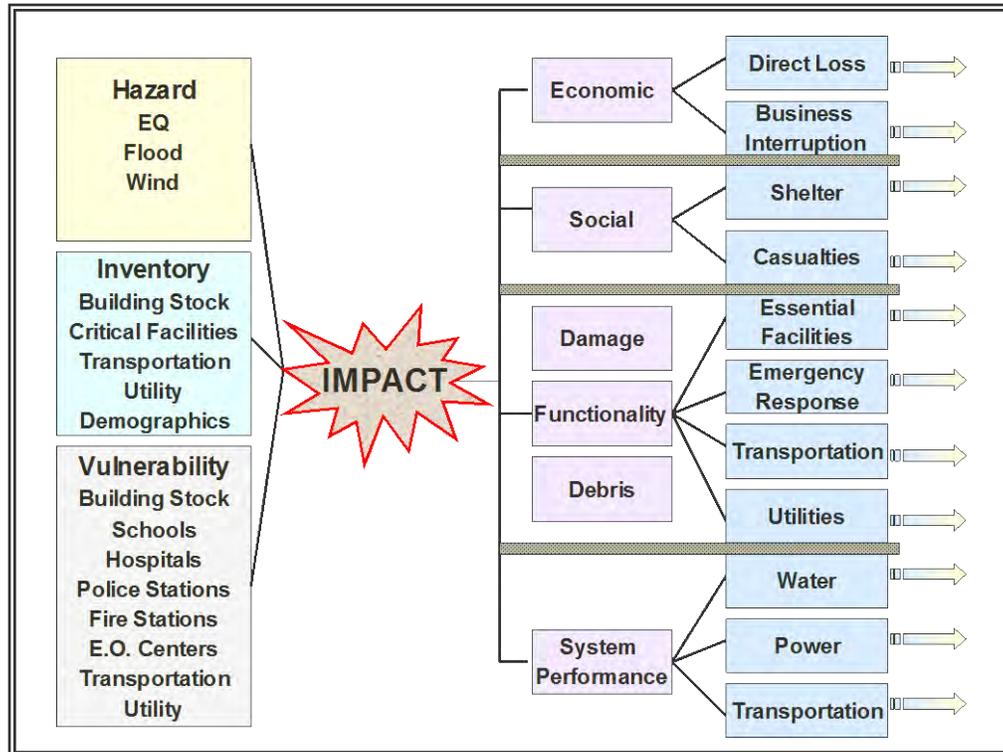
#### Explanation of HAZUS-MH Vulnerability Assessment Methodology

HAZUS-MH is FEMA's standardized loss estimation software program, built upon an integrated geographic information system (GIS) platform (**Figure 4 - 1**). This vulnerability

## Hazard and Vulnerability and Risk Assessment

assessment applied HAZUS-MH to produce regional profiles and estimate losses for three of the nine ranked hazards addressed in this section: flood, hurricane winds and earthquake.

**Figure 4-1: Conceptual Model of HAZUS-MH Methodology**



### Explanation of Regional Vulnerability Assessment Methodology

Vulnerabilities associated with other natural hazards were analyzed using a regional assessment methodology developed and used specifically for this effort. This approach is based on the principal that any spatially; nonspecific hazard event is essentially a random occurrence within a region and had just as much chance of occurring within the study area as outside. Historical data for each hazard are used and statistical evaluations are performed using manual calculations. The general steps used in the statistical vulnerability assessment methodology are summarized below:

- Buffer the study area to determine the regional assessment area;
- Compile hazard occurrence data for the regional area from national and local sources;
- Categorize hazard parameters for each hazard to be modeled;
- Calculate the annualized occurrence and loss estimates for each regional subdivision;
- Normalize the annualized occurrence and loss estimates by land area and number of housing units respectively; and
- Determine the overall regional average of annualized occurrence and loss.

The economic loss results are presented here using two interrelated vulnerability indicators:

## Hazard and Vulnerability and Risk Assessment

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1. The Annualized Loss (AL), which is the estimated long-term value of losses to the general building stock in any single year in a specified geographic area (i.e., city or County).
2. The Annualized Loss Ratio (ALR), which expresses estimated annualized loss as a fraction of the building inventory replacement value.

The estimated Annualized Loss (AL) addresses two key components of vulnerability: the probability of the hazard occurring in the study area and the consequences of the hazard, largely a function of building construction type and quality, and of the intensity of the hazard event. By annualizing estimated losses, the AL factors in historic patterns of frequent smaller events with infrequent but larger events to provide a balanced presentation of the vulnerability.

The Annualized Loss Ratio (ALR) represents the AL as a fraction of the replacement value of the local building inventory. This ratio is calculated using the following formula:

$$\text{“ALR} = \text{ANNUALIZED LOSSES} / \text{TOTAL EXPOSURE AT RISK”}$$

The annualized loss ratio gauges the relationship between average annualized loss and building replacement value. This ratio can be used as a measure of relative vulnerability between areas and, since it is normalized by replacement value, it can be directly compared across different geographic units such as metropolitan areas or counties.

It is important to note that HAZUS-MH was used to produce “worst case scenario” results. The outputs in this document are considered to be the result of a worst-case scenario event for each hazard, and it is understood that any smaller events would most likely create fewer losses than those calculated here.

Finally, in each of the loss tables for specific jurisdictions, the loss is listed as negligible. Negligible specifically means less than \$5,000 in losses per jurisdiction. While not listed individually, these small losses are included in the total loss estimates.

### Minor Civil Divisions (MCDs)

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Many of the tables presented in the *Risk and Vulnerability Assessment* use Minor Civil Divisions (MCDs), which are a traditional way to divide counties into subdivisions<sup>10</sup> (Figure 4-2). MCDs are recognized by the U.S. Census Bureau and are a national standard by which HAZUS-MH results are prepared (due in part to the reliance of HAZUS on U.S. Census data.) Minor Civil Divisions cover the entire country and provide a standard level of geography below the County boundary.<sup>11</sup>

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<sup>10</sup> <sup>1</sup> The expanded definition of a Minor Civil Division according to the U.S. Census Bureau is, “the primary governmental or administrative division of a County or statistically equivalent entity in many states and statistically equivalent entities...a Minor Civil Division is created to govern or administer an area rather than a specific population.”

<sup>11</sup> Minor Civil Divisions are typically most common in the Eastern United States, while Census County Divisions (CCDs), a similar method of dividing counties into subdivisions, are more common in the Western United States.

Figure 4-2: Minor Civil Divisions (U.S. Census 2000)



In the studies conducted for Sussex County, and cities, such as Lewes and Seaford, are separated from the MCDs in jurisdiction-level analyses. This was done in order to provide a more detailed cross section of the planning area and eliminate tendencies to double-count available information.

### *Overview of Sussex County's Assets and Development Trends*

To better understand a community's risks, an evaluation of which assets are exposed to hazard events must be completed. The inventory of assets that should be considered includes the population, structures, and lifelines that could be impacted by hazard events. Section 3 provides brief descriptions of historical hazard impacts, the locations and extent of the hazards, and the impact on life and property due to each of the hazards. This Section will describe the County's overall inventory that could be injured, damaged, or destroyed during the occurrence of a hazard and possible future development trends. FEMA's spatial loss estimation software, HAZUS-MH, includes data for a number of inventory categories and was used as the foundation for the inventory data for this Plan. HAZUS-MH utilizes a number of data sources, including Census 2010 data, Dun & Bradstreet data, and Homeland Security Infrastructure Protection data to create the inventory database. Since this is a national inventory database, the accuracy of HAZUS-MH outputs can be improved by refining the inventory data based on local data.

#### **Development Trends**

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The resident population of the State of Delaware is projected to increase from 197,145 in 2010 to approximately 247,276 by 2030 (U.S. Census Bureau and Delaware Population Consortium). Delaware's rate of population change, at 25.43 percent, ranks as the 17th largest in the Nation. The percent change in housing units in the State is estimated to have been 18.3 percent from 2000 to 2010, which ranks Delaware as 13th in the Nation. These trends demonstrate that Delaware's population is increasing, and consequently the number of residential structures and the associated exposure of residential buildings will increase as well. Assuming a multiplier of 1.00812, the total residential exposure of Sussex County could reach an estimated dollar value of nearly \$22 billion by 2025. This estimate does not of course take into account many other development factors, such as available land for new residential construction.

#### **Population and Demographics**

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According to Census Bureau statistics, there was a population of 49,255 in 1960 in Sussex County. This increased by 57.40% by 1970, again by 49.78% in the following decade, and by 12.77% from 1980 to 1990. According to the 2000 Census data, Sussex saw an increase from 1990 to 2000 of 10.10%, for a total population of 156,638. From 2000 to 2010, the County underwent a 25.86% growth for a population of 197,145. **Table 4-1** on the next page shows the population growth from 1990 to 2010 in individual municipalities. **Figure 4-3** on the following page shows the County population levels projected out to 2030 based on 2010 Census data.

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<sup>12</sup> Based on the percent change in housing units for a two-year period and weighted for Sussex County

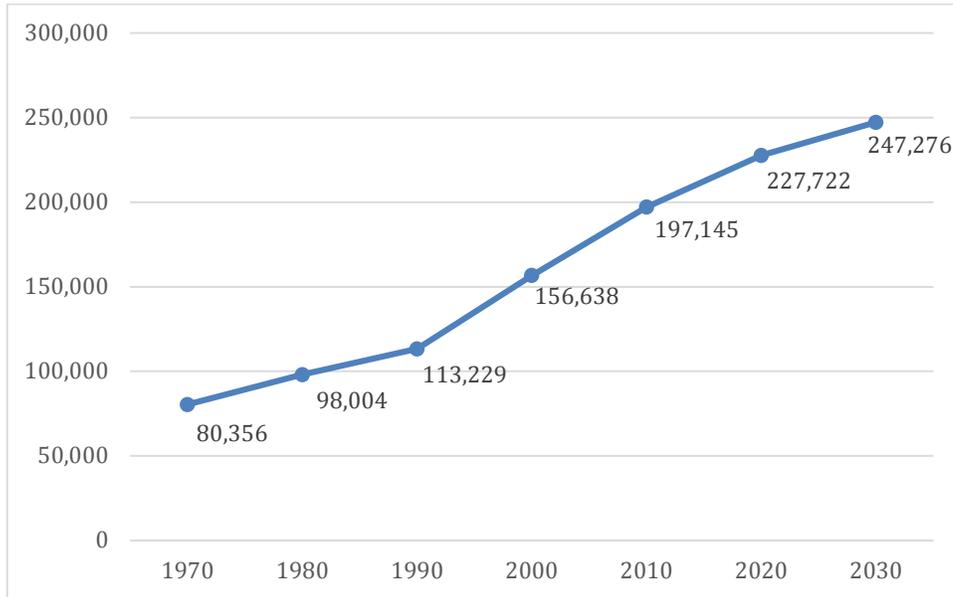
## Hazard and Vulnerability and Risk Assessment

**Table 4-1: Population Growth from 1980 to 2000 by Municipality in Sussex County**

Jurisdiction	1990 Population	2000 Population	2010 Population	% Change from 2000 to 2010
Sussex County	113,229	156,638	197,145	25.86%
Town of Bethany Beach	315	905	1,060	17.13%
Town of Bethel	157	184	171	-7.07%
Town of Blades	1079	1100	1,241	12.82%
Town of Bridgeville	1361	1546	2,048	32.47%
Town of Dagsboro	488	520	805	54.81%
Town of Delmar	1,292	1,443	1,597	10.67%
Dewey Beach	208	300	341	13.67%
Town of Ellendale	334	336	381	13.39%
Town of Fenwick Island	178	343	379	10.50%
Town of Frankford	536	716	847	18.30%
Town of Georgetown	3,983	4,789	6,422	34.10%
Town of Greenwood	587	844	973	15.28%
Town of Henlopen Acres	108	133	122	-8.27%
Town of Laurel	3,431	3,746	3,708	-1.01%
City of Lewes	2,343	2,923	2,747	-6.01%
Town of Millsboro	1,688	2,497	3,877	55.27%
Town of Millville	189	255	544	113.34%
Town of Milton	1,703	1,719	2,576	49.85%
Town of Ocean View	770	1,044	1,882	80.27%
City of Rehoboth Beach	1,335	1,500	1,327	-11.53%
City of Seaford	5,703	6,786	6,928	2.09%
Town of Selbyville	1,482	1,723	2,167	25.77%
Town of Slaughter Beach	100	198	207	4.55%
Town of South Bethany	146	493	449	-8.92%

Source: U.S. Census Bureau, 2010 Census Redistricting Data (Public Law 94-171) Summary File

**Figure 4-3: Sussex County Growth**



Source: U.S. Census Bureau, 2010 Census Redistricting Data (Public Law 94-171) Summary File

## General Building Stock

Sussex County is the geographically largest of Delaware’s three counties with 979 square miles with over 79,000 households. There are an estimated 117,721 buildings in the region with a total building replacement value (excluding contents) of \$29,088,935. Approximately 95% of the County’s structures and 85% of the building value are associated with residential housing. Wood frame construction makes up 81% of the building inventory, with the other 19% constructed of steel, concrete, precast, and reinforced masonry, unreinforced masonry, or manufactured housing. In HAZUS-MH analysis, the general building stock is grouped and evenly distributed at the census block or tract level.

**Table 4-2: Building Exposure by Occupancy in Sussex County**

Occupancy	Exposure	% of Total Building Inventory
<b>Residential</b>	\$24,583,638	84.3%
<b>Commercial</b>	\$2,929,442	10.1%
<b>Industrial</b>	\$837,785	2.9%
<b>Agricultural</b>	\$137,440	0.5%
<b>Religious</b>	\$302,380	1.0%
<b>Government</b>	\$131,853	0.5%
<b>Education</b>	\$166,397	0.6%

## Hazard and Vulnerability and Risk Assessment

Occupancy	Exposure	% of Total Building Inventory
<b>Total</b>	<b>\$29,088,935</b>	<b>100.0%</b>

Source: HAZUS-MH Analysis completed June 2016.

### Critical Facilities

For this Plan, a focus on the accuracy of the essential facilities and some of the lifeline data was a priority. The lifeline data that was updated for this Plan included potable water system facilities and wastewater treatment plants. The Delaware River Basin Commission (DRBC) shared the HAZUS-MH data that was updated based on their partnerships with certain communities, which they compiled in 2007 for the *Multi-Jurisdictional Flood Mitigation Plan for Municipalities in the Non-tidal, New Jersey Section of the Delaware River Basin*. This update did not include the entire County, only those municipalities within the designated watershed who chose to participate. Sussex County GIS Department provided data for essential facilities updates. All of the relevant data was then compiled and reloaded into HAZUS-MH for use in the analysis and loss estimations.

**Table 4-3** provides the facility class codes for essential facilities and utilities that are included in **Tables 4-4** through **4-10**.

**Table 4-3: Facility Class Code Definitions**

Facility Class	Type of Facility	Occupancy Class	Description
EFE0	ESF: Emergency Response	Emergency Operation Centers	-
EFFS	ESF: Emergency Response	Fire Station	-
EFPS	ESF: Emergency Response	Police Station	-
EFHS	ESF: Medical Care	Small Hospital	Hospital with less than 50 beds
EFHM	ESF: Medical Care	Medium Hospital	Hospital with beds between 50-150
EFHL	ESF: Medical Care	Large Hospital	Hospital with greater than 150 beds
EFMC	ESF: Medical Care	Medical Clinic	Clinics, Labs, Blood Banks
MDFLT	ESF: Medical Care	Default for Medical	
EFS1	ESF: School	School	Primary and High School, K-12
EFS2	ESF: School	College/University	Community and State Colleges, State and Private Universities
PDFLT	Utility	Default for Potable Water	-
WDFLT	Utility	Default for Waste Water Facility	-

## Hazard and Vulnerability and Risk Assessment

Source: HAZUS-MH Technical and User Manuals.

There is 1 Emergency Operations Center in the Sussex County essential facility inventory that was used for analysis, as listed in **Table 4-4**.

**Table 4-4: Essential Facilities – Emergency Operation Centers in Sussex County**

Facility Name	Jurisdiction	Facility Class
Sussex County Emergency Operations Center	Sussex County	EFEO

Source: HAZUS-MH, DRBC, and local data sources.

There are 27 fire station facilities in the Sussex County essential facility inventory that were used for analysis, as listed in **Table 4-5**.

**Table 4-5: Essential Facilities – Fire Station Facilities in Sussex County**

Facility Name	Jurisdiction	Facility Class
Bethany Beach Fire Sta. 70 Station 1	Bethany Beach	EFFS
Bethany Beach Fire Sta. 70 Station 2	Fenwick Island	EFFS
Bethany Beach Police Department	Bethany Beach	EFFS
Blades Volunteer Fire Sta. 71	Blades	EFFS
Bridgeville Volunteer Fire Sta. 72	Bridgeville	EFFS
Carlisle Fire Co. Station 42	Milford	EFFS
Dagsboro Fire Sta. 73	Dagsboro	EFFS
Delmar Fire Sta. 74	Delmar	EFFS
Ellendale Volunteer Fire Sta. 75	Ellendale	EFFS
Frankford Volunteer Fire Sta. 76	Frankford	EFFS
Georgetown Fire Sta. 77	Georgetown	EFFS
Greenwood Volunteer Fire Sta. 78	Greenwood	EFFS
Gumboro Volunteer Fire Sta. 79	Millsboro	EFFS
Indian River Volunteer Fire Sta. 80 Station 1	Millsboro	EFFS
Indian River Volunteer Fire Sta. 80 Station 2	Millsboro	EFFS
Laurel Fire Sta. 81	Laurel	EFFS
Lewes Fire Sta. 82 Station 1	Lewes	EFFS
Lewes Fire Sta. 82 Station 2	Lewes	EFFS
Lewes/Rehoboth Station 3	Lewes	EFFS
Memorial Fire Sta. 89	Slaughter Beach	EFFS
Millsboro Volunteer Fire Sta. 83	Millsboro	EFFS
Millville Volunteer Fire Sta. 84	Millville	EFFS
Milton Fire Sta. 85	Milton	EFFS
Rehoboth Beach Volunteer Fire Sta. 86 Station 1	Rehoboth Beach	EFFS
Rehoboth Beach Volunteer Fire Sta. 87 Station 2	Rehoboth Beach	EFFS
Roxana Volunteer Fire Sta. 90 HQ	Roxana	EFFS
Roxana Volunteer Fire Sta. 90 Station 2	Selbyville	EFFS

Source: HAZUS-MH, DRBC, and local data sources.

## Hazard and Vulnerability and Risk Assessment

There are 23 police station facilities in the Sussex County essential facility inventory that were used for analysis, as listed in **Table 4-6**.

**Table 4-6: Essential Facilities – Police Station Facilities in Sussex County**

Facility Name	Jurisdiction	Facility Class
Bethany Beach Police Department	Bethany Beach	EFPS
Blades Police Department	Blades	EFPS
Bridgeville Police Department	Bridgeville	EFPS
Dagsboro Police Department	Dagsboro	EFPS
Lewes Police Department	Lewes	EFPS
Delmar Police Department	Delmar	EFPS
Dewey Beach Police Department	Dewey Beach	EFPS
DSP Aviation Unit South	Georgetown	EFPS
DSP Troop 4	Georgetown	EFPS
DSP Troop 5	Bridgeville	EFPS
DSP Troop 7	Lewes	EFPS
Ellendale Police Department	Ellendale	EFPS
Fenwick Island Police Department	Fenwick Island	EFPS
Georgetown Police Department	Georgetown	EFPS
Greenwood Police Department	Greenwood	EFPS
Laurel Police Department	Laurel	EFPS
Millsboro Police Department	Millsboro	EFPS
Milton Police Department	Milton	EFPS
Ocean View Police Department	Ocean View	EFPS
Rehoboth Beach Police Department	Rehoboth Beach	EFPS
Seaford Police Department	Seaford	EFPS
Selbyville Police Department	Selbyville	EFPS
South Bethany Police Department	South Bethany	EFPS

Source: HAZUS-MH, DRBC, and local data sources.

There are 14 medical care facilities in the Sussex County essential facility inventory that was used for analysis, as listed in **Table 4-7**.

**Table 4-7: Essential Facilities – Medical Care Facility in Sussex County**

Facility Name	Jurisdiction	Facility Class
Bayhealth- Milford Memorial Hospital	Milford	EFHL
Beebe Medical Center	Lewes	EFMC
Nanticoke Memorial Hospital	Seaford	EFHM
Bayview Endoscopy Center, LLC	Lewes	EFMC
Cedar Tree Surgical Center	Millsboro	EFMC
Coastal Care Pain Center	Lewes	EFMC
Delaware Eye Surgery Center	Rehoboth Beach	EFMC
Seaside Endoscopy Pavilion	Lewes	EFMC
FMC Dialysis Services of Milford, INC.	Milford	EFMC

## Hazard and Vulnerability and Risk Assessment

Facility Name	Jurisdiction	Facility Class
FMC Dialysis Services of Rehoboth, INC.	Rehoboth Beach	EFMC
FMC Dialysis Services of Seaford, INC.	Seaford	EFMC
Mid Sussex	Georgetown	EFMC
Liberty Seaford	Seaford	EFMC
Delaware Eye Institute	Rehoboth Beach	EFMC

Source: HAZUS-MH, DRBC, and local data sources.

There are 56 school facilities in the Sussex County essential facility inventory that were used for analysis, as listed in **Table 4-8**.

**Table 4-8: Essential Facilities – School Facilities in Sussex County**

Facility Name	School District	Facility Class
Beacon Middle School	Cape Henlopen School District	EFS1
Cape Henlopen High School	Cape Henlopen School District	EFS1
H. O. Brittingham Elementary School	Cape Henlopen School District	EFS1
Mariner Middle School	Cape Henlopen School District	EFS1
Milton Elementary School	Cape Henlopen School District	EFS1
Rehoboth Elementary School	Cape Henlopen School District	EFS1
Richard A. Shields Elementary School	Cape Henlopen School District	EFS1
Sussex Consortium	Cape Henlopen School District	EFS1
Delmar Middle School	Delmar School District	EFS1
Delmar Senior High School	Delmar School District	EFS1
East Millsboro Elementary School	Indian River School District	EFS1
Georgetown Elementary School	Indian River School District	EFS1
Georgetown Middle School	Indian River School District	EFS1
G. W. Carver Center	Indian River School District	EFS1
Howard T. Ennis School	Indian River School District	EFS1
Indian River High School	Indian River School District	EFS1
John M. Clayton Elementary School	Indian River School District	EFS1
Kindergarten Center	Indian River School District	EFS1
Long Neck Elementary School	Indian River School District	EFS1
Lord Baltimore Elementary School	Indian River School District	EFS1
Millsboro Middle School	Indian River School District	EFS1
North Georgetown Elementary School	Indian River School District	EFS1
Phillip C. Showell Elementary School	Indian River School District	EFS1
Selbyville Middle School	Indian River School District	EFS1
Southern Delaware School of the Arts	Indian River School District	EFS1
Sussex Central High School	Indian River School District	EFS1
Laurel Intermediate School	Laurel School District	EFS1
Laurel Middle School	Laurel School District	EFS1

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Facility Name	School District	Facility Class
Laurel Senior High School	Laurel School District	EFS1
North Laurel Elementary School	Laurel School District	EFS1
Paul Laurence Dunbar Elementary School	Laurel School District	EFS1
Western Sussex Academy	Laurel School District	EFS1
Benjamin Banneker Elementary School	Milford School District	EFS1
Morris Early Childhood Center	Milford School District	EFS1
Lulu M. Ross Elementary School	Milford School District	EFS1
Milford Central Academy	Milford School District	EFS1
Milford Senior High School	Milford School District	EFS1
Misphillion Elementary School	Milford School District	EFS1
Delmarva Christian High School	Private	EFS1
Epworth Christian School	Private	EFS1
Lighthouse Christian School	Private	EFS1
Seaford Christian Academy	Private	EFS1
The Cedars Academy	Private	EFS1
The Jefferson School	Private	EFS1
Blades Elementary School	Seaford School District	EFS1
Frederick Douglass Elementary School	Seaford School District	EFS1
Seaford Central Elementary School	Seaford School District	EFS1
Seaford High School	Seaford School District	EFS1
Seaford Middle School	Seaford School District	EFS1
West Seaford Elementary	Seaford School District	EFS1
Sussex Academy	Sussex County	EFS1
Sussex Technical High School	Sussex County	EFS1
Early Childhood Education Center	Woodbridge School District	EFS1
Phillis Wheatley Elementary School	Woodbridge School District	EFS1
Woodbridge Middle School	Woodbridge School District	EFS1
Woodbridge High School	Woodbridge School District	EFS1

Source: HAZUS-MH, DRBC, and local data sources.

There are 6 potable water facilities in the Sussex County utilities inventory that were used for analysis, as listed in **Table 4-9**.

**Table 4-9: Utilities – Potable Water Facilities in Sussex County**

Facility Name	Jurisdiction	Facility Class
South Coastal Wastewater Treatment Plant #40	Frankford	PDFLT
Inland Bay's Treatment Facility #84	Millsboro	PDFLT
Piney Neck Treatment Facility	Dagsboro	PDFLT
South Coastal Wastewater Treatment Plant #40	Frankford	PDFLT
Sussex County Industrial Airpark Water Plant #25	Georgetown	PDFLT
Wolfeneck Treatment Facility	Rehoboth Reach	PDFLT

Source: HAZUS-MH, DRBC, and local data sources.

## Hazard and Vulnerability and Risk Assessment

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There are 17 waste water system facilities in the Sussex County utilities inventory that were used for analysis, as listed in **Table 4-10**.

**Table 4-10: Utilities – Waste Water System Facilities in Sussex County**

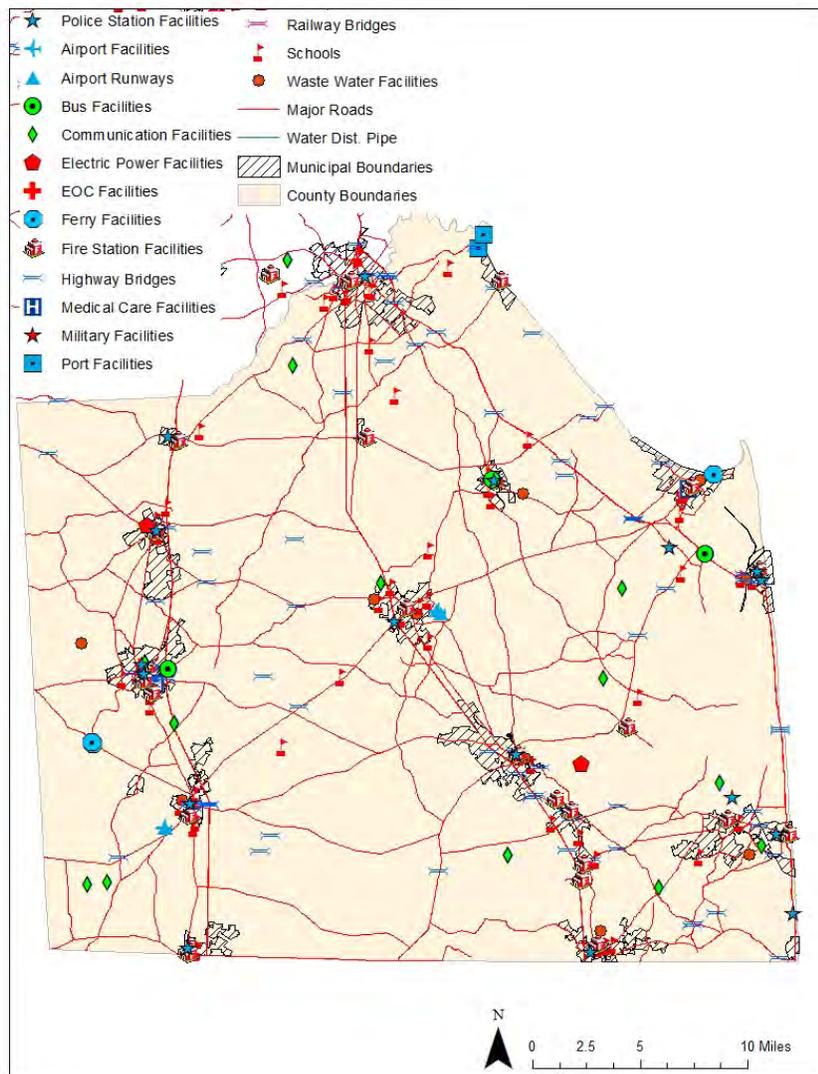
Facility Name	Jurisdiction	Facility Class
DB-4	Dewey Beach	WDFLT
DB-5	Dewey Beach	WDFLT
DB-6		WDFLT
DF-8	Dagsboro	WDFLT
AIR-26	Georgetown	WDFLT
SC-43	Bethany Beach	WDFLT
BL-45	Blades	WDFLT
SC-67	Frankford	WDFLT
LN-82	Millsboro	WDFLT
EL-90	Ellendale	WDFLT
SC-99	Ocean View	WDFLT
SC-100	Ocean View	WDFLT
OO-189	Millsboro	WDFLT
WR-196	Lewes	WDFLT
LN-197	Millsboro	WDFLT
WR-210	Lewes	WDFLT
CN-256	Henlopen Acres	WDFLT

Source: HAZUS-MH, DRBC, and local data sources.

Figure 4-4 on the following page shows the locations of the essential facilities, potable water facilities, and waste water system facilities throughout Sussex County that were used in this analysis.

# Hazard and Vulnerability and Risk Assessment

Figure 4-4: Essential Facilities, Potable Water Facilities, and Waste Water System Facilities in Sussex County



Source: HAZUS-MH, DRBC, and local data sources.

In Sussex County, the replacement value of the transportation systems is estimated to be approximately \$2,052,000,000 and the utility lifeline systems to be about \$398,000,000, for a total of over \$2,450,000,000. This inventory includes approximately 290 kilometers of highways, 155 bridges, and 6,383 kilometers of pipes.

## Summary of Risk and Vulnerability Assessment

### Critical Facilities

For the purposes of this risk and vulnerability assessment, the label “critical facility” may refer to any of the following: airports, colleges, dams, day care centers, dispatch centers, electric switching stations, Emergency Operations Centers (EOCs), fire departments, food storage facilities, gas compressor stations, gas LNG plants, gate stations for utility

## Hazard and Vulnerability and Risk Assessment

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companies, generating stations, government facilities, hospitals, hotels/motels, major bridges, medical facilities, military bases, minor bridges, newspaper offices, nursing homes, paramedic/EMS stations, police departments, ports, prisons, public shelters, radio/television towers, railroad facilities, schools, sewage treatment plants, substations and TV/radio stations.

### Flood

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Using FEMA DFIRM, where available, along with the modeling approach described earlier, losses were estimated using return period events ranging from 10-year to 500-year events. With this approach, annualized losses were calculated by accounting for the losses from different return period events and their respective annual probabilities of occurrence. (i.e., the annual probability of observing a 100-year flood is 1 percent).

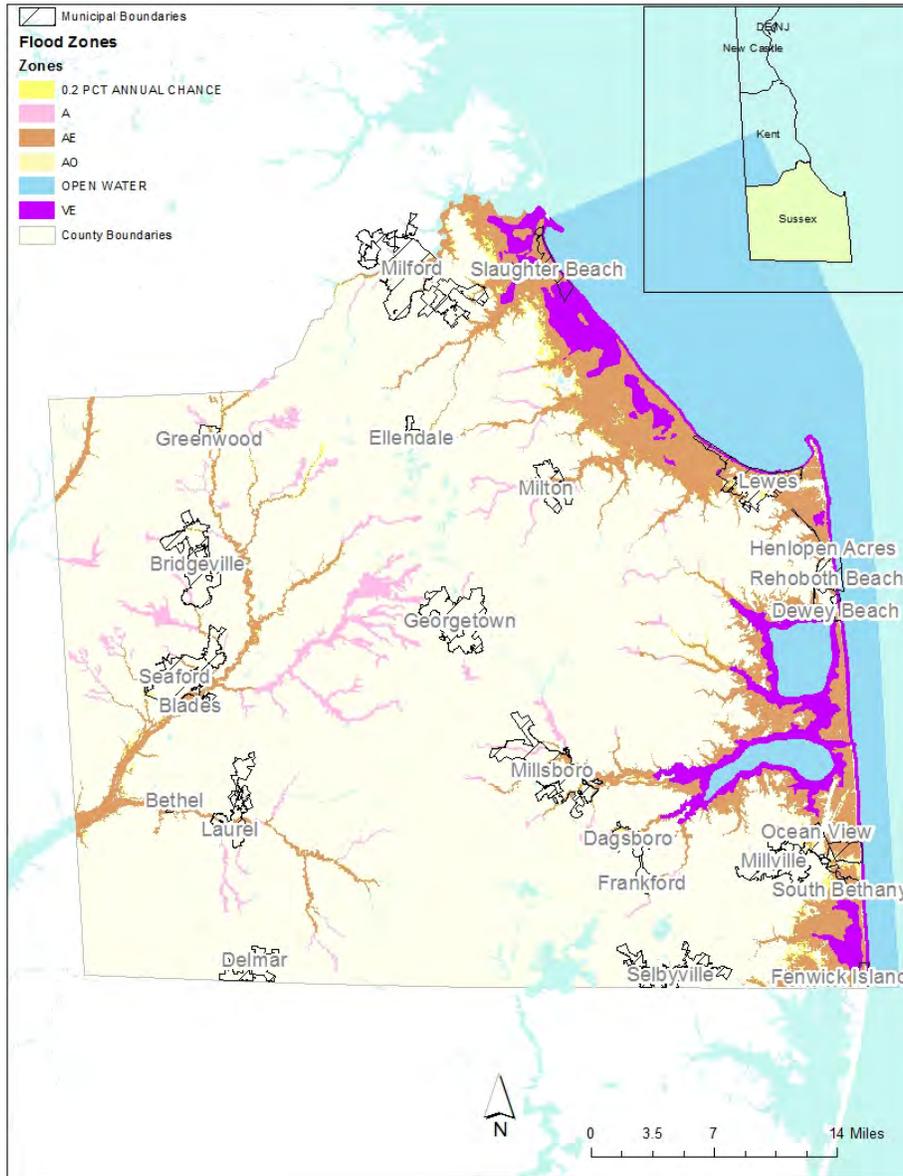
Describing vulnerability in terms of annualized losses provides three primary benefits:

1. Potential losses from all future disasters are accounted for using this approach;
2. Results across hazards are readily comparable and hence easier to rank; and
3. A risk ranking approach facilitates the evaluation of mitigation alternatives.

### Coastal Flooding

Modeling conducted by the US Army Corps of Engineers in Philadelphia, PA provides an approximation of the extents of storm surge flooding by category of tropical storm. The Sea, Lake, and Overland Surges from Hurricanes (SLOSH) model is a robust, empirically-verified storm surge model that creates maps of potential storm surge areas. Coastal flooding profiles were created for Category 1 through Category 3 storms to illustrate the expected storm surge associated with each magnitude event. In Sussex County, the risk of a Category 2 storm surge is about 1% any given year. The area of storm surge was mapped to show the intersection of surge with major cities and major roads, and can also be compared to population density/distribution. **Figure 4-5** on the following page shows the storm surge areas for Category 1 through Category 3 storm events in Sussex County.

Figure 4-5: Hurricane Storm Surge Extent (USACE)



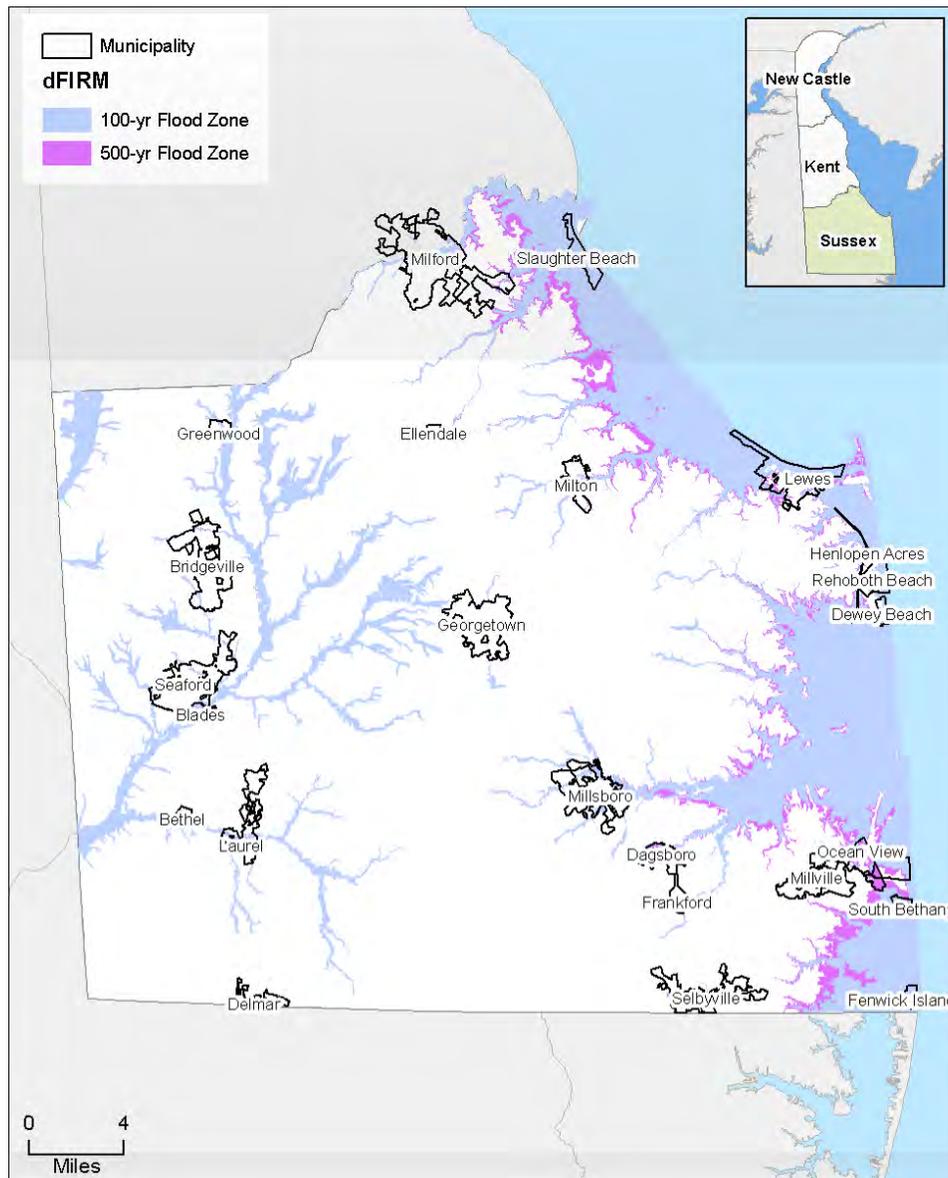
## Riverine Flooding

In addition to coastal flooding, the Sussex County is vulnerable to riverine flooding, primarily due to the accumulation of excessive rainfall in the watersheds upstream along the Mispillion River, Cedar Creek, Slaughter Creek, Primehook Creek, the Broadkill River, Old Mill Creek, Love Creek, Herring Creek, Guinea Creek, the Indian River, Pepper Creek, Vines Creek, Miller Creek, Dirickson Creek, the Nanticoke River, Broad Creek, Bridgeville Branch, Gravelly Branch, Marshyhope Creek, and other smaller tributaries. A map of the 100- and 500-year floodplains can be found in **Figure 4-6**.

## Hazard and Vulnerability and Risk Assessment

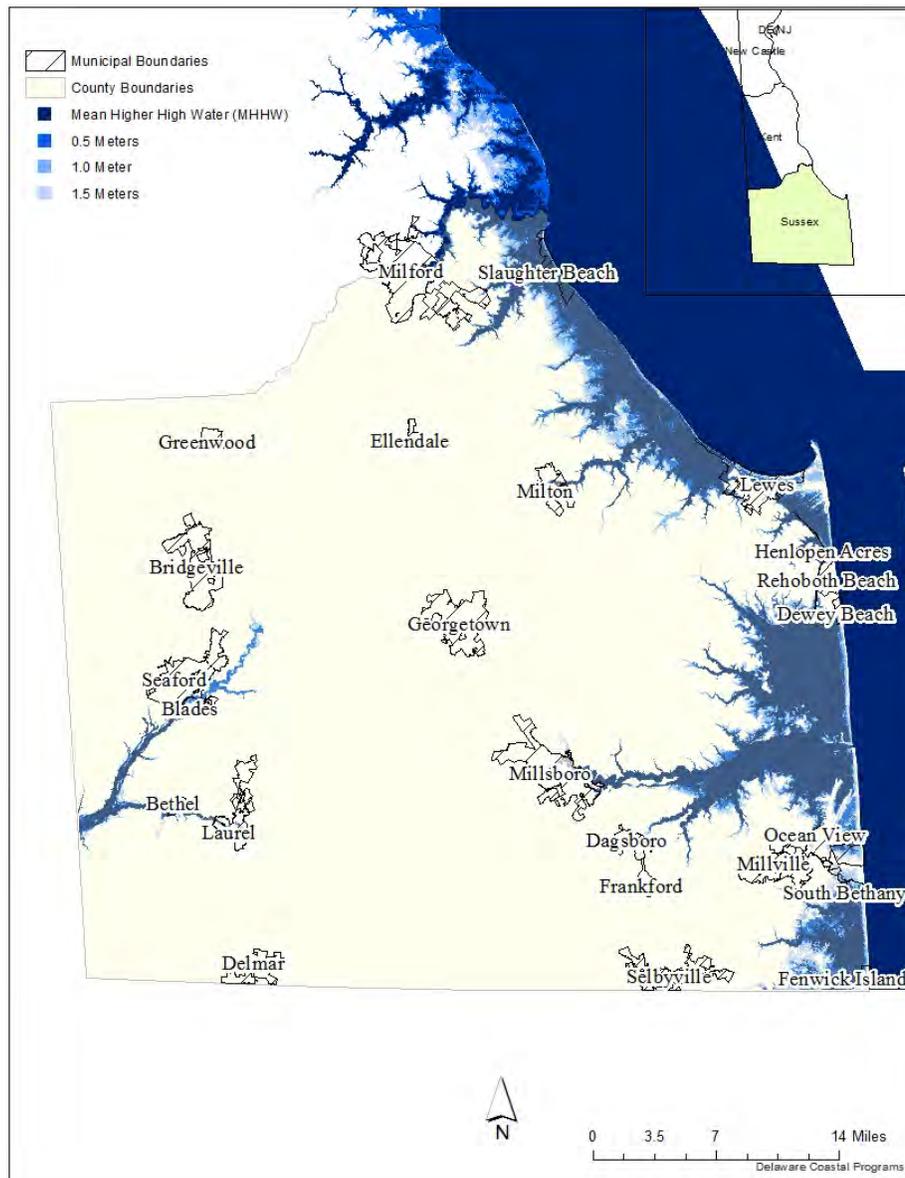
When taken together, the extent of potential coastal flooding and the extent of riverine flooding equal the total flood hazard zone. HAZUS-MH calculated the depth of the flood of various periodicities and compared that to the intersecting building stock exposure to predict the flood loss for each particular return period as well as an annualized estimate. **Figure 4-7** displays the result of the hydrology and hydraulic modeling in HAZUS-MH used to generate an estimate of the depth of the 100-year flood in Sussex County. **Table 4-11** shows total annualized expected losses from both coastal and riverine flooding events by jurisdiction within Sussex County. The total potential annualized losses for Sussex County equal \$129,520,000.

**Figure 4-6: 100-year and 500-year Floodplains**



# Hazard and Vulnerability and Risk Assessment

**Figure 4-7: Modeled 100-year Flood Depth**



**Table 4-11: Potential Annualized Losses from Flooding**

Jurisdiction	Estimated Losses
Bethany Beach	\$8,221,887
Bethel	\$76,408
Blades	\$115,000
Bridgeville	Negligible
Dagsboro	Negligible
Delmar	Negligible
Dewey Beach	\$1,430,177

## Hazard and Vulnerability and Risk Assessment

Jurisdiction	Estimated Losses
Ellendale	Negligible
Fenwick Island	\$2,258,541
Frankford	\$63,925
Georgetown	Negligible
Greenwood	\$7,101
Henlopen Acres	\$409,600
Laurel	\$2,182,198
Lewes	\$700,624
MCD Bridgeville-Greenwood	\$1,091,200
MCD Georgetown	\$255,801
MCD Laurel-Delmar	\$991,374
MCD Lewes	\$19,357,870
MCD Milford South	\$1,912,048
MCD Millsboro	\$36,640,370
MCD Milton	\$445,316
MCD Seaford	\$1,403,417
MCD Selbyville-Frankford	\$43,167,201
Milford	\$630,092
Millsboro	\$411,348
Millville	\$124,808
Milton	\$338,142
Ocean View	\$1,008,480
Rehoboth Beach	\$499,965
Seaford	\$560,861
Selbyville	\$148,809
Slaughter Beach	\$333,152
South Bethany	\$4,017,172
<b>TOTAL</b>	<b>\$129,520,000</b>

Another means of gauging the vulnerability within Sussex County to flooding was the vulnerability of state-owned critical facilities to the 100- and 500-year flood return periods. Within Sussex County, 1,637 critical facilities were assessed with regard to flood risk (**Table 4-12**). In summary, in a 100-year flood event, as many as 1,561 of these facilities could sustain slight damage and 72 could sustain moderate damage. In a 500-year event, as many as 1,240 facilities could be slightly damaged and 397 could be moderately damaged. No facilities would escape with merely negligible damage (less than \$5,000) in either event.

**Table 4-12: Potential Damage to Critical Facilities from Flood<sup>13</sup>**

<sup>13</sup> The definitions used are as follows. Negligible: less than 1 percent damage. Slight: 1 to 5 percent damage. Moderate: 5 to 30 percent damage. Extensive (where applicable): 30 to 60 percent damage.

## Hazard and Vulnerability and Risk Assessment

Jurisdiction	Total Number of Critical Facilities	100-year Flood			500-year Flood		
		Moderate Damage	Slight Damage	Negligible Damage	Moderate Damage	Slight Damage	Negligible Damage
Bethany Beach	14	0	12	2	0	14	0
Bethel	1	0	1	0	0	1	0
Blades	7	0	7	0	0	7	0
Bridgeville	25	0	25	0	11	14	0
Dagsboro	11	0	11	0	0	11	0
Delmar	7	0	7	0	0	7	0
Dewey Beach	11	0	11	0	11	0	0
Ellendale	6	0	6	0	0	6	0
Fenwick Island	5	0	5	0	0	5	0
Frankford	8	0	8	0	0	8	0
Georgetown	40	0	40	0	0	40	0
Greenwood	8	0	8	0	0	8	0
Laurel	31	10	21	0	10	21	0
Lewes	40	0	39	1	0	40	0
MCD Bridgeville-Greenwood	76	12	64	0	31	45	0
MCD Georgetown	83	0	83	0	6	77	0
MCD Harrington	1	0	1	0	0	1	0
MCD Laurel-Delmar	172	17	155	0	48	124	0
MCD Lewes	175	8	166	1	30	145	0
MCD Milford North	1	0	1	0	0	1	0
MCD Milford South	121	0	121	0	19	102	0
MCD Millsboro	137	2	135	0	64	73	0
MCD Milton	62	0	62	0	10	52	0
MCD Seaford	163	19	144	0	72	91	0
MCD Selbyville-Frankford	258	4	254	0	45	213	0
Milford	33	0	33	0	0	33	0
Millsboro	14	0	14	0	0	14	0
Millville	5	0	5	0	0	5	0
Milton	20	0	20	0	6	14	0
Ocean View	6	0	6	0	0	6	0
Rehoboth Beach	33	0	33	0	1	32	0
Seaford	50	0	50	0	33	17	0

## Hazard and Vulnerability and Risk Assessment

Jurisdiction	Total Number of Critical Facilities	100-year Flood			500-year Flood		
		Moderate Damage	Slight Damage	Negligible Damage	Moderate Damage	Slight Damage	Negligible Damage
Selbyville	2	0	2	0	0	2	0
Slaughter Beach	2	0	2	0	0	2	0
South Bethany	7	0	7	0	0	7	0
<b>TOTAL</b>	<b>1,637</b>	<b>72</b>	<b>1,561</b>	<b>4</b>	<b>397</b>	<b>1,240</b>	<b>0</b>

### Repetitive Loss Properties

A repetitive loss property is an NFIP-insured property that has had at least four (4) paid flood losses of more than \$1,000, or has had two (2) paid flood losses within 10 years that, in aggregate, equal or exceed the value of the property, or has had three (3) or more paid losses that, in aggregate, equal or exceed the value of the property. Addressing repetitive loss properties through the implementation of specific mitigation projects represent one of the most effective ways to reduce future flood losses. As a result, the mitigation strategies listed in the Sussex County Flood Mitigation Plan were specifically designed to address identified repetitive loss properties and are cited by reference here.<sup>14</sup> **Table 4-13** contains a tally of the number of repetitive loss properties in the County and individual municipalities, the number of flood insurance policies currently in force (as of July 1, 2009), and the percentage of current policies that represent repetitive loss properties. There are no severe repetitive loss properties in Sussex County. A severe repetitive loss property is one that has had at least four (4) claim payments greater than \$5,000, or the cumulative amount of the four (4) payments exceeds \$20,000, or has had two (2) cumulative claim payments that exceed the value of the property. The location of the repetitive loss properties in relation to the DFIRM floodplain may be found in **Figure 4-8**.

**Table 4-13: Repetitive Loss Properties as of July 1, 2009 (DEMA)**

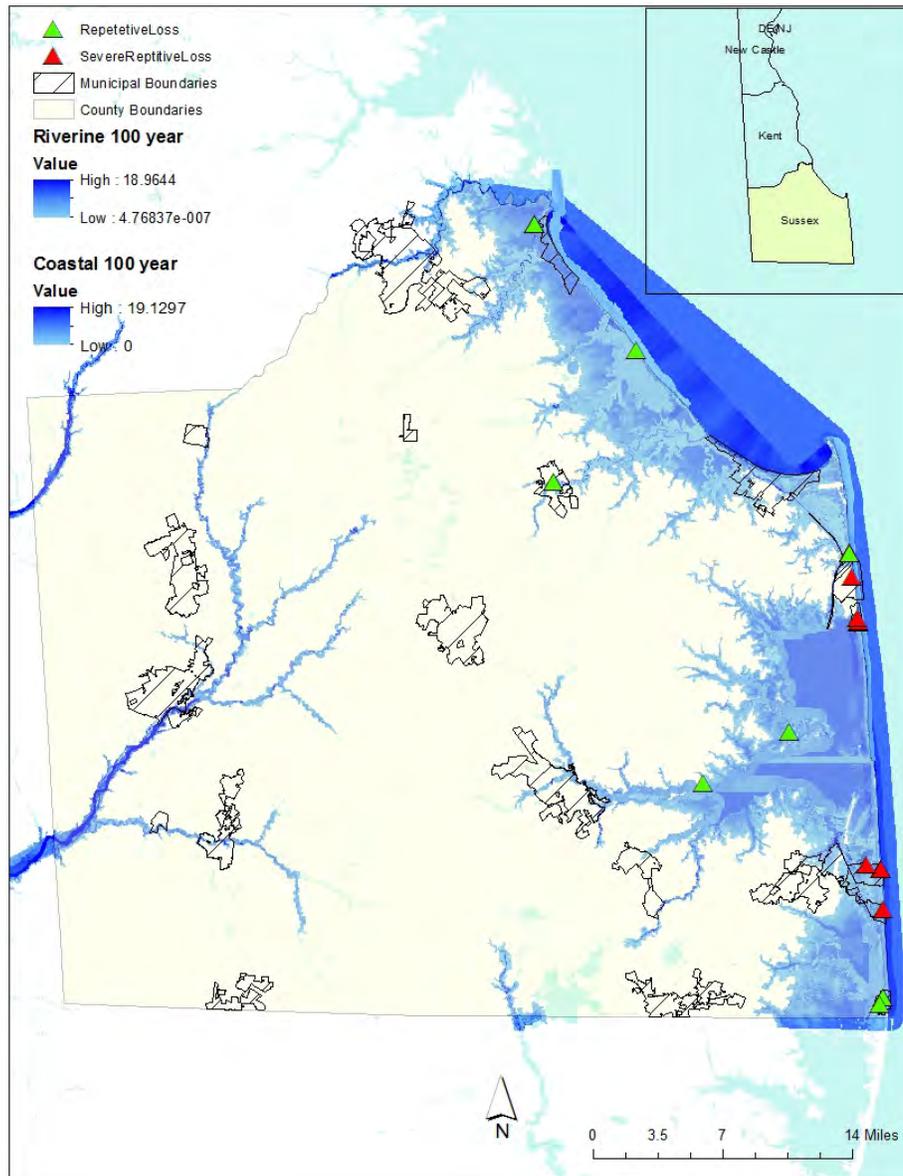
Jurisdiction	Number of Rep Losses	Number of Policies	% Rep Loss
Sussex County	231	12,427	1.9%
Town of Bethany Beach	68	2,016	3.4%
Town of Dewey Beach	67	1,116	6.0%
Town of Fenwick Island	23	687	3.3%
City of Rehoboth Beach	11	1,121	1.0%
Town of South Bethany	110	896	12.3%

<sup>14</sup> Sussex County Flood Mitigation Plan maintained by DNREC, last updated 1999

## Hazard and Vulnerability and Risk Assessment

Jurisdiction	Number of Rep Losses	Number of Policies	% Rep Loss
City of Milford	6	74	8.1%

**Figure 4-8: Location of Repetitive Loss Properties**



### Tropical Storm Winds

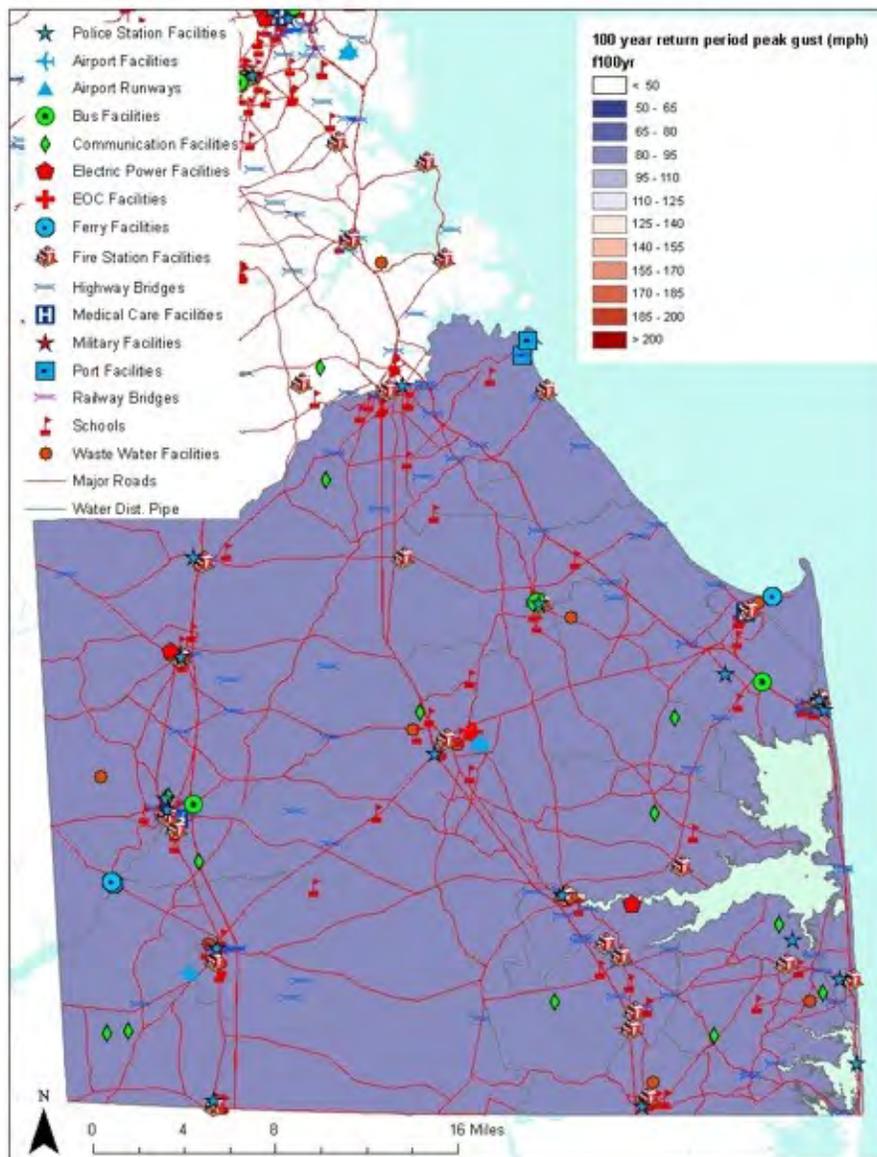
Historical evidence shows that the State of Delaware is vulnerable to hurricane and tropical storm-force winds. HAZUS-MH's modeling scenarios provided wind speed data for a range of

## Hazard and Vulnerability and Risk Assessment

return periods as well as an inventory and damage functions, which were used in estimating losses. The HAZUS-MH method involves Monte Carlo simulations to estimate the probable track of a tropical storm with a particular recurrence interval, and then estimates the wind field of that probably tropical storm to predict losses.

**Figures 4-9** shows the potential tropical storm winds that could affect the area for a 100-year wind event. The total potential annualized losses equal \$1,926,244.

**Figure 4-9: Potential Hurricane Winds for 100-year Wind Events**



## Hazard and Vulnerability and Risk Assessment

### Critical Facilities Risk for Earthquake/Geological

All critical facilities are vulnerable to earthquakes. A critical facility would encounter many of the same impacts as any other building within the County, depending on the level of building code used to construct the structure. These impacts include structural failure and loss of facility functionality. In other words, a damaged police station may not be able to serve the community.

The HAZUS-MH earthquake module also provides loss estimates for some transportation and utility lifeline losses. As previously mentioned, essential facilities, potable water facilities, and wastewater facilities were updated before analysis based on DRBC and local updates.

**Table 4-14** shows the potential damage to critical facilities from hurricane-force wind events. **Table 4-15** shows total annualized expected losses from hurricane wind events by jurisdiction within Sussex County.

**Table 4-14: Potential Damage to Critical Facilities from Tropical Storm Winds<sup>15</sup>**

Jurisdiction	Total Number of Critical Facilities	100-year Wind			500-year Wind			
		Moderate Damage	Slight Damage	Negligible Damage	Extensive	Moderate Damage	Slight Damage	Negligible Damage
Bethany Beach	14	10	4	0	8	4	2	0
Bethel	1	1	0	0	0	0	1	0
Blades	7	4	2	1	0	2	5	0
Bridgeville	25	8	14	3	0	6	19	0
Dagsboro	11	6	5	0	2	5	4	0
Delmar	7	6	1	0	0	0	7	0
Dewey Beach	11	11	0	0	11	0	0	0
Ellendale	6	5	1	0	0	0	6	0
Fenwick Island	5	5	0	0	5	0	0	0
Frankford	8	5	3	0	1	3	4	0
Georgetown	40	34	4	2	11	4	25	0
Greenwood	8	4	2	2	0	3	5	0
Laurel	31	17	4	10	0	8	19	4
Lewes	40	30	10	0	15	8	17	0
MCD Bridgeville-Greenwood	76	30	19	27	0	40	36	0
MCD Georgetown	83	50	11	22	15	28	39	1
MCD Harrington	1	1	0	0	0	0	1	0

<sup>15</sup> The definitions used are as follows. Negligible: less than 1 percent damage. Slight: 1 to 5 percent damage. Moderate: 5 to 30 percent damage. Extensive (where applicable): 30 to 60 percent damage.

## Hazard and Vulnerability and Risk Assessment

Jurisdiction	Total Number of Critical Facilities	100-year Wind			500-year Wind			
		Moderate Damage	Slight Damage	Negligible Damage	Extensive	Moderate Damage	Slight Damage	Negligible Damage
MCD Laurel-Delmar	172	67	46	59	2	97	70	3
MCD Lewes	175	136	36	3	127	31	14	3
MCD Milford North	1	0	0	1	0	1	0	0
MCD Milford South	121	50	24	47	11	63	41	6
MCD Millsboro	137	91	43	3	81	40	14	2
MCD Milton	62	44	14	4	43	15	3	1
MCD Seaford	163	85	36	42	0	63	96	4
MCD Selbyville-Frankford	258	180	78	0	156	70	32	0
Milford	33	22	6	5	4	8	21	0
Millsboro	14	11	3	0	5	2	7	0
Millville	5	5	0	0	5	0	0	0
Milton	20	11	7	2	3	6	9	2
Ocean View	6	2	4	0	2	4	0	0
Rehoboth Beach	33	31	2	0	27	2	4	0
Seaford	50	25	14	11	0	20	29	1
Selbyville	2	2	0	0	0	0	2	0
Slaughter Beach	2	2	0	0	1	0	1	0
South Bethany	7	4	3	0	4	3	0	0
<b>TOTAL</b>	<b>1,637</b>	<b>995</b>	<b>396</b>	<b>246</b>	<b>539</b>	<b>536</b>	<b>533</b>	<b>29</b>

**Table 4-15: Potential Annualized Losses from Tropical Storm Winds**

Jurisdiction	Estimated Losses
Bethany Beach	\$11,377
Bethel	Negligible
Blades	Negligible
Bridgeville	Negligible
Dagsboro	Negligible
Delmar	Negligible

## Hazard and Vulnerability and Risk Assessment

Jurisdiction	Estimated Losses
Dewey Beach	Negligible
Ellendale	Negligible
Fenwick Island	Negligible
Frankford	Negligible
Georgetown	\$5,236
Greenwood	Negligible
Henlopen Acres	Negligible
Laurel	Negligible
Lewes	\$7,481
MCD Bridgeville-Greenwood	\$25,390
MCD Georgetown	\$48,865
MCD Laurel-Delmar	\$95,369
MCD Lewes	\$367,759
MCD Milford South	\$48,034
MCD Millsboro	\$616,112
MCD Milton	\$111,662
MCD Seaford	\$61,270
MCD Selbyville-Frankford	\$451,242
Milford	Negligible
Millsboro	\$8,191
Millville	\$10,358
Milton	Negligible
Ocean View	\$10,134
Rehoboth Beach	\$5,387
Seaford	\$9,739
Selbyville	\$8,370
Slaughter Beach	Negligible
South Bethany	\$5,155
<b>TOTAL</b>	<b>\$1,926,244</b>

### Severe Thunderstorm Wind

Sussex County, according to historical records, is affected by severe thunderstorms several times a year. The strong winds and lightning generated from severe thunderstorms pose a threat to

## Hazard and Vulnerability and Risk Assessment

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the residents, the built environment, and particularly the trees within the County. However, because severe thunderstorms are not spatially-constrained, one must consider the entire County at risk. The extent of damage from severe thunderstorm wind may be either localized or widespread but it is rarely consistent across space. Therefore, it is impossible to predict if certain areas of the County may be more vulnerable than others and even to estimate the number of buildings that may suffer loss from a severe thunderstorm wind.

The approach to determining the County’s vulnerability to severe thunderstorm wind is to examine not just severe thunderstorm events in the County boundary, but to look at all of the events of the neighboring counties within 25 miles of the boundary of the County as well. A severe thunderstorm that impacts Dorchester County, MD (to the west of Sussex County) could have just as easily impacted Sussex County instead. The actual location of the severe thunderstorm at this scale of analysis is simply a matter of luck rather than any of the County’s unique geographical factors. Because the neighboring jurisdictions are of differing sizes and densities, the results for must be scaled appropriately. For example, Sussex County had 5.5 severe thunderstorm events per year, compared to Kent County’s 4.69 events per year. But, Sussex County is bigger than Kent County; one would expect the larger County to have more thunderstorm events. Sussex County is 159% the size of Kent County. Therefore, a County the size of Kent would have been impacted by 7.46 events per year if the County had been the same size as Sussex. The annualized losses are scaled similarly, but use numbers of housing units as a proxy for differences in building exposure.

**Table 4-16** shows the number of events in Sussex County and those counties within 25 miles of Sussex County. **Table 4-17** shows the number of annual events and the amount of annual loss in Sussex County and those counties within 25 miles of the County after the appropriate scale factor has been applied.

**Table 4-18** shows annualized expected losses from severe thunderstorm wind events by jurisdiction within Sussex County. The total estimated annualized losses for the County equal \$168,211.

**Table 4-16: Losses from Severe Thunderstorm Wind Events (NOAA)**

County	Total Events	Total Loss	Years	Annual Events	Annual Loss	Deaths	Injuries
Sussex County, DE	286	\$8,747,000	52	5.50	\$168,211	2	10
Kent County, DE	239	\$4,153,000	51	4.69	\$81,431	2	5
Caroline County, MD	147	\$1,426,000	53	2.77	\$26,905	0	0
Dorchester County, MD	65	\$10,451,000	41	1.59	\$254,902	0	2
Wicomico County, MD	89	\$5,255,000	51	1.75	\$103,039	0	0
Worcester County, MD	59	\$6,605,000	53	1.11	\$124,622	0	0
<b>Average</b>	<b>147.5</b>	<b>\$6,106,167</b>	<b>50.2</b>	<b>4.50</b>	<b>\$126,518</b>	<b>0.67</b>	<b>2.83</b>

## Hazard and Vulnerability and Risk Assessment

**Table 4-17: Normalized Occurrences and Losses from Severe Thunderstorm Wind Events (NOAA)**

County	Annual Events	Area Scale Factor	Scaled Events	Annual Loss	HU Scale Factor	Scaled Annual Loss
Sussex County, DE	5.50	1.000	5.50	\$168,211	1.000	\$168,211
Kent County, DE	4.69	1.590	7.46	\$81,431	1.844	\$150,131
Caroline County, MD	2.77	2.929	8.11	\$26,905	7.624	\$205,115
Dorchester County, MD	1.59	1.691	2.69	\$254,902	6.340	\$1,615,948
Wicomico County, MD	1.75	2.046	3.58	\$103,039	2.705	\$278,766
Worcester County, MD	1.11	1.981	2.20	\$124,622	1.954	\$243,514
<b>Normalized Average</b>			<b>4.93</b>			<b>\$443,614</b>

**Table 4-18: Potential Normalized Annualized Losses from Severe Thunderstorms by MCD and Municipality**

Jurisdiction	Estimated Losses
Bethany Beach	Negligible
Bethel	Negligible
Blades	Negligible
Bridgeville	Negligible
Dagsboro	Negligible
Delmar	Negligible
Dewey Beach	Negligible
Ellendale	Negligible
Fenwick Island	Negligible
Frankford	Negligible
Georgetown	Negligible
Greenwood	Negligible
Henlopen Acres	Negligible
Laurel	Negligible
Lewes	Negligible
MCD Bridgeville-Greenwood	\$17,559
MCD Georgetown	\$11,452
MCD Laurel-Delmar	\$30,869
MCD Lewes	\$14,471
MCD Milford South	\$20,936
MCD Millsboro	\$16,369
MCD Milton	\$10,649
MCD Seaford	\$15,314

## Hazard and Vulnerability and Risk Assessment

Jurisdiction	Estimated Losses
MCD Selbyville-Frankford	\$21,801
Milford	Negligible
Millsboro	Negligible
Millville	Negligible
Milton	Negligible
Ocean View	Negligible
Rehoboth Beach	Negligible
Seaford	Negligible
Selbyville	Negligible
Slaughter Beach	Negligible
South Bethany	Negligible
<b>TOTAL</b>	<b>\$168,211</b>

### Tornado

Historical evidence shows that Sussex County is vulnerable to tornado activity. This particular hazard may result from severe thunderstorm activity or may occur during a tropical storm or hurricane. Because it cannot be predicted where a tornado may touchdown, all buildings and facilities are considered to be exposed to this hazard and could potentially be impacted. It is also not possible to estimate the number of residential, commercial, and other buildings or facilities that may experience losses.

The approach to determining vulnerability to tornadoes is similar to that used for severe thunderstorm wind. Historical tornado loss data from the National Oceanic and Atmospheric Administration (NOAA) was gathered for Sussex County and the neighboring counties within 25 miles of the boundary of the County. All historical losses were scaled to account for inflation, and average historic tornado losses were calculated (**Table 4-19**). As with severe thunderstorms, the neighboring jurisdictions are of differing sizes and densities, the results must be normalized appropriately using the method described previously (**Table 4-20**). Annualized expected losses from tornado events by jurisdiction within Sussex County are omitted as none registers more than a negligible amount. The total estimated annualized losses for the County equal \$11,000.

**Table 4-19: Losses from Tornado Events (NOAA)**

County	Total Events	Total Loss	Years	Annual Events	Annual Loss	Deaths	Injuries
Sussex County, DE	18	\$594,000	54	0.33	\$11,000	0	11
Kent County, DE	18	\$4,908,000	45	0.40	\$109,067	2	54
Caroline County, MD	6	\$375,000	57	0.11	\$6,579	0	0
Dorchester County, MD	11	\$5,722,000	25	0.44	\$228,880	1	16
Wicomico County, MD	8	\$133,000	47	0.17	\$2,830	0	2
Worcester County, MD	10	\$250,000	51	0.20	\$4,902	0	0

## Hazard and Vulnerability and Risk Assessment

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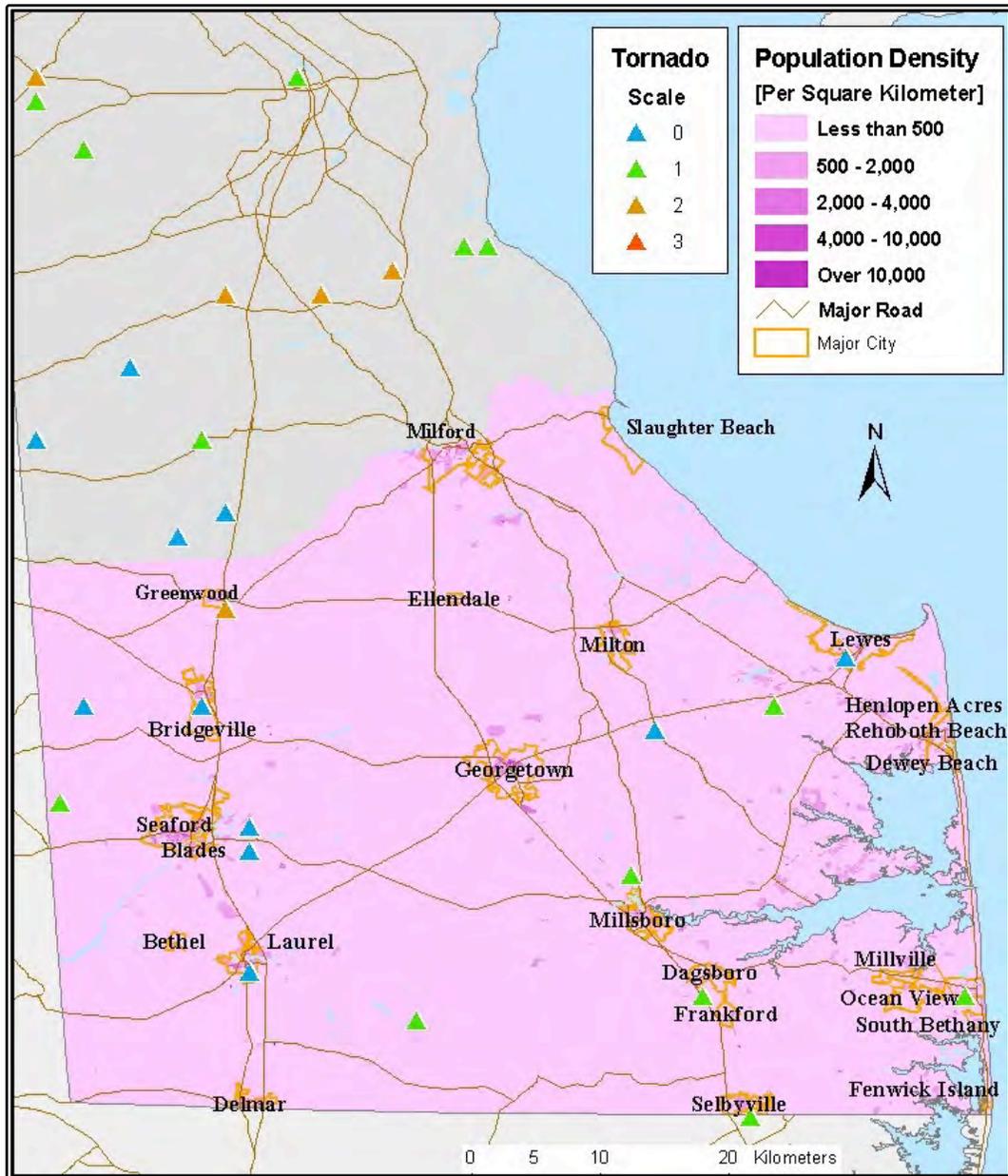
County	Total Events	Total Loss	Years	Annual Events	Annual Loss	Deaths	Injuries
Average	11.8	\$1,997,000	46.5	0.275	\$60,543	0.5	13.8

**Table 4-20: Normalized Occurrences and Losses from Tornado Events (NOAA)**

County	Annual Events	Area Scale Factor	Scaled Events	Annual Loss	HU Scale Factor	Scaled Annual Loss
Sussex County, DE	0.33	1.000	0.33	\$11,000	1.000	\$11,000
Kent County, DE	0.40	1.590	0.64	\$109,067	1.844	\$201,082
Caroline County, MD	0.11	2.929	0.31	\$6,579	7.624	\$50,156
Dorchester County, MD	0.44	1.691	0.74	\$228,880	6.340	\$1,450,982
Wicomico County, MD	0.17	2.046	0.35	\$2,830	2.705	\$7,656
Worcester County, MD	0.20	1.981	0.40	\$4,902	1.954	\$9,579
<b>Normalized Average</b>			<b>0.461</b>			<b>\$288,409</b>

# Hazard and Vulnerability and Risk Assessment

Figure 4-10 shows the location and magnitude of past tornado events in relation to population density.



## Drought

Although the State of Delaware as a whole is vulnerable to drought, estimated potential losses are somewhat difficult to calculate because drought causes little damage to the built environment, mostly affecting crops and farmland. Therefore, it is assumed that all buildings and facilities are exposed to drought, but would experience negligible damage in the occurrence of a drought event.

## Hazard and Vulnerability and Risk Assessment

The approach used to determine vulnerability within Sussex County consisted of a number of factors. Statistical data for the past 100 years from the University of Nebraska, developed based on Palmer Drought and Crop Severity Indices, was analyzed. Drought event frequency/impact was then determined for Sussex County. Also used was USDA agriculture data from 1997. Drought impact on the non-irrigated agriculture products profile was then determined.

**Table 4-21** shows annualized expected losses from drought events by jurisdiction within Sussex County. The total estimated annualized losses for the County equal \$14,659,834.

**Table 4-21: Annualized Expected Losses from Drought**

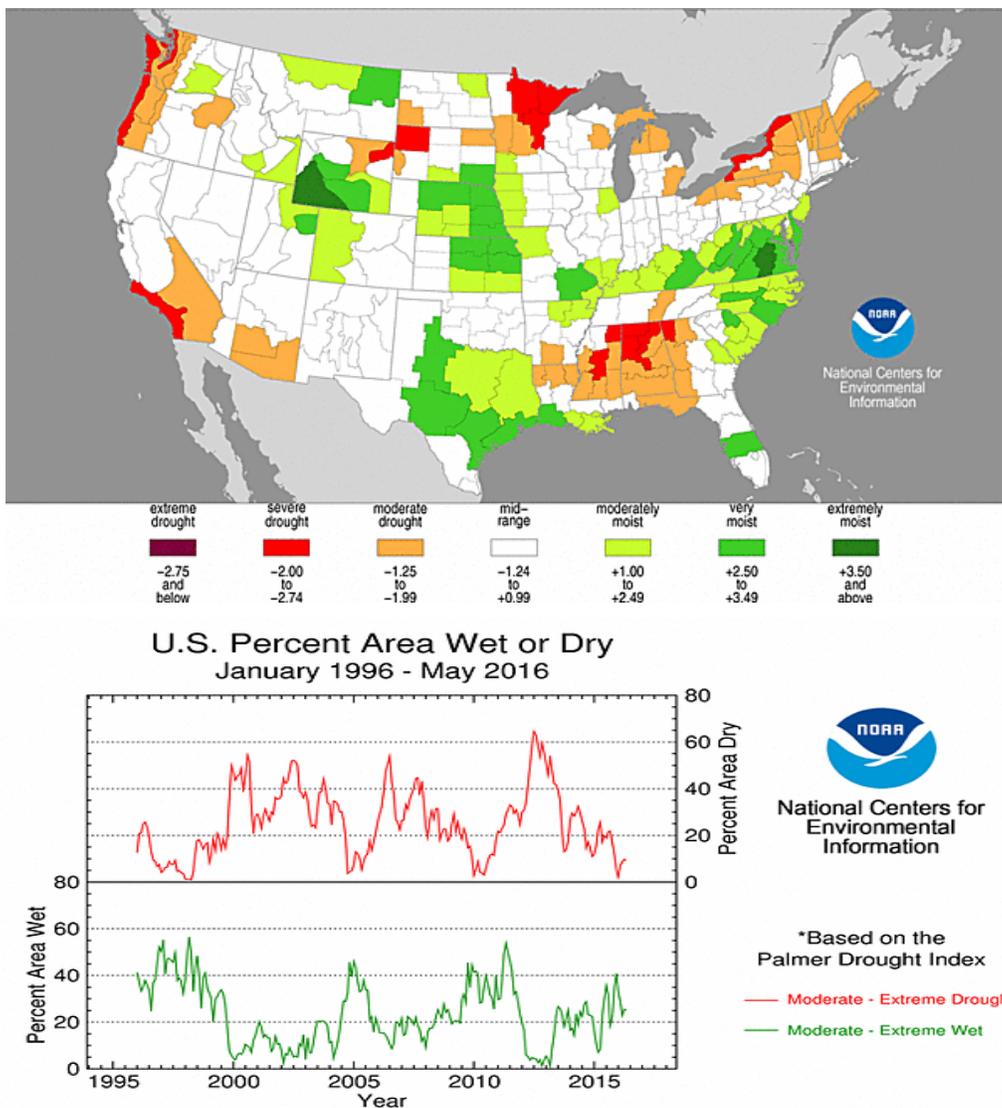
Jurisdiction	Estimated Losses
Bethany Beach	\$17,626
Bethel	\$6,671
Blades	\$7,230
Bridgeville	\$67,345
Dagsboro	\$20,999
Delmar	\$13,992
Dewey Beach	\$6,732
Ellendale	Negligible
Fenwick Island	\$7,536
Frankford	\$10,766
Georgetown	\$69,388
Greenwood	\$11,048
Henlopen Acres	Negligible
Laurel	\$40,473
Lewes	\$65,458
MCD Bridgeville-Greenwood	\$1,530,281
MCD Georgetown	\$998,028
MCD Laurel-Delmar	\$2,690,299
MCD Lewes	\$1,261,154
MCD Milford South	\$1,824,606
MCD Millsboro	\$1,426,546
MCD Milton	\$928,101
MCD Seaford	\$1,334,655
MCD Selbyville-Frankford	\$1,900,032
Milford	\$142,649
Millsboro	\$61,221
Millville	\$35,871
Milton	\$24,765
Ocean View	\$37,724
Rehoboth Beach	\$24,588

## Hazard and Vulnerability and Risk Assessment

Jurisdiction	Estimated Losses
Seaford	\$75,703
Selbyville	\$50,804
Slaughter Beach	\$20,816
South Bethany	\$7,933
<b>TOTAL</b>	<b>\$14,659,834</b>

Figure 4.3-10 shows the hazard profile for drought in the geographic area surrounding Sussex County.

Figure 4.3-10: Hazard Profile for Drought in and Around Sussex County (May 2016)



## Hazard and Vulnerability and Risk Assessment

### Hail

The State of Delaware is minimally vulnerable to hail storms. Hail does occur in the Mid-Atlantic, but is usually not large enough nor widespread enough to cause any significant damage to the built environment. It does, however, have the potential of harming crops in the agricultural areas of Sussex County.

The approach to determining vulnerability to hail is similar to that used for severe thunderstorm wind. Historical hail loss data from the National Oceanic and Atmospheric Administration (NOAA) was gathered for Sussex County and the neighboring counties within 25 miles of the boundary of the County. All historical losses were scaled to account for inflation, and average historic losses were calculated (**Table 4-22**). As with severe thunderstorms (above), because the neighboring jurisdictions are of differing sizes and densities, the results must be normalized appropriately using the method described previously (**Table 4-23**). Because the total estimated annualized losses for the County is negligible (\$7,560), annualized expected losses from hail events by jurisdiction were not calculated.

**Table 4-22: Losses from Hail Events (NOAA)**

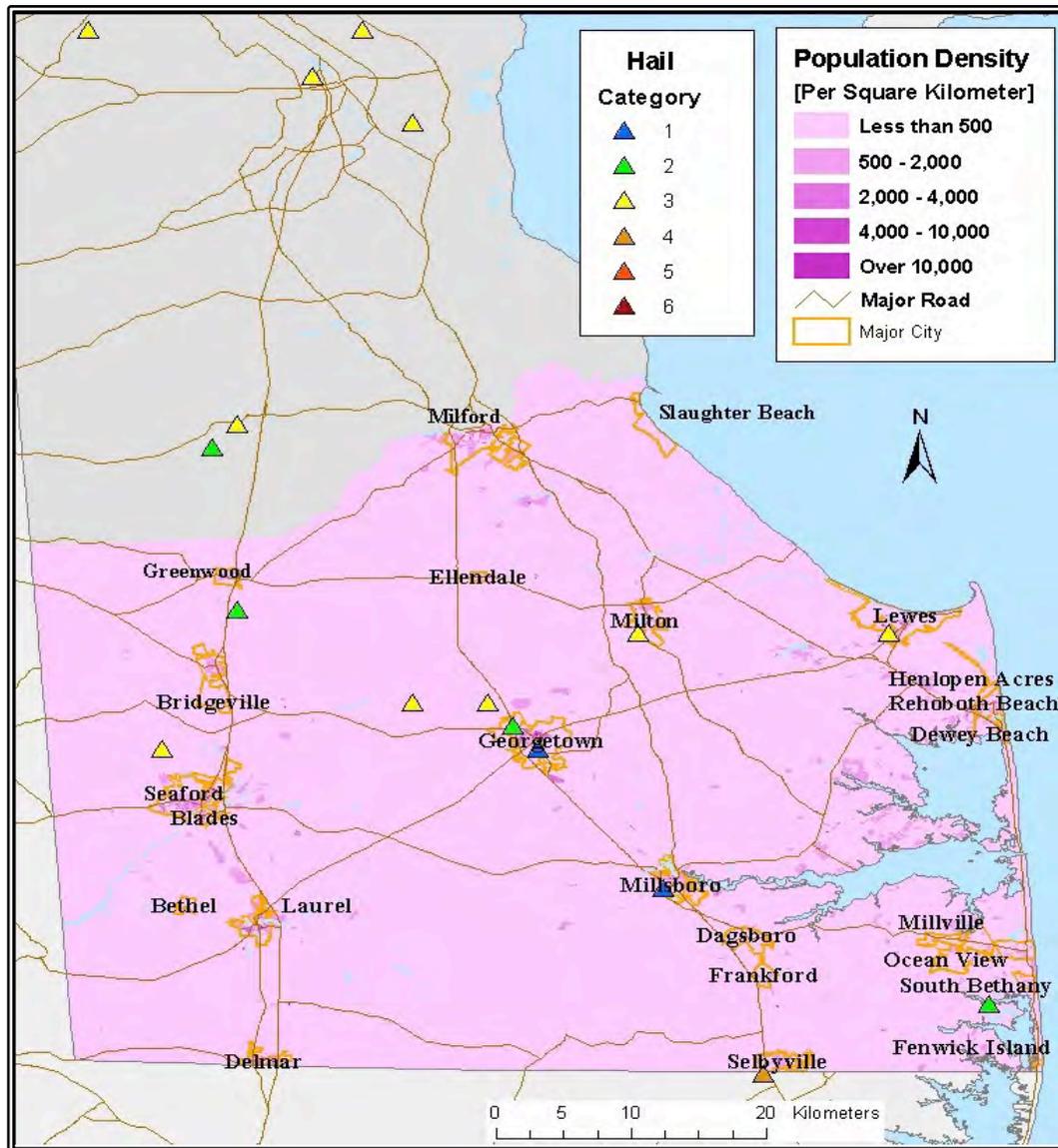
County	Total Events	Total Loss	Years	Annual Events	Annual Loss	Deaths	Injuries
Sussex County, DE	28	\$310,000	41	0.68	\$7,560	0	0
Kent County, DE	22	\$105,000	41	0.54	\$2,561	0	0
Caroline County, MD	10	\$50,000	18	0.56	\$2,778	0	0
Dorchester County, MD	23	\$0	51	0.45	\$0	0	0
Wicomico County, MD	26	\$0	42	0.62	\$0	0	0
Worcester County, MD	25	\$3,000	51	0.49	\$59	0	0
<b>Average</b>	<b>22.3</b>	<b>\$78,000</b>	<b>41.0</b>	<b>0.56</b>	<b>\$2,160</b>	<b>0.0</b>	<b>0.0</b>

**Table 4-23: Normalized Occurrences and Losses from Hail Events (NOAA)**

County	Annual Events	Area Scale Factor	Scaled Events	Annual Loss	HU Scale Factor	Scaled Annual Loss
Kent County, DE	0.54	1.590	0.86	\$2,561	1.844	\$4,722
Caroline County, MD	0.56	2.929	1.64	\$2,778	7.624	\$21,179
Dorchester County, MD	0.45	1.691	0.76	\$0	6.340	\$0
Wicomico County, MD	0.62	2.046	1.27	\$0	2.705	\$0
Worcester County, MD	0.49	1.981	0.97	\$59	1.954	\$115
<b>Normalized Average</b>			<b>1.030</b>			<b>\$5,596</b>

Figure 4-12 shows recorded hail activity by hailstone size in relation to population distribution.

Figure 4-12: Recorded Hail Activity by Hailstone Size in Relation to Population Distribution



### Winter Storms

Historical evidence shows that Sussex County is quite vulnerable to winter storms, with several occurring each year. Because winter storms generally impact large areas, all buildings and facilities are exposed to this hazard and could potentially be impacted. It is also not possible to estimate the number of residential, commercial, and other buildings or facilities that may experience losses.

## Hazard and Vulnerability and Risk Assessment

The approach to determining vulnerability to winter storms is similar to that used for severe thunderstorm wind. Historical winter storm loss data from the National Oceanic and Atmospheric Administration (NOAA) was gathered for Sussex County and the neighboring counties within 25 miles of the boundary of the County. All historical losses were scaled to account for inflation, and average historic losses were calculated (**Table 4-24**). As with severe thunderstorms (above), because the neighboring jurisdictions are of differing sizes and densities, the results must be normalized appropriately using the method described previously (**Table 4-25**). **Table 4-26** shows annualized expected losses from winter storm events by jurisdiction within Sussex County. The total estimated annualized losses for the County equal \$340,625.<sup>16</sup>

**Table 4-24: Losses from Winter Storm Events (NOAA)**

County	Total Events	Total Loss	Years	Annual Events	Annual Loss	Deaths	Injuries
Sussex County, DE	66	\$5,450,000	16	4.13	\$340,625	0	65
Kent County, DE	78	\$5,500,000	16	4.87	\$343,750	1	60
Caroline County, MD	67	\$1,400,000	16	4.19	\$87,500	0	0
Dorchester County, MD	42	\$5,000,000	16	2.63	\$312,500	0	0
Wicomico County, MD	39	\$5,000,000	16	2.44	\$312,500	0	0
Worcester County, MD	37	\$5,020,000	16	2.31	\$313,750	0	0
<b>Average</b>	<b>54.8</b>	<b>\$4,561,667</b>	<b>16.0</b>	<b>3.43</b>	<b>\$285,104</b>	<b>0.2</b>	<b>20.8</b>

**Table 4-25 Normalized Occurrences and Losses from Winter Storm Events (NOAA)**

County	Annual Events	Area Scale Factor	Scaled Events	Annual Loss	HU Scale Factor	Scaled Annual Loss
Sussex County, DE	4.13	1.000	4.13	\$340,625	1.000	\$340,625
Kent County, DE	4.87	1.590	7.74	\$343,750	1.844	\$633,759
Caroline County, MD	4.19	2.929	12.27	\$87,500	7.624	\$677,073
Dorchester County, MD	2.63	1.691	4.45	\$312,500	6.340	\$1,981,089
Wicomico County, MD	2.44	2.046	4.99	\$312,500	2.705	\$845,451
Worcester County, MD	2.31	1.981	4.58	\$313,750	1.954	\$613,074
<b>Normalized Average</b>			<b>6.360</b>			<b>\$846,845</b>

**Table 4-26: Annualized Expected Losses from Winter Storms**

Jurisdiction	Estimated Losses
Bethany Beach	Negligible
Bethel	Negligible
Blades	Negligible

<sup>16</sup> It is important to note that for winter storm, some factors that contribute to a community's actual and perceived losses are not reflected in this analysis, such as removal of snow from roadways, debris clean-up, some indirect losses from power outages, etc.

## Hazard and Vulnerability and Risk Assessment

Jurisdiction	Estimated Losses
Bridgeville	Negligible
Dagsboro	Negligible
Delmar	Negligible
Dewey Beach	Negligible
Ellendale	Negligible
Fenwick Island	Negligible
Frankford	Negligible
Georgetown	Negligible
Greenwood	Negligible
Henlopen Acres	Negligible
Laurel	Negligible
Lewes	Negligible
MCD Bridgeville-Greenwood	\$35,556
MCD Georgetown	\$23,189
MCD Laurel-Delmar	\$62,510
MCD Lewes	\$29,303
MCD Milford South	\$42,395
MCD Millsboro	\$33,146
MCD Milton	\$21,565
MCD Seaford	\$31,011
MCD Selbyville-Frankford	\$44,148
Milford	Negligible
Millsboro	Negligible
Millville	Negligible
Milton	Negligible
Ocean View	Negligible
Rehoboth Beach	Negligible
Seaford	Negligible
Selbyville	Negligible
Slaughter Beach	Negligible
South Bethany	Negligible
<b>TOTAL</b>	<b>\$340,625</b>

### Earthquake

**Figure 4-13** shows the potential ground motion for a 100-year and 500-year earthquake. While Sussex County has felt earthquakes every so often, none have been significant enough to cause any damage for well over 100 years. The coastal plain of the Mid-Atlantic is notorious for being a seismically quiet zone. However, if a serious earthquake were to occur, the losses would likely be significant. This explains the amount of potential annualized losses for the County of

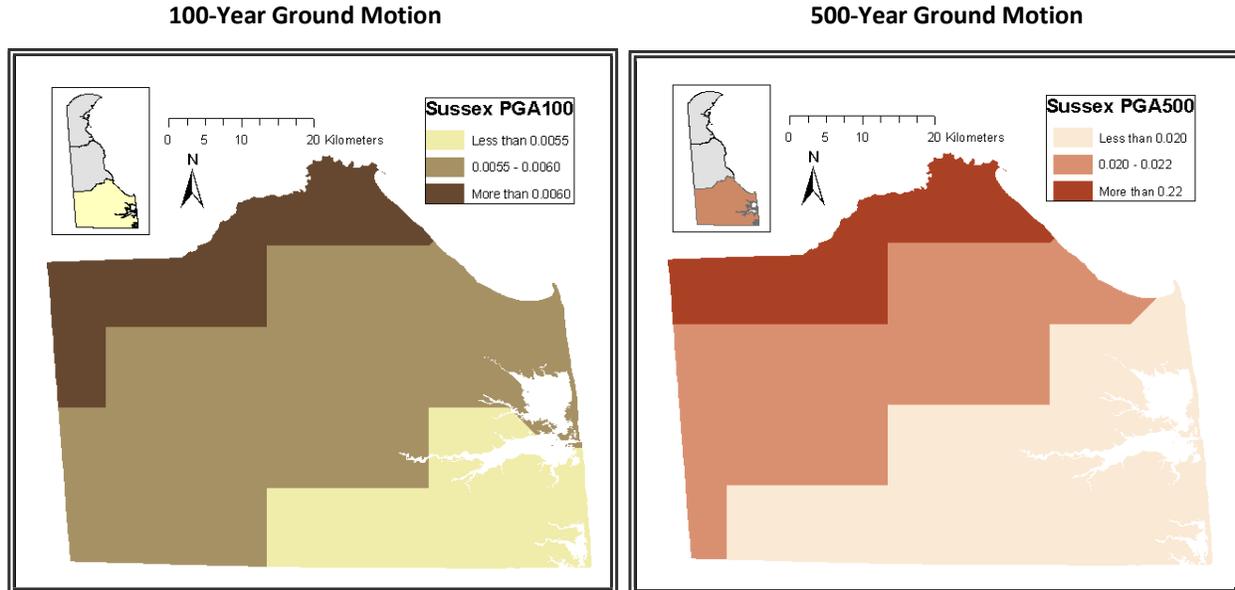
## Hazard and Vulnerability and Risk Assessment

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\$190,778 (Table 4-27). Table 4-28 shows potential damage to critical facilities from earthquake events by jurisdiction within Sussex County.

## Hazard and Vulnerability and Risk Assessment

**Figure 4-13: Peak Ground Acceleration (Ground Motion) for 100- and 500-Year Events**



**Table 4-27: Potential Annualized Losses from Earthquake**

Jurisdiction	Estimated Losses
Bethany Beach	Negligible
Bethel	Negligible
Blades	Negligible
Bridgeville	Negligible
Dagsboro	Negligible
Delmar	Negligible
Dewey Beach	Negligible
Ellendale	Negligible
Fenwick Island	Negligible
Frankford	Negligible
Georgetown	Negligible
Greenwood	Negligible
Henlopen Acres	Negligible
Laurel	Negligible
Lewes	Negligible
MCD Bridgeville-Greenwood	\$11,232
MCD Georgetown	\$12,767
MCD Laurel-Delmar	\$14,884
MCD Lewes	\$40,144
MCD Milford South	\$16,310
MCD Millsboro	\$16,409
MCD Milton	\$9,429

## Hazard and Vulnerability and Risk Assessment

Jurisdiction	Estimated Losses
MCD Seaford	\$21,886
MCD Selbyville-Frankford	\$24,987
Milford	Negligible
Millsboro	Negligible
Millville	Negligible
Milton	Negligible
Ocean View	Negligible
Rehoboth Beach	Negligible
Seaford	\$5,284
Selbyville	Negligible
Slaughter Beach	Negligible
South Bethany	Negligible
<b>TOTAL</b>	<b>\$190,778</b>

**Table 4-28: Potential Damage to Critical Facilities from Earthquake<sup>17</sup>**

Jurisdiction	Total Number of Critical Facilities	100-year Earthquake			500-year Earthquake		
		Moderate Damage	Slight Damage	Negligible Damage	Moderate Damage	Slight Damage	Negligible Damage
Bethany Beach	14	0	0	14	0	0	14
Bethel	1	0	0	1	0	0	1
Blades	7	0	0	7	0	0	7
Bridgeville	25	0	0	25	0	0	25
Dagsboro	11	0	0	11	0	0	11
Delmar	7	0	0	7	0	0	7
Dewey Beach	11	0	0	11	0	0	11
Ellendale	6	0	0	6	0	0	6
Fenwick Island	5	0	0	5	0	0	5
Frankford	8	0	0	8	0	0	8
Georgetown	40	0	0	40	0	0	40
Greenwood	8	0	0	8	0	0	8
Laurel	31	0	0	31	0	0	31
Lewes	40	0	0	40	0	0	40
MCD Bridgeville-Greenwood	76	0	0	76	0	0	76
MCD Georgetown	83	0	0	83	0	0	83

<sup>17</sup> The definitions used are as follows. Negligible: less than 1 percent damage. Slight: 1 to 5 percent damage. Moderate: 5 to 30 percent damage. Extensive (where applicable): 30 to 60 percent damage

## Hazard and Vulnerability and Risk Assessment

Jurisdiction	Total Number of Critical Facilities	100-year Earthquake			500-year Earthquake		
		Moderate Damage	Slight Damage	Negligible Damage	Moderate Damage	Slight Damage	Negligible Damage
MCD Harrington	1	0	0	1	0	0	1
MCD Laurel-Delmar	172	0	0	172	0	0	172
MCD Lewes	175	0	0	175	0	0	175
MCD Milford North	1	0	0	1	0	0	1
MCD Milford South	121	0	0	121	0	0	121
MCD Millsboro	137	0	0	137	0	0	137
MCD Milton	62	0	0	62	0	0	62
MCD Seaford	163	0	0	163	0	0	163
MCD Selbyville-Frankford	258	0	0	258	0	0	258
Milford	33	0	0	33	0	0	33
Millsboro	14	0	0	14	0	0	14
Millville	5	0	0	5	0	0	5
Milton	20	0	0	20	0	0	20
Ocean View	6	0	0	6	0	0	6
Rehoboth Beach	33	0	0	33	0	0	33
Seaford	50	0	0	50	0	0	50
Selbyville	2	0	0	2	0	0	2
Slaughter Beach	2	0	0	2	0	0	2
South Bethany	7	0	0	7	0	0	7
<b>TOTAL</b>	<b>1,280</b>	<b>0</b>	<b>0</b>	<b>1,280</b>	<b>0</b>	<b>0</b>	<b>1,280</b>

### Dam/Levee Failure

The approach for determining vulnerability to dam and/or levee failure consists of a number of factors. Data from the USACE National Inventory of Dams (NID)<sup>18</sup> in addition to the HAZUS-MH demographic inventory was used, with an assumption that dam breaks most likely will occur at the time of maximum capacity.<sup>19</sup> The affected population was then calculated.

<sup>18</sup> With the National Dam Inspection Act of 1972, the U.S. Congress authorized the U.S. Army Corps of Engineers (USACE) to inventory dams located in the United States. The Water Resources Development Act of 1986 authorized USACE to maintain and periodically publish an updated National Inventory of Dams (NID).

<sup>19</sup> Downstream quarter-circle buffer proportional to the maximum capacity of dams are assumed to represent the maximum impact area.

## Hazard and Vulnerability and Risk Assessment

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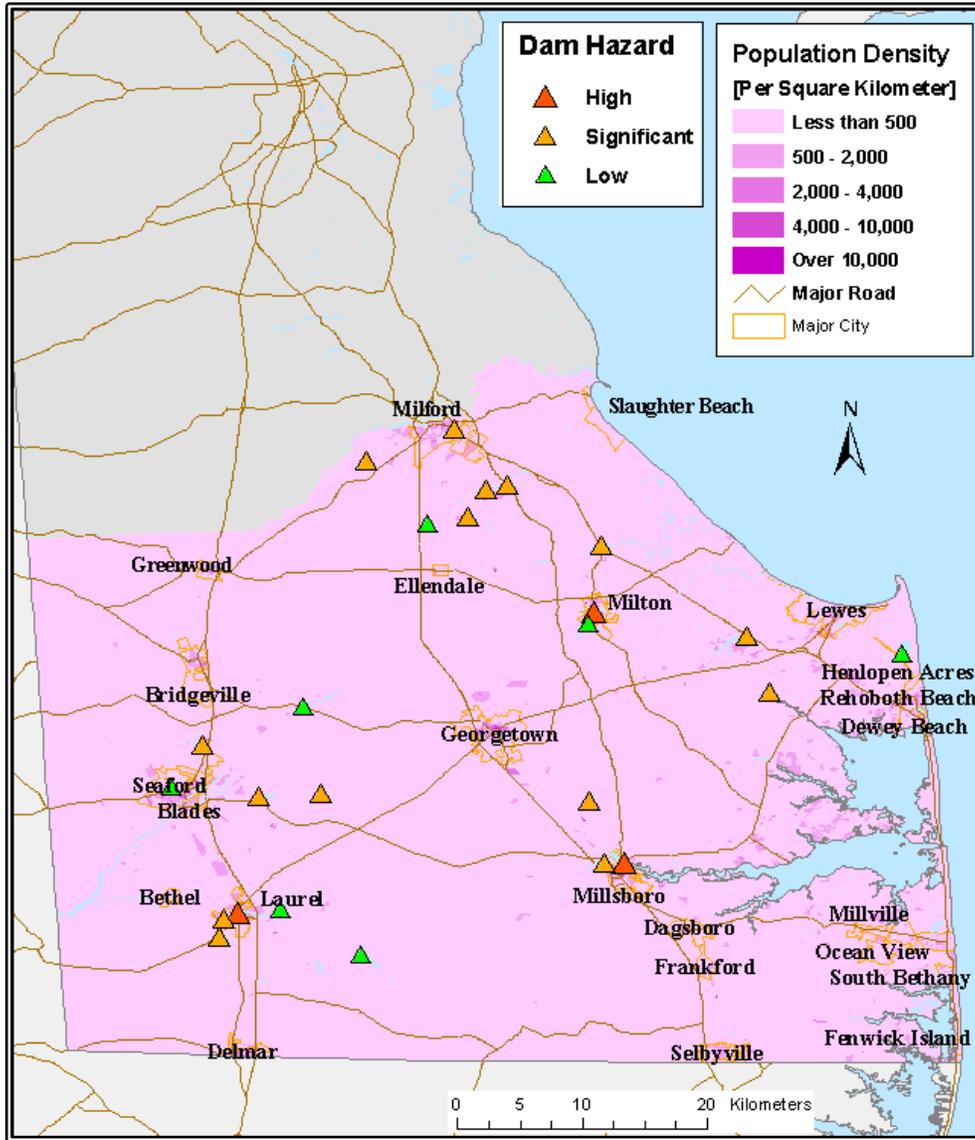
**Table 4-29** shows estimated exposure of people to dam failure. **Figure 4-14** on the following page shows the location of dams within Sussex County, along with their hazard ranking (high, significant or low), in relation to population density.

**Table 4-29: Estimated Exposure of People to Dam Failure**

Dam Name	Nearest City/Town	Potential People at Risk
Williams Pond Dam	Seaford	716
Collins Pond Dam	Seaford SW	613
Hearns Pond Dam	Seaford S	549
Records Pond Dam	Laurel	466
Red Mill Pond Dam	Lewes E	346
Gordons Pond Dam	Rehoboth S	343
Horseys Pond Dam	Laurel NE	319
Wagamons Pond Dam	Milton	281
Denoname 4	Laurel	266
Denoname 3	Laurel	266
Swiggets Pond Dam	Milford NW	261
Millsboro Pond	Millsboro	229
Denoname 5	Laurel	221
Cabbage Pond Dam	Milford NW	204
Chipman Pond Dam	Laurel SW	174
Waples Pond Dam	Broadkill Beach E	149
Marshall Millpond Dam	Milford	121
Goslee Mill Pond Dam	Lewes NE	95
Trap Pond Dam	Laurel NW	83
Diamond Pond Dam	Milton NE	67
Hudson Pond Dam	Ellendale S	47

# Hazard and Vulnerability and Risk Assessment

Figure 4-14: Location of Dams (With Hazard Ranking) in Relation to Population Density



## Hazard and Vulnerability and Risk Assessment

### Weapons of Mass Destruction

Using FEMA Publication 426 Reference Manual to Mitigate Potential Terrorist Attacks in High Occupancy Buildings as a basis, a vulnerability assessment was conducted for Weapons of Mass Destruction (WMDs) in order to expand the scope of the hazard mitigation planning process in the State of Delaware to include vulnerability to acts of terrorism. The methodology used employs a vulnerability ranking of 1 to 5 for certain transportation, water/hydrology, emergency and public safety, and utility elements. The sum total for each element is then multiplied against a value for that asset (also on a 1 to 5 scale) and multiplied against a factor representing the Department of Homeland Security Threat Level. For the purposes of this Plan, the Threat Level is assumed to be Orange (High). This part of the assessment is the same for all three counties in Delaware. In the final analysis, the total risk for each County is multiplied by a unique weighted factor to arrive at County-specific scores. For Sussex County, a weighted factor of 1.00 was used. Abbreviated findings of this methodology are presented in **Table 4-30**. Complete information is stored in a Microsoft® Excel® file separate from this Plan.

**Table 4-30: Assessment of Vulnerability to Weapons of Mass Destruction**

		Based on FEMA 426: Reference Manual to Mitigate Potential Terrorist Attacks in High Occupancy Buildings																
		Asset Visibility	Target Value to Asset	Asset Mobility	Target Threat of Collateral	Site	Pot. for Collateral	SUM	Asset Value of	Homeland	Risk		Sussex					
											X		1.00					
<b>Transportation</b>																		
	Major bridges	5	4	5	5	0	2	1	0	22	X	4	X	6	=	528	:	528
	Airports	4	4	3	5	0	1	2	0	19	X	4	X	6	=	456	:	456
<b>Water / Hydrology</b>																		
	Reservoirs	3	5	3	5	1	3	1	0	21	X	5	X	6	=	630	:	630
	Dams	4	5	2	5	1	4	1	0	22	X	5	X	6	=	660	:	660
<b>Emergency and Public Safety</b>																		
	Hospitals	4	3	4	5	4	2	2	2	26	X	5	X	6	=	780	:	780
	Military Facilities	2	4	1	5	4	3	3	2	24	X	5	X	6	=	720	:	720
	Schools	4	4	4	5	1	1	2	1	22	X	3	X	6	=	396	:	396
<b>Utilities</b>																		
	Gas LNG plant	3	3	3	5	2	3	1	2	22	X	3	X	6	=	396	:	396
	Electric substations	3	2	3	5	1	2	1	0	17	X	2	X	6	=	204	:	204

To provide perspective to these findings, the final scores for each element were compared to the maximum score defined in FEMA Publication 426 (**Table 4-31**). This comparison shows hospitals, military facilities and day care centers to have the three highest rankings compared to all other elements. These three elements are the focal point of the chemical and radiological agents sections.

## Hazard and Vulnerability and Risk Assessment

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**Table 4-31: Comparison of Sussex County and FEMA 426 Model**

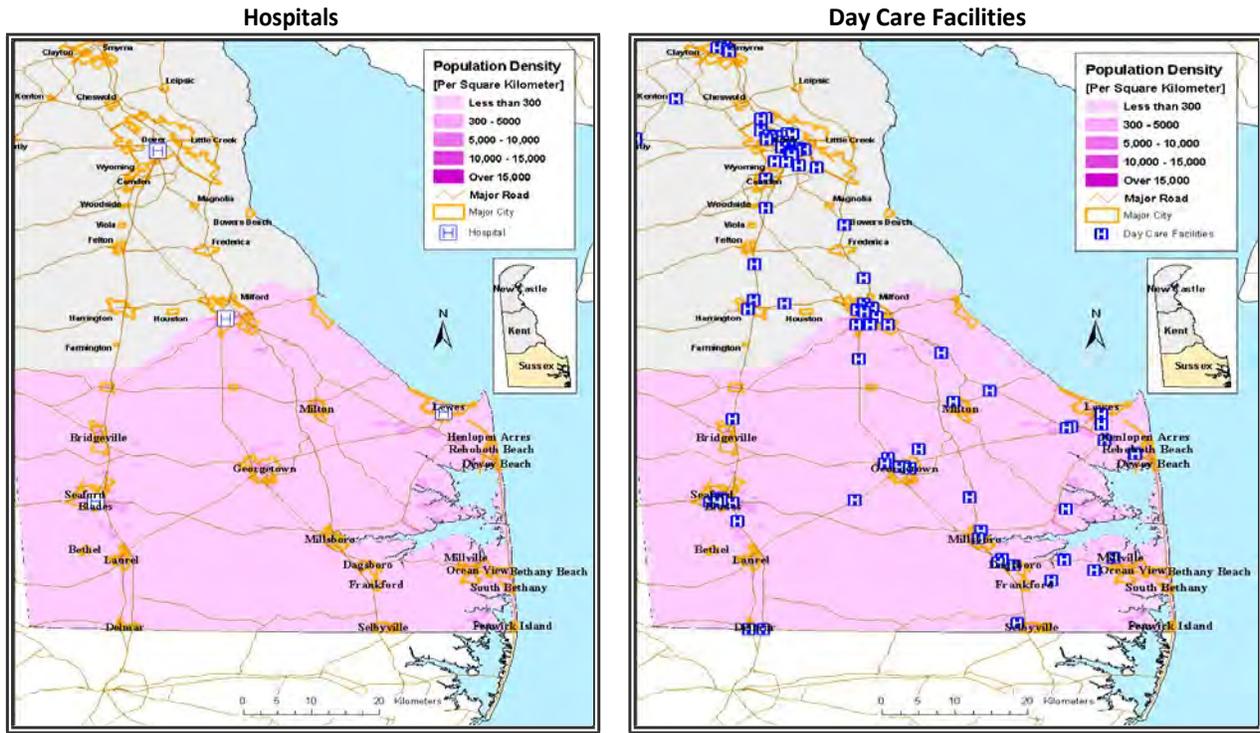
Facility	Threat	Percent Comparison
<b>Maximum Score in FEMA 426 Model</b>	<b>14.400</b>	<b>100%</b>
Hospitals	7.800	54%
Military Facilities	7.200	50%
Day Care Centers	6.900	48%
Hazardous Material Sites	6.600	46%
Dams	6.600	46%
Reservoirs	6.300	44%
Major Bridges	5.280	37%
All Gas Pipelines	1.020	7%
U.S. Roads	0.960	7%
State Roads	0.960	7%

### Chemical Agents

In planning for the possible release of a chemical agent as an act of terrorism, Sussex County identified two (2) hospitals and 47 daycare facilities throughout the County as potential targets. **(Figure 4-15)** graphically illustrates the locations of these facilities. In order to create a more complete assessment of the damage that would be inflicted should such an attack occur, Sussex County also determined the surrounding population and building stock within both an 8-mile radius of the target (the “Immediate Response Zone”) and a 20-mile radius (the “Protective Action Zone”). This approach is believed to more accurately represent the overall exposure of the County and its communities to the threat of a chemical agent. **Tables 4-31** and **4-32** offer the results of this analysis. In order to keep this planning document brief, only the top three day care facilities in terms of affected population are included in Table Complete information for all 47 facilities is stored in a Microsoft Excel file separate from this Plan.

# Hazard and Vulnerability and Risk Assessment

**Figure 4-15: Location of and Hospitals and Day Care Facilities in Sussex County**



**Table 4-31: Hospitals and Surrounding Exposure**

Name of Hospital	City	Immediate Response Zone (IRZ) 8 miles from each hospital		Protective Action Zone (PAZ) 20 miles from each hospital	
		Population	Buildings	Population	Buildings
Beebe Medical Center	Lewes	27,779	24,313	104,072	67,839
Nanticoke Memorial Hospital	Seaford	39,178	15,727	105,689	41,312

**Table 4-32: Day Care Facilities and Surrounding Exposure**

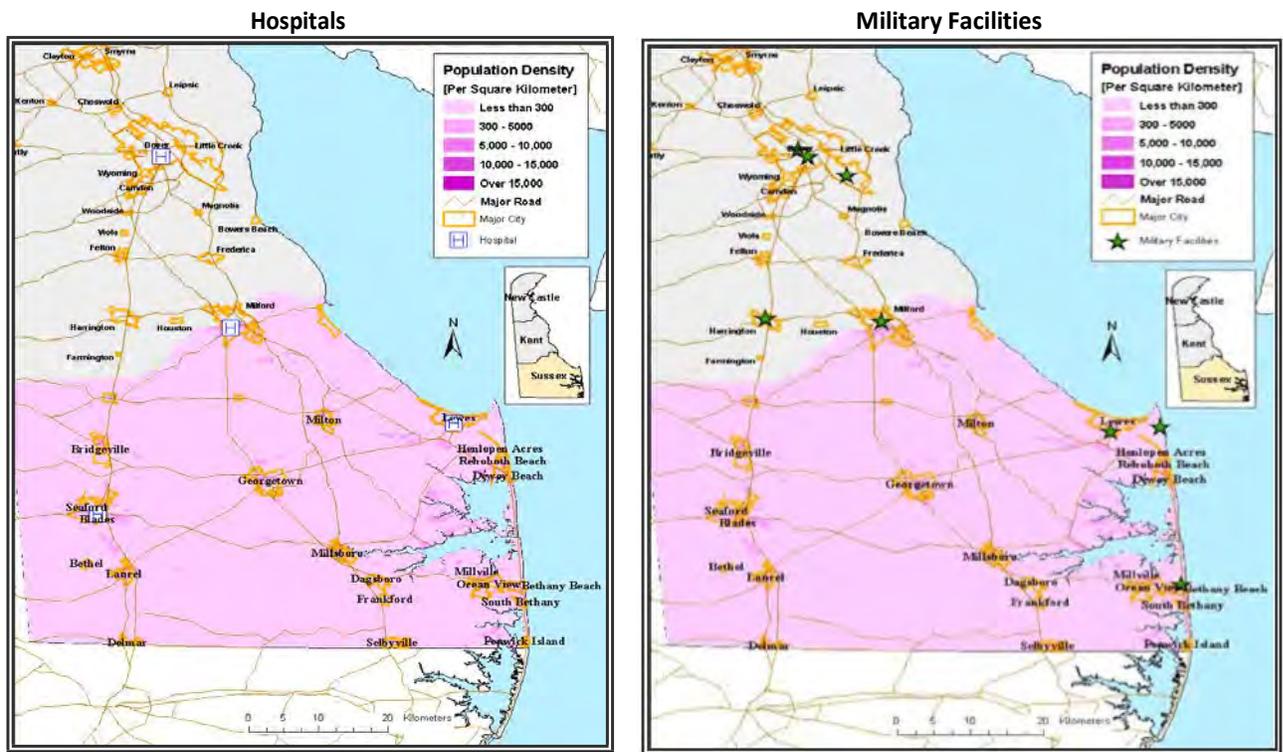
Name of Day Care Facility	City	Immediate Response Zone (IRZ) 8 miles from each hospital		Protective Action Zone (PAZ) 20 miles from each hospital	
		Population	Buildings	Population	Buildings
Little Hearts Learning Center, Inc.	Dagsboro	42,170	33,212	98,415	67,841
Noah's Ark II	Millsboro	47,946	35,688	105,026	70,483
Child Craft Company	Seaford	38,877	15,611	103,191	40,292

# Hazard and Vulnerability and Risk Assessment

## Radiological

In planning for the possible release of a radiological agent as an act of terrorism, Sussex County identified two (2) hospitals and three (3) military facilities throughout the County as potential targets. **Figure 4-16** graphically illustrates the locations of these facilities. In order to create a more complete assessment of the damage that would be inflicted should such an attack occur, Sussex County also determined the surrounding population and building stock within both an 8-mile radius of the target the (“Immediate Response Zone”) and a 20-mile radius the (“Protective Action Zone”). This approach is believed to more accurately represent the overall exposure of the County and its communities to the threat of a radiological agent. **Tables 4-33** and **4-34** contain the results of this analysis.

**Figure 4-16: Location of Hospitals and Military Facilities in Sussex County**



**Table 4-33: Hospitals**

Name of Hospital	City	Immediate Response Zone (IRZ) 8 miles from each hospital		Protective Action Zone (PAZ) 20 miles from each hospital	
		Population	Buildings	Population	Buildings
Beebe Medical Center	Lewes	37,030	29,952	289,318	142,796
Nanticoke Memorial Hospital	Seaford	43,576	17,387	289,397	142,825

## Hazard and Vulnerability and Risk Assessment

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**Table 4-34: Military Facilities**

Name of Military Facility	Immediate Response Zone (IRZ) 8 miles from each hospital		Protective Action Zone (PAZ) 20 miles from each hospital	
	Population	Buildings	Population	Buildings
U.S. Naval Reserve	29,758	26,019	287,550	142,133
Army Reserve Center	38,823	31,243	289,054	142,708
Delaware National Guard	32,588	30,818	241,475	125,650

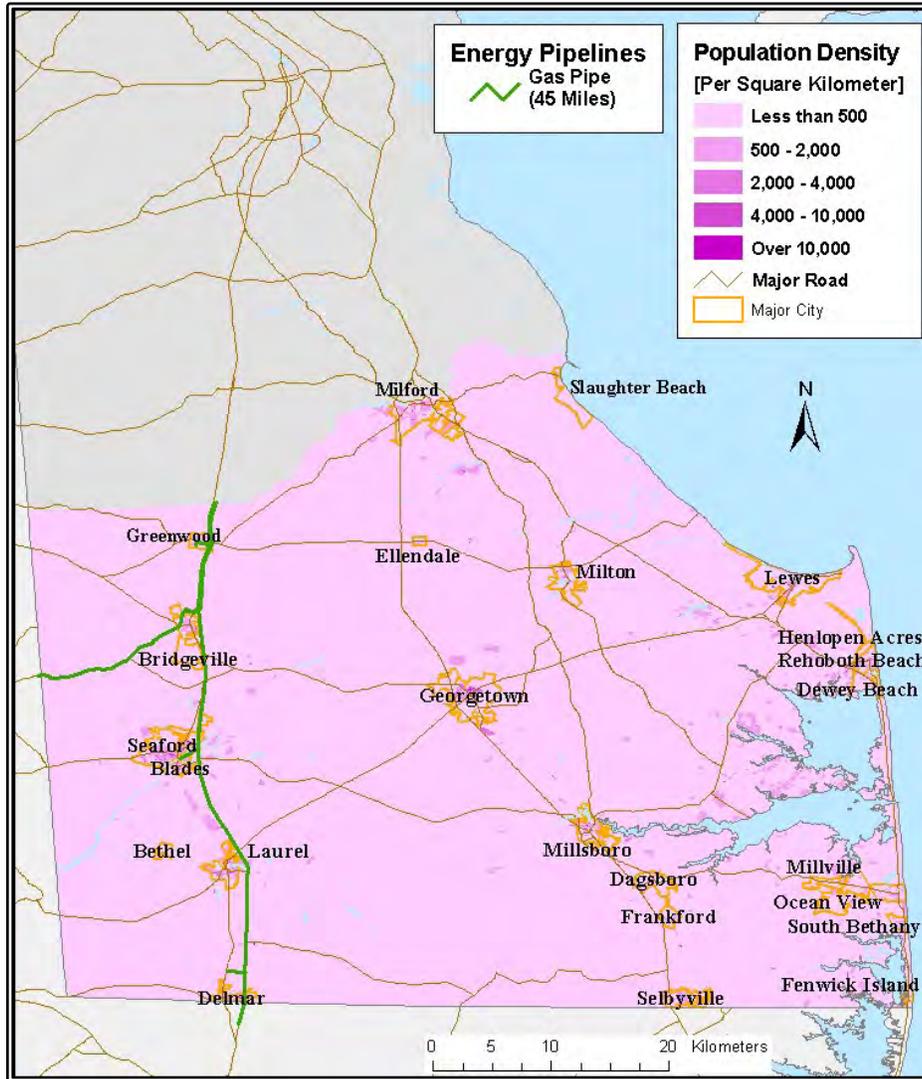
### Biological Agents

The relative risk of Sussex County to Delaware in terms of the release of a biological agent is 6.28 percent. This is based on a risk formula of “VULNERABILITY x HAZARD x EXPOSURE.” Vulnerability in this case is a measure of the speed at which infection will spread among the population. Population was studied based on general occupancy class: residential, commercial, industrial, education, government, agricultural and religious. The hazard component was considered to be a measure of the introduction of the disease among the population. This also was broken down by occupancy class, in this case residential, commercial, industrial, education, government and religious. The exposure was determined using HAZUS-MH data.

### Energy Pipelines

Energy pipelines cross most of the State of Delaware, including some of Sussex County. If any of these energy pipelines, oil or gas, were to rupture, such an event could endanger property and lives in the immediate area, within less than half a mile radius. **Figure 4-16** on the following page shows the location of 45 miles of energy pipelines within the County’s boundaries in relation to population density and municipalities.

Figure 4-16: Energy Pipelines



### Hazardous Materials (HazMat)

Assessing vulnerability to a hazardous material (HazMat) release on a Countywide scale can consist of a number of factors, such as the type(s) of hazardous materials present, the potential for mass casualties, potential consequences for the surrounding area, accessibility, public awareness, and the likelihood of being a terrorist target. The assessment conducted for Sussex County focuses on the first three of these factors, and a comprehensive study was undertaken to document information for 13 identified hazardous material sites from State of Delaware exposure data.<sup>20</sup> High consequence events were then

<sup>20</sup> If a facility houses more than one hazardous material, it is treated as a separate entry in this table, partially due to the fact that potential population at risk and projected clean-up area could vary depending on the chemical.

## Hazard and Vulnerability and Risk Assessment

selected, (high material toxicity and population density), and ALOHA<sup>21</sup> was used for calculating the impact area.

Affected population (based on Census 2000) and exposure value (HAZUS-MH) was then reported per selected events.

**Table 4-35** offers the results of this analysis for all 13 HazMat facilities.

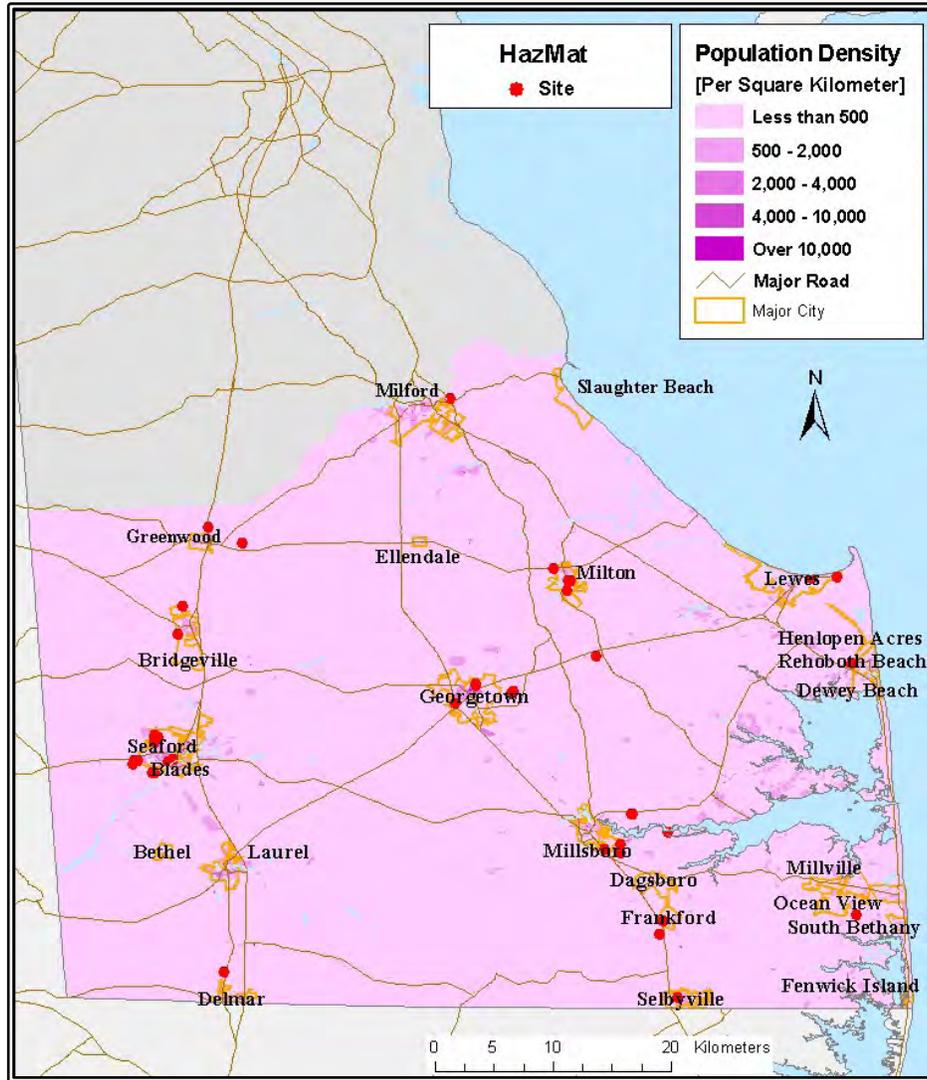
**Table 4-35: Hazardous Materials Facilities**

Facility Name	City	Chemical Name	Potential Residential Population at Risk	Clean-up Area (square kms)
Orient Corp. of America	Seaford	Aniline	192	3.118
Johnson Polymer	Seaford	Butyl Acrylate	143	2.325
Orient Corp. of America	Seaford	Nitrobenzene	65	0.856
Du Pont Seaford Plant	Seaford	Antimony Compounds **Reacts with Water	19	0.447
Johnson Polymer	Seaford	Ammonia	8	0.096
Du Pont Seaford Plant	Seaford	Zinc Compounds	0	0.048
Du Pont Seaford Plant	Seaford	Hydrochloric Acid	0	0.028
Du Pont Seaford Plant	Seaford	Mercury Compounds	0	0.000
Du Pont Seaford Plant	Seaford	Sulfuric Acid	0	0.000
Du Pont Seaford Plant	Seaford	Chromium Compounds	0	0.000
Du Pont Seaford Plant	Seaford	Biphenyl	0	0.000
Du Pont Seaford Plant	Seaford	Chlorodifluoromethane	0	0.000
Green Tree Chemical Technologies, Inc., Aerosols Div.	Seaford	1,1-Dichloro-1-Fluoroethane	0	0.000

<sup>21</sup> ALOHA (Areal Locations of Hazardous Atmospheres) is a computer program that uses information provided by its operator and physical property data from its extensive chemical library to predict how a hazardous gas cloud might disperse in the atmosphere after an accidental chemical release

# Hazard and Vulnerability and Risk Assessment

Figure 4-17: Location of Hazardous Materials Facilities in Relation to Population Density



## Other Hazards

Though communities in the State of Delaware recognize that the state is vulnerable to other hazards such as wildfires, erosion, sinkholes, landslides and tsunamis, a high-level detailed risk assessment was not completed for Sussex County due to the low level of risk and/or vulnerability for these hazards within the area as a whole as compared with other hazards.

## Hazard and Vulnerability and Risk Assessment

### Conclusions on Hazard Risk

**Table 4-36** summarizes the annualized expected losses presented for each natural hazard in this section. Based upon the methodologies described in the beginning of this section, the risk from natural hazards in Sussex County can be rated on a scale of Low, Moderate or High for each identified natural hazard based upon these annualized losses and an annualized loss ratio (**Table 4-38**).<sup>22</sup> Because of the nature of human-caused hazards and the nature in which risk and vulnerability is presented for human-caused hazards, it is not possible to rank them fairly in direct comparison with natural hazards. In summary, all human-caused hazards addressed in this section; terrorism (chemical, radiological and biological agents), hazardous materials incidents (HazMat), and energy pipeline failures, warrant an overall rating of low risk for Sussex County.

In order to create a final overall risk ranking per hazard in Sussex County, the previous hazard analysis and the risk assessment are combined in **Table 4-39**. A number of analyzed hazards were deemed to be of little consequence to the County. They are added to the risk ranking as low risk but unranked. Other hazards, such as extreme heat/cold, generate no direct monetary losses and are excluded from the risk assessment. However, their frequency of occurrence and their potential to cause injuries and death warrants them to be ranked at a medium level of risk. The final risk ranking demonstrates that flooding and drought are the two most critical threats to Sussex County’s population and built environment.

**Table 4-36: Potential Annualized Losses per Jurisdiction**

Jurisdiction	Flood	Tropical Storm Wind	Thunderstorm	Tornado	Drought	Hail	Winter Storm	Earthquake
Bethany Beach	\$8,221,887	\$11,377	Negligible	Negligible	\$17,626	Negligible	Negligible	Negligible
Bethel	\$76,408	Negligible	Negligible	Negligible	\$6,671	Negligible	Negligible	Negligible
Blades	\$115,000	Negligible	Negligible	Negligible	\$7,230	Negligible	Negligible	Negligible
Bridgeville	Negligible	Negligible	Negligible	Negligible	\$67,345	Negligible	Negligible	Negligible
Dagsboro	Negligible	Negligible	Negligible	Negligible	\$20,999	Negligible	Negligible	Negligible
Delmar	Negligible	Negligible	Negligible	Negligible	\$13,992	Negligible	Negligible	Negligible
Dewey Beach	\$1,430,177	Negligible	Negligible	Negligible	\$6,732	Negligible	Negligible	Negligible
Ellendale	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Fenwick Island	\$2,258,541	Negligible	Negligible	Negligible	\$7,536	Negligible	Negligible	Negligible
Frankford	\$63,925	Negligible	Negligible	Negligible	\$10,766	Negligible	Negligible	Negligible
Georgetown	Negligible	\$5,236	Negligible	Negligible	\$69,388	Negligible	Negligible	Negligible

<sup>22</sup> The annualized loss ratio is multiplied by 50,000 (x 500 for a proxy 500-year loss and x 100 for a percentage number.) Low risk equals 0 to 5 percent; Medium risk equals 6 to 20 percent, and High risk is any percentage over 20.

## Hazard and Vulnerability and Risk Assessment

Jurisdiction	Flood	Tropical Storm Wind	Thunderstorm	Tornado	Drought	Hail	Winter Storm	Earthquake
Greenwood	\$7,101	Negligible	Negligible	Negligible	\$11,048	Negligible	Negligible	Negligible
Henlopen Acres	\$409,600	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Laurel	\$2,182,198	Negligible	Negligible	Negligible	\$40,473	Negligible	Negligible	Negligible
Lewes	\$700,624	\$7,481	Negligible	Negligible	\$65,458	Negligible	Negligible	Negligible
MCD Bridgeville-Greenwood	\$1,091,200	\$25,390	\$17,559	Negligible	\$1,530,281	Negligible	\$35,556	\$11,232
MCD Georgetown	\$255,801	\$48,865	\$11,452	Negligible	\$998,028	Negligible	\$23,189	\$12,767
MCD Laurel-Delmar	\$991,374	\$95,369	\$30,869	Negligible	\$2,690,299	Negligible	\$62,510	\$14,884
MCD Lewes	\$19,357,870	\$367,759	\$14,471	Negligible	\$1,261,154	Negligible	\$29,303	\$40,144
MCD Milford South	\$1,912,048	\$48,034	\$20,936	Negligible	\$1,824,606	Negligible	\$42,395	\$16,310
MCD Millsboro	\$36,640,370	\$616,112	\$16,369	Negligible	\$1,426,546	Negligible	\$33,146	\$16,409
MCD Milton	\$445,316	\$111,662	\$10,649	Negligible	\$928,101	Negligible	\$21,565	\$9,429
MCD Seaford	\$1,403,417	\$61,270	\$15,314	Negligible	\$1,334,655	Negligible	\$31,011	\$21,886
MCD Selbyville-Frankford	\$43,167,201	\$451,242	\$21,801	Negligible	\$1,900,032	Negligible	\$44,148	\$24,987
Milford	\$630,092	Negligible	Negligible	Negligible	\$142,649	Negligible	Negligible	Negligible
Millsboro	\$411,348	\$8,191	Negligible	Negligible	\$61,221	Negligible	Negligible	Negligible
Millville	\$124,808	\$10,358	Negligible	Negligible	\$35,871	Negligible	Negligible	Negligible
Milton	\$338,142	Negligible	Negligible	Negligible	\$24,765	Negligible	Negligible	Negligible
Ocean View	\$1,008,480	\$10,134	Negligible	Negligible	\$37,724	Negligible	Negligible	Negligible
Rehoboth Beach	\$499,965	\$5,387	Negligible	Negligible	\$24,588	Negligible	Negligible	Negligible
Seaford	\$560,861	\$9,739	Negligible	Negligible	\$75,703	Negligible	Negligible	\$5,284
Selbyville	\$148,809	\$8,370	Negligible	Negligible	\$50,804	Negligible	Negligible	Negligible
Slaughter Beach	\$333,152	Negligible	Negligible	Negligible	\$20,816	Negligible	Negligible	Negligible
South Bethany	\$4,017,172	\$5,155	Negligible	Negligible	\$7,933	Negligible	Negligible	Negligible
<b>TOTAL</b>	<b>\$129,520,000</b>	<b>\$1,926,244</b>	<b>\$168,211</b>	<b>\$11,000</b>	<b>\$14,659,834</b>	<b>\$7,560</b>	<b>\$340,625</b>	<b>\$190,778</b>

**Table 4-38: Estimated Level of Risk by Hazard (High, Moderate, Low)**

Flood	Hurricane Wind	Thunder storm	Tornado	Drought	Hail	Winter Storm	Earthquake
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## Hazard and Vulnerability and Risk Assessment

High	Low	Moderate	Low	High	Low	Moderate	Low
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It should be noted that although some hazards may show Medium or Low risk, hazard occurrence is still possible. Also, any hazard occurrence could potentially cause a great impact and losses could be extremely high (i.e., an F5 tornado or a Category 5 hurricane).

**Table 4-39: Overall Risk Ranking for Sussex County**

Hazard	Rank
Flood	1
Thunderstorm	2
Hurricane Wind	3
Drought	4
Extreme Heat/Cold	5
Winter Storms	6
Tornado	7
Hail	8
Tsunami	9
Earthquake	Unranked
Wildfire	Unranked
Erosion	Unranked
Dam/Levee Failure	Unranked
Terrorism	Unranked
HazMat Incident	Unranked
Pipeline Failure	Unranked

### Unique Risks for Local Jurisdictions

To address unique risks within individual jurisdictions of the multi-jurisdictional planning area, the *Unique Risk for Local Jurisdictions* section documents responses gathered from local government officials by the Delaware Emergency Management Agency. Through this process, unique risks were identified for Bethany Beach, as well as all coastal communities within the County.

#### **Town of Bethany Beach**

##### *Identified by Bethany Beach Police Department*

Bethany Beach experiences tidal flooding on the Back Bays, as well as flooding on all streets east of State Route 1 during severe storms and/or heavy rain. This includes all areas along the oceanfront on the Atlantic Ocean. This flooding is confined to a distinct geographic boundary, streets flood within the corporate limits of Bethany Beach in areas with poor drainage and low elevation. Approximately 650 homes are at risk within this area, as well as

## Hazard and Vulnerability and Risk Assessment

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several motels on Boardwalk, a lifeguard building and other public facilities. The residential properties hold an estimated value of \$500,000 per structure. The 50 or so commercial structures are estimated to be valued at approximately \$250,000 to \$500,000 each. The lifeguard station and other public facilities have an estimated total value of \$500,000. No lifelines or infrastructure are known to be at risk.

### **Town of Ellendale**

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*Identified by the Town of Ellendale Mayor's Office*

Wildfires are known to be caused by coal-fired train engines and loaded coal cars. Sparks from the wheels and tracks have generated fires at least twice in the past two years that are reported to have burnt for more than three days causing damage to forestry and grasslands. No lives, homes, businesses, infrastructure or critical facilities are known to be at risk from this hazard.

### **All Coastal Communities**

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*Identified by the Delaware Department of National Resources and Environmental Control*

One unique hazard affecting all coastal communities in Sussex County is the issue of long-term coastal erosion and sea level rise. Generally speaking, this hazard is confined to the distinct geographic boundaries of the Delaware Bay shore, the Atlantic Ocean coast and the inland bays.

# SECTION 5: CAPABILITIES ASSESSMENT

## *Contents of this Section*

This section of the Plan discusses the capability of Sussex County and the participating municipal jurisdictions to implement hazard mitigation activities. It consists of four sections:

- What is a Capability Assessment?
- Capability Assessment Update;
- Capability Assessment Findings; and
- Conclusions on Local Capability.

## *Requirement for the Planning Process*

**Requirement §201.6(b)(3):** *The planning process must include a review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.*

## *What is a Capability Assessment?*

The purpose of conducting a capability assessment is to determine the ability of a local jurisdiction to implement a mitigation strategy, and to identify potential opportunities for establishing or enhancing specific mitigation policies, programs or projects.<sup>23</sup> As in any planning process, it is important to try to establish which goals, objectives and actions are feasible, based on an understanding of the organizational capacity of those agencies or departments tasked with their implementation. A capability assessment helps to determine which mitigation actions are practical and likely to be implemented over time given the fiscal, technical, administrative and political framework of the community.

A capability assessment has two primary components: an inventory of a local jurisdiction's relevant plans, programs or policies already in place; and an analysis of its capacity to carry them out. Examination of local capabilities will detect existing gaps, shortfalls or weaknesses with ongoing government activities. A capability assessment also highlights the positive mitigation measures already in place or being implemented at the local government level, which should continue to be supported and enhanced if possible through future mitigation efforts.

The capability assessment completed for Sussex County serves as a critical part of the foundation for designing an effective hazard mitigation strategy. Coupled with the *Risk Assessment*, the *Capability Assessment* helps identify and target meaningful mitigation actions for incorporation in the *Mitigation Strategy* portion of the All Hazard Mitigation Plan. It not

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<sup>23</sup> While the Final Rule for implementing the Disaster Mitigation Act of 2000 does not require a local capability assessment to be completed for local hazard mitigation plans, it is a critical step to develop a mitigation strategy that meets the needs of each jurisdiction while taking into account their own unique abilities. The Rule does state that a community's mitigation strategy should be "based on existing authorities, policies, programs and resources, and its ability to expand on and improve these existing tools" (44 CFR, Part 201.6(c) (3)).

## Capabilities Assessment

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only helps establish the goals and objectives for Sussex County to pursue under this Plan, but also ensures that those goals and objectives are realistically achievable under given local conditions.

### *Capability Assessment Update*

The original Capability Assessment survey distributed in 2003 to local government officials, asked specific questions about existing local plans, policies, programs or ordinances that contributed to and/or hindered the community's ability to implement hazard mitigation actions. In addition, a series of questions were asked concerning each jurisdiction's technical, fiscal, administrative and political capabilities to implement mitigation actions. The survey results provided an extensive inventory of existing local plans, policies, programs and ordinances and required local officials to conduct a self-assessment of their jurisdiction's specific capabilities. The 2010 plan information was reviewed and updated during interviews conducted with community officials as part of this update.

Originally, the information provided by the participating jurisdictions in response to the survey questionnaire was incorporated into a database for further analysis. A general scoring methodology<sup>24</sup> was then applied to quantify and rank each jurisdiction's overall capability relative to one another. According to the scoring system, each plan, policy, ordinance or program was assigned a point value based on its relevance to hazard mitigation. Additional points were added based on each jurisdiction's self-assessment of their own fiscal, technical, administrative and political capability. A total score and general capability rating (High, Moderate or Limited) was then determined according to the total number of points received. The survey results also serve as a good source of introspection or those jurisdictions wishing to improve their capability, as identified gaps, weaknesses or conflicts may be recast as opportunities for specific mitigation actions.

During this Plan update process the Capability Assessment results from the 2010 plan were distributed and discussed with participating municipalities. The 2010 information was shared with municipal officials and areas where plans, ordinances, and political, fiscal, or administrative and technical capability had changed were indicated. This information was shared at the Committee meeting and has been incorporated into the overall Capability Assessment.

### *Capability Assessment Findings*

The findings of the capability assessment are summarized in this Plan to provide insight into relevant capacity of Sussex County's jurisdictions to implement hazard mitigation activities. All information is based upon the responses provided by local government officials to during one on one interviews and meetings.

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<sup>24</sup> A copy of the original survey and the scoring system used to assess County and municipal capabilities is available through Sussex County upon request. Due to the length of the survey and the number of participating jurisdictions, the completed surveys were not included in this document.

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**Table 5.1** on the following page provides a summary of the local plans and programs in place for Sussex County’s participating local governments. An “X” indicates that the given plan or program is currently in place and being implemented by the local jurisdiction. A more detailed discussion follows, along with the incorporation of additional information based on the narrative comments provided by local officials.

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**Table 5.1 Relevant Plans and Programs in Place**

Jurisdiction	HMP	DRP	CLUP	FMP	SMP	EOP	COOP	REP	SARA	TRANS	CIP	REG-PL	HPP	ZO	SO	FDPO	NFIP	CRS	BC
Sussex County	X	X	X	X		X		X	X	X	X	X	X	X	X	X	X		X
Bethany Beach	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X
Bethel									X			X	X	X		X	X		X
Blades			X						X					X	X	X	X		X
Bridgeville	X		X	X		X	X	X	X	X	X	X	X	X		X	X		X
Dagsboro			X						X		X	X		X	X	X	X		X
Delmar			X			X	X		X	X	X			X	X	X	X		X
Dewey Beach			X	X					X			X		X	X	X	X	X	X
Ellendale			X						X					X	X				X
Fenwick Island	X		X	X	X	X			X		X	X		X	X	X	X	X	X
Frankford			X	X					X		X			X	X	X	X		X
Georgetown			X	X					X		X	X		X	X	X	X		X
Greenwood			X	X					X					X	X	X	X		X
Henlopen Acres				X		X	X		X		X	X		X	X	X	X		X
Laurel			X		X				X		X			X	X	X	X		X
Lewes	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Millsboro			X	X					X					X	X	X	X		X
Millville			X	X					X			X	X	X	X	X	X		X
Milton			X	X								X	X	X	X	X	X		X
Ocean View	X		X	X		X			X		X	X		X	X	X	X		X
Rehoboth Beach		X	X	X	X	X	X		X		X		X	X	X	X	X	X	X
Seaford		X	X	X		X	X		X	X		X	X	X	X	X	X	X	X
Selbyville	X		X	X	X	X			X		X	X	X	X	X	X	X		X
Slaughter Beach			X			X	X		X			X		X	X	X	X		X
South Bethany		X	X	X		X	X		X		X	X		X	X	X	X	X	X

Highlighted Entries Are 2010 Data, Pending Participation

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### Key to Table 5.1

- HMP** – Hazard Mitigation Plan
- DRP** – Disaster Recovery Plan
- CLUP** – Comprehensive Land Use Plan
- FMP** – Floodplain Management Plan / Flood Mitigation Plan
- SMP** – Stormwater Management Plan
- EOP** – Emergency Operations Plan
- COOP** – Continuity of Operations Plan
- REP** – Radiological Emergency Plan
- SARA** – SARA Title III Emergency Response Plan
- TRANS** – Transportation Plan
- CIP** – Capital Improvements Plan (that regulates infrastructure in hazard areas)
- REG-PL** – Regional Planning
- HPP** – Historic Preservation Plan
- ZO** – Zoning Ordinance
- SO** – Subdivision Ordinance
- FDPO** – Flood Damage Prevention Ordinance
- NFIP** – National Flood Insurance Program
- CRS** – Community Rating System
- BC** – Building Codes

### Emergency Management Capabilities

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Hazard mitigation is widely recognized as one of the four primary phases of emergency management. Other phases include preparedness, response and recovery. In reality, each phase is interconnected with hazard mitigation as **Figure 5.1** suggests. Planning for each phase is a critical part of a comprehensive emergency management program and a key to the successful implementation of hazard mitigation actions.

#### Hazard Mitigation Plan

A Hazard Mitigation Plan represents a community's blueprint for how they intend to reduce the impact of natural and human-caused hazards on people and the built environment. The essential elements of a Hazard Mitigation Plan include a risk assessment, capability assessment and mitigation strategy. Twenty of the 25 communities in Sussex County are participating in the development of this Multi-Jurisdictional All Hazard Mitigation Plan.

In addition, the survey shows that of the twenty communities participating, seven jurisdictions have local hazard mitigation plans. This includes Lewes Delaware that has prepared a Hazard Mitigation and Climate Adaptation Action Plan.

Eighteen jurisdictions report to have completed a Floodplain Management Plan or Flood Mitigation Plan, including Sussex County. Six communities reported completing a Stormwater Management Plan. This is an increase of three communities from the 2010 All-Hazard Hazard Mitigation Plan.

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**Disaster Recovery Plan:** A Disaster Recovery Plan serves to guide the physical, social, environmental and economic recovery and reconstruction process following a disaster. In many instances, hazard mitigation principles and practices are incorporated into local disaster recovery plans with the intent of capitalizing on opportunities to break the cycle of repetitive disaster losses.

Survey results indicate that six jurisdictions have prepared a Disaster Recovery Plan. This is a 100 percent increase over the three identified in the 2010 All-Hazard Mitigation Plan.

**Emergency Operations Plan:** An emergency operations plan outlines responsibilities and the means by which resources are deployed following an emergency or disaster.

Survey results indicate that eleven jurisdictions have an emergency operations plan. This is an increase of three communities that have completed an EOP since 2010. Sussex County has an EOP was updated in 2004 and is available to the community via the Sussex County Emergency Operations Center Website.

The municipalities of Bethany, Bridgeville, Delmar, Fenwick Island, Lewes, Rehoboth Beach, Seaford, Selbyville, and South Bethany also have emergency operations plans covering their jurisdictions.

Several of the municipal officials indicated that their jurisdictions continue to rely on the County for emergency operations planning and management.

**Continuity of Operations Plan (COOP):** COOP Plans establish a chain of command, line of succession and plans for backup or alternate emergency facilities in case of an extreme emergency.

Survey results indicate that eight jurisdictions have completed COOP Plans. This is a doubling over the past 5 years. In 2010 the plan reported only 4 had completed a COOP plan. Many times communities include COOP planning into their Emergency Operations Plan. An additional three communities also have completed a municipal EOP and may also have completed a COOP plan as part of that effort.

**Radiological Emergency Plan:** A Radiological Emergency Plan delineates roles and responsibilities for assigned personnel and the means to deploy resources in the event of a radiological accident.

Survey results indicate that three jurisdictions have a Radiological Emergency Plan. This has not changed since the 2010 report. However, Sussex County indicated that their Radiological Emergency Plan is a component of their Emergency Operations Plan.

**SARA Title III Emergency Response Plan:** A SARA Title III Emergency Response Plan outlines the procedures to be followed in the event of a chemical emergency such as the accidental release of toxic substances. These plans are required by Federal law under Title III of the Superfund Amendments and Re-authorization Act (SARA), also known as the Emergency Planning and Community Right-to-Know Act (EPCRA).

The Sussex County Local Emergency Planning Committee (LEPC) has developed an Emergency Response Plan for hazardous materials incidents throughout the County in coordination with

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the Delaware State Emergency Response Commission. Sussex County LEPC maintains the goal to review and update the Per Hazardous Material Response Plan annually. The 2015 SERC Annual Report, the Sussex County Hazardous Material Response Plan is scheduled for review and update in 2016.

All Sussex County Jurisdictions interviewed, with the exception of Milton, report active SARA Title III Emergency Response Plans in place. Many of the municipalities participate in the LEPC through town and city representatives. In addition, the County LEPC has approximately 34 industry representatives engaged as members of the County LEPC.

### General Planning Capabilities

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The implementation of hazard mitigation activities often involves agencies and individuals with planning and, land use management and risk management from other disciplines. Other stakeholders may include local planners, public works officials, economic development specialists and others. In many instances, concurrent local planning efforts will help to achieve or complement hazard mitigation goals even though they are not designed as such. Therefore, the Capability Assessment included a discussion with each jurisdiction regarding general planning capabilities.

**Regional Planning:** Regional planning refers to any type of planning effort that involves a community working in conjunction with neighboring jurisdictions. For example, the development of this All Hazard Mitigation Plan is representative of a regional planning effort.

Survey results indicate that sixteen jurisdictions participate in regional planning decisions. Fifteen communities also maintain a Capital Improvement Plan. Sussex County provides coordination with municipalities on issues and projects related to the County's Comprehensive Plan and the State's *Livable Delaware* initiative. Many local jurisdictions also coordinate on regional issues through the Sussex County Association of Towns (SCAT).

All of Sussex County's local jurisdictions are members of the Delaware League of Local Governments (DLLG). The DLLG is a statewide, nonprofit, nonpartisan association of city, town, and County governments established in 1963 to improve and assist local governments through legislative advocacy at the state and Federal level. The DLLG also serves as a clearinghouse for important governmental and business-oriented information.

**Comprehensive Plan:** A comprehensive plan establishes the overall vision for what a community wants to be and a guide to future governmental decision-making. Typically, a comprehensive plan is comprised of demographic conditions, land use, transportation elements and community facilities. Given the broad nature of the plan and its regulatory standing in many communities, the integration of hazard mitigation measures into the comprehensive plan can enhance the likelihood of achieving risk reduction goals, objectives and actions.

The State of Delaware requires its counties to adopt and regularly update comprehensive plans in conformity with the Quality of Life Act of 1988. The Act requires the plans to include the following elements: Economic Development, Housing, Conservation (including Agriculture), Historic Preservation, Recreation and Open Space, Accomplishments,

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Intergovernmental Coordination, Mobility, Water and Sewer, Community Facilities, and Future Land Use. An optional element is Community Design.

Such plans are used by local governments to establish land-use policies, identify growth areas, and also give consideration to various other community concerns, such as affordable housing availability, agriculture preservation, open space protection, historic preservation, economic development and transportation mobility.

Delaware law mandates that all counties and municipalities have a comprehensive plan in place. Under a change in Delaware law in 2011, counties and municipalities must review and update their plans for State certification every 10 years, while providing yearly updates on the progress of implementation.

Sussex County approved the 2016 Comprehensive Plan Annual Report August 9, 2016.

**Table 5.2** on the following page shows the progress made as of 2016 by the municipal jurisdictions in Sussex County to update their comprehensive plans according to the Delaware Office of State Planning Coordination.

**Table 5.2 Local Comprehensive Plan Updates**

Jurisdiction	Plan Status
Bethany Beach	Complete
Bethel	Contacted
Blades	Certified (2008)
Bridgeville	Certified (2016)
Dagsboro	Certified (2003), Contacted
Delmar	Complete (2010) Update Pending 2016
Dewey Beach	In Progress, Contacted
Ellendale	Update in Progress (2009) Contacted
Fenwick Island	Update in Progress (2016)
Frankford	Complete (2009)
Georgetown	Certified (2010) Update in Progress (2016)
Greenwood	Completed (2013)
Henlopen Acres	Completed (2016)
Laurel	Completed
Lewes	Update in Progress (2016)
Millsboro	Certified (2012)
Millville	Completed (2010)
Milton	Revised (2015)
Ocean View	Completed (2010) Revised (2012)
Odessa	Complete (2001)
Rehoboth Beach	Complete (2014)
Seaford	Updated (2015)
Selbyville	Certified (2007)

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Slaughter Beach	Approved 2010 and updated in 2016
South Bethany	Certified (2016) Pending

*Source: Delaware Office of State Planning Coordination*

**Transportation Plan:** A transportation plan identifies the means to gauge transportation demands and the options to meet those needs, while considering the social, economic and environmental characteristics of the area. The development of transportation networks can significantly impact the amount, type and location of future growth. As a result, transportation planning can have a dramatic effect on future hazard vulnerability.

Survey results indicate that most jurisdictions do not have their own stand-alone transportation plan. Five of the jurisdictions reported having a Transportation Plan. There is no change from the 2010 report. Transportation planning (including emergency evacuation planning) is commonly addressed as an element to the local comprehensive plans and in coordination with the Delaware Department of Transportation.

**Capital Improvements Plan:** A capital improvements plan guides the scheduling of spending on public improvements. A capital improvement plan can serve as an important mechanism to guide future development away from identified hazard areas. Limiting public spending in hazardous areas is one of the most effective long-term mitigation actions available to local governments.

Survey results indicate that fourteen jurisdictions have capital improvement plans that regulate the provision or extension of infrastructure in hazard areas. This is an increase of six communities that have now adopted Capital Improvements Plans as part of their development strategy.

**Historic Preservation Plan:** A historic preservation plan is intended to preserve historic structures or districts within a community. An often-overlooked aspect of the historic preservation plan is the assessment of buildings and sites located in areas subject to natural hazards to include the identification of the most effective way to reduce future damages.<sup>25</sup> This may involve retrofitting or relocation techniques that account for the need to protect buildings that do not meet current building standards or are within a historic district that cannot easily be relocated out of harm's way.

Survey results indicate that nine jurisdictions have historic preservation plans. There is no change from the 2010 Plan update.

**Zoning Ordinances:** Zoning represents the means by which local governments control land use. As part of a community's police powers, zoning is used to protect the public health, safety and welfare of those in a given jurisdiction that maintains zoning authority. A zoning ordinance is the mechanism through which zoning is typically implemented. Since zoning regulations

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<sup>25</sup> See Protecting the Past from Natural Disasters. 1989. Nelson, Carl. National Trust for Historic Preservation: Washington, D.C.

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enable municipal governments to limit the type and density of development, it can serve as a powerful tool when applied in identified hazard areas.

Survey results indicate that all twenty-five jurisdictions listed in the All-Hazard Mitigation Plan have a zoning ordinance.

**Subdivision Ordinances:** A subdivision ordinance is intended to regulate the development of housing, commercial, industrial or other uses, including associated public infrastructure, as land is subdivided into buildable lots for sale or future development. Subdivision design that accounts for natural hazards can dramatically reduce the exposure of future development.<sup>26</sup>

Survey results indicate that twenty-three jurisdictions have a subdivision ordinance. The only two communities that do not have a Subdivision Ordinance are the towns of Bethel and Bridgeville.

Sussex County's zoning ordinance was adopted in 1982 and is periodically updated through association with the zoning ordinance.

**Building Codes, Permitting and Inspections:** Building Codes regulate construction standards. In many communities, permits are issued for, and inspections of work take place on, new construction. Decisions regarding the adoption of building codes (that account for hazard risk), the type of permitting process required both before and after a disaster, and the enforcement of inspection protocols all affect the level of hazard risk faced by a community.

Surveys reaffirmed that all jurisdictions interviewed have adopted a local building code.

In addition to using survey results, the adoption and enforcement of building codes by local jurisdictions was assessed using the Building Code Effectiveness Grading Schedule (BCEGS) program developed by the Insurance Services Office, Inc. (ISO).<sup>27</sup> Under the BCEGS program, ISO assesses the building codes in effect in a particular community and how the community enforces its building codes, *with special emphasis on mitigation of losses from natural hazards*. The results of BCEGS assessments are routinely provided to ISO's member private insurance companies, which in turn may offer ratings credits for new buildings constructed in communities with strong BCEGS classifications. The concept is that communities with well-enforced, up-to-date codes should demonstrate better loss experience, and insurance rates can reflect that.

In conducting the assessment, ISO collects information related to personnel qualification and continuing education as well as a number of inspections performed per day. This type of information, combined with local building codes, is used to determine a grade for that jurisdiction. The grades range from 1 to 10, with the lower grade being more ideal. A BCEGS grade of 1 represents exemplary commitment to building code enforcement, and a grade of 10

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<sup>26</sup> For additional information regarding the use of subdivision regulations in reducing flood hazard risk, see Subdivision Design in Flood Hazard Areas. 1997. Morris, Marya. Planning Advisory Service Report Number 473. American Planning Association: Washington, D.C.

<sup>27</sup> Participation in BCEGS is voluntary and may be declined by local governments if they do not wish to have their local building codes evaluated.

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indicates less than minimum recognized protection. BCEGS grades for each of Sussex County's local jurisdictions are listed in **Table 5.3**.

**Table 5.3: BCEGS Grades for Sussex County Jurisdictions**

Jurisdiction	BCEGS Grade
Sussex County	8
Bethany Beach	<i>Declined Participation</i>
Bethel	<b>8*</b>
Blades	<i>Declined Participation</i>
Bridgeville	8*
Dagsboro	<b><i>Declined Participation</i></b>
Delmar	<i>Not Evaluated</i>
Dewey Beach	8*
Ellendale	<b>8*</b>
Fenwick Island	8*
Frankford	8*
Georgetown	8*
Greenwood	8*
Henlopen Acres	8*
Laurel	6
Lewes	9
Millsboro	7
Millville	8*
Milton	8*
Ocean View	8*
Odessa	8*
Rehoboth Beach	6
Seaford	6
Selbyville	8
Slaughter Beach	8*
South Bethany	<i>Declined Participation</i>

Source: Insurance Services Office, Inc.

***Highlighted data is from 2010***

***\* Building code administered and enforced by Sussex County***

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### Floodplain Management Capability

Flooding represents the greatest natural hazard facing the nation. At the same time, the tools available to reduce the impacts associated with flooding are among the most developed when compared to other hazard-specific mitigation techniques. In addition to approaches that cut across hazards, such as education, outreach, and the training of local officials, the *National Flood Insurance Program* (NFIP) contains specific regulatory measures that enable government officials to determine where and how growth occurs relative to flood hazards. Participation in the NFIP is voluntary for local governments, but the program is promoted by FEMA and DEMA as a first basic step for implementing and sustaining an effective hazard mitigation program. It is therefore used as a key indicator for measuring local capability.

In order for a County or municipality to join the NFIP, they must adopt a local flood damage prevention ordinance that requires jurisdictions to follow established minimum building standards in the floodplain. These standards require that all new buildings and substantial improvements to existing buildings will be protected from damage by the 100-year flood, and that new floodplain development will not aggregate existing flood problems or increase damage to other properties.

Another key service provided by the NFIP is the mapping of identified flood hazard areas. Once prepared, the Flood Insurance Rate Maps (FIRMs) are used to assess flood hazard risk, regulate construction practices and set flood insurance rates. FIRMs are an important source of information to educate residents, government officials and the private sector about the likelihood of flooding in their community. Research data obtained through the National Flood Insurance Program shows that the Current Effective Floodplain Map for all jurisdictions is from March 16, 2015. Only one community, Ellendale, is reported as a Non-Special Flood Hazard Area. However, Ellendale was not interviewed. **Table 5.4** summarizes NFIP participation for each of Sussex County’s local jurisdictions.

**Table 5.4: NFIP Participation in Sussex County**

Jurisdiction	NFIP Entry Date	Current Effective Map
Sussex County	10/06/76	3/16/15
Bethany Beach	4/06/73	3/16/15
Bethel	1/16/81	3/16/15
Blades	1/16/81	3/16/15
Bridgeville	1/07/77	3/16/15
Dagsboro	6/01/81	3/16/15
Delmar	2/27/07	3/16/15
Dewey Beach	6/18/82	3/16/15
Ellendale	4/19/11	NSFHA
Fenwick Island	3/23/73	3/16/15
Frankford	9/16/81	3/16/15
Georgetown	5/05/03	3/16/15
Greenwood	2/24/78	3/16/15

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Henlopen Acres	8/15/78	3/16/15
Laurel	1/16/81	3/16/15
Lewes	3/15/77	3/16/15
Millsboro	9/01/78	3/16/15
Millville	9/25/81	3/16/15
Milton	8/01/78	3/16/15
Ocean View	9/03/80	3/16/15
Rehoboth Beach	3/30/73	3/16/15
Seaford	2/01/79	3/16/15
Selbyville	7/16/91	3/16/15
Slaughter Beach	7/02/80	3/16/15
South Bethany	10/6/76	3/16/15

Source: FEMA, Community Status Book Report (Delaware) <http://www.fema.gov/cis/DE.html>

An additional indicator of floodplain management capability is the number of participants in the *Community Rating System* (CRS). The CRS is an incentive-based program that encourages counties and municipalities to undertake defined flood mitigation activities that go beyond the minimum requirements of the NFIP, adding extra local measures to provide protection from flooding. All of the 18 creditable CRS mitigation activities are assigned a range of point values. As points are accumulated and reach identified thresholds, communities can apply for an improved CRS class. Class ratings, which run from 10 to 1, are tied to flood insurance premium reductions as shown in **Figure 5.2**. As class ratings improve (decrease), the percent reduction in flood insurance premiums for NFIP policyholders in that community increases.

**Figure 5.2: CRS Premium Discounts, By Class**

CRS Class	Premium Reduction
1	45%
2	40%
3	35%
4	30%
5	25%
6	20%
7	15%
8	10%
9	5%
10	0

Source: FEMA- [http://www.fema.gov/media-library-data/1458756801023-311019d76271533f6b21ce505df7bd3c/20\\_crs\\_508\\_apr2016.pdf](http://www.fema.gov/media-library-data/1458756801023-311019d76271533f6b21ce505df7bd3c/20_crs_508_apr2016.pdf)

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Community participation in the CRS is voluntary. Any community that is in full compliance with the rules and regulations of the NFIP may apply to FEMA for a CRS classification better than class 10. The CRS application process has been greatly simplified over the past several years based on community comments to make the CRS more user friendly as possible, and extensive technical assistance is also available for communities who request it.

**Table 5.5** lists the current CRS communities in Sussex County. A total of seven municipalities belong to the Community Rating System. Of these seven, five municipalities are a class 8 and two municipalities are class 9 communities.

**Table 5.5: CRS Communities in Sussex County**

Jurisdiction	CRS Entry Date	Current CRS Class
Bethany Beach	5/1/09	8
Dewey Beach	10/1/94	8
Fenwick Island	10/1/94	8
Lewes	10/1/92	9
Rehoboth Beach	10/1/95	8
Seaford	10/1/96	9
South Bethany	10/1/07	8

Source: FEMA- [http://www.fema.gov/media-library-data/1458756801023311019d76271533f6b21ce505df7bd3c/20\\_crs\\_508\\_apr2016.pdf](http://www.fema.gov/media-library-data/1458756801023311019d76271533f6b21ce505df7bd3c/20_crs_508_apr2016.pdf)

Survey results indicate that eighteen jurisdictions interviewed have a floodplain management plan or flood mitigation plan.

All Floodplain maps in the County were updated in May 2015. As a result of these floodplain map updates, all communities in Delaware, which participate in the National Flood Insurance Program will be required up adopt updated floodplain regulatory language to comply with NFIP requirements.

To assist communities in meeting these requirements, DNREC has developed “model” floodplain ordinances which communities may find easier to adopt, rather than amending existing floodplain regulations. Four model ordinances have been developed, to assist both coastal and non-coastal communities, as well as communities wishing to adopt higher floodplain standards, which DNREC highly recommends as a way to reduce flood damage and lower flood insurance premiums.

**Stormwater Management Plan:** A stormwater management plan is designed to address flooding associated with stormwater runoff. The stormwater management plan is typically focused on design and construction measures that are intended to reduce the impact of more frequently occurring minor urban flooding.

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Survey results indicate that six of the jurisdictions interviewed have a stormwater management plan. Many communities identified this as one of their hazard mitigation needs going forward. Several have plans under development utilizing state grants and technical resources to manage stormwater runoff.

### County and Municipal Self-Assessment

In addition to the above inventory of existing plans, programs and policies, the Capability Assessment required each local jurisdiction to evaluate the 2010 self-assessment of its capability to implement hazard mitigation activities. As part of this process, County and municipal officials were encouraged to consider the barriers implementing mitigation strategies in addition to the mechanisms that could further such strategies. In response to the survey questionnaire local officials classified the capabilities listed the following capabilities as either “limited,” “moderate” or “high”:

- Technical capability
- Fiscal capability
- Administrative capability
- Political capability

**Table 5.6** summarizes the results of the self-assessment process for technical, fiscal and administrative capabilities. An “L” indicates limited capability; an “M” indicated moderate capability; and an “H” indicates high capability. Further descriptions and discussions on each are provided below, in addition to some of general findings on political capability.

**Table 5.6: Self-Assessment of Local Capability**

Jurisdiction	Technical Capability	Fiscal Capability	Administrative Capability
Sussex County	M	M	M
Bethany Beach	M	M	M
Bethel *	L	L	L
Blades	M	M	M
Bridgeville	M	L	M
Dagsboro *	L	L	L
Delmar	L	L	L
Dewey Beach*	H	H	L

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Jurisdiction	Technical Capability	Fiscal Capability	Administrative Capability
Ellendale*	L	L	L
Fenwick Island	M	M	M
Frankford	M	L	M
Georgetown	L	M	L
Greenwood	M	M	M
Henlopen Acres	M	M	M
Laurel	L	L	M
Lewes	M	M	M
Millsboro	M	M	M
Millville	M	L	L
Milton	L	L	L
Ocean View	M	M	M
Rehoboth Beach	H	M	H
Seaford	M	M	H
Selbyville	M	M	M
Slaughter Beach	L	L	L
South Bethany	M	L	H

\*2010 Data. Technical Capability

Technical capability can be defined as possessing the skills and tools needed to improve decision making, including the development and implementation of sound mitigation actions. For purposes of gauging the technical capability of Sussex County's local jurisdictions for mitigation planning purposes, the Capability Assessment interview focused on the local availability and application of Geographic Information Systems (GIS).

A majority of cities and towns don't employ GIS staff or have direct access to GIS systems due to financial limitations. Sussex County maintains a GIS system. Many local officials also

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indicated that they rely on Sussex County and state agencies to provide technical capabilities and resources, as needed.

The analysis of the responses to the Capability Assessment indicated that there is generally a *limited, to moderate* technical capability of Sussex County's jurisdictions to implement mitigation strategies. Eight of the 25 jurisdictions indicated they had limited technical capability; fifteen indicated they had moderate technical capability; and two indicated they had high technical capability. With approximately six communities have shifted from low to moderate. This is a substantial shift in technical capabilities of Sussex County communities to moderate technical capability.

**Recommendations:** Technical capabilities among the communities in the County have significantly increased. It is evident that the strategy of developing resource and capability sharing has been successful over the past five years. Several communities also have increased staffing to provide more technical capabilities within the community. There are still communities with limited technical capabilities throughout the County. There remains a need for ongoing support for a systematic sharing of technical resources to support risk reduction strategy development. Sharing resources and capabilities with the County should continue to increase the level of technical capability to analyze natural hazards and develop meaningful actions to reduce their impact. This includes additional training to enhancing the ability to use information technologies to facilitate the formulation, development, implementation and monitoring of mitigation efforts.

### Fiscal Capability

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The ability to take action is often closely associated with the amount of money available to implement policies and projects. This may take the form of grants received or state and locally based revenue. The costs associated with policy and project implementation vary widely. In some cases, policies are tied primarily to staffing costs associated with the creation and monitoring of a given program. In other cases, money is linked to an actual project, like the development of stormwater management strategies and the acquisition of flood-prone homes, which can require a substantial commitment from local, state and federal funding sources.

It is imperative that jurisdictions research non-federal sources of revenue and funding for risk management strategies. This will lead to a reduction in the dependence on the availability of federal and state funding to implement mitigation actions. Additional assistance may be available from economic development and private sector partnerships that would consider funding community resiliency to support overall growth and sustainability.

The analysis of the responses to the Capability Assessment indicated that there has been movement of a significant number of communities from limited to moderate fiscal capability of Sussex County's jurisdictions to implement mitigation strategies. In part this is due to significant growth and development in the County.

## Capabilities Assessment

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Eleven jurisdictions indicated they had limited fiscal capability. Thirteen municipalities, and Sussex County, now identify as having moderate fiscal capabilities to support mitigation efforts. Only one, Dewey Beach, based on 2010 data remains at a high fiscal capability.

**Recommendations:** The results of the local Capability Assessment should be used as a general guide to help craft mitigation actions that are achievable. When considering the effect of fiscal capability on the implementation of mitigation policies and projects, jurisdictions should consider whether the actions require monetary commitment or staff resources. Consideration should be given to available government and non-governmental grant funding sources. It may also be possible to combine resources such as Community Development Block Grants, rural development grants and County or other resources to meet risk reduction priorities. In addition, it may be possible to create a regional effort by working with other municipalities to offset costs of implementation. Consideration should also be made as to whether the jurisdiction is willing to commit local revenue to assure community resiliency and sustainability.

In most cases, in order to implement mitigation projects and policies, some monetary commitment or staff resources will be required as a cost share. This may take the form of a non-federal match requirement or the costs associated with staff time devoted to project administration, policy development, program implementation and monitoring. The identification of eligible Pre-Disaster Mitigation projects, as well as other federal funding sources identified in the Sussex County Multi-Jurisdictional All Hazard Mitigation Plan, enables communities to compete nationally for available funding. The County and municipal governments should consider, whenever possible, combining financial and staff resources to address hazards, most of which tend to impact regions rather than individual jurisdictions.

Finally, if local governments have access to an ongoing source of revenue, rather than a strict reliance on grant funds, a more comprehensive and sustained mitigation effort can be achieved. Examples include the development of a stormwater utility fee, special district for floodplain management, or the development of a budgetary line item that specifically addresses hazard mitigation.

### Administrative Capability

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County and municipal staffing and existing organizational structures for local governments were evaluated to implement mitigation strategies and administrative capability. The ability of a local government to develop and implement mitigation projects, policies and programs is directly tied to its ability to direct staff time and resources for that purpose.

The analysis of the responses to the Capability Assessment indicated that there is generally a *moderate to high* administrative capability of Sussex County's jurisdictions to implement mitigation strategies. Three jurisdictions indicated they had limited administrative capability, while thirteen indicated they have moderate administrative capability. New in 2016 is that nine communities report high administrative capability. Local municipal jurisdictions in Sussex County indicated that they work cooperatively with the County on many activities, helping to offset their administrative and staff limitations. This includes emergency-related activities

## Capabilities Assessment

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coordinated by the Sussex County EOC and through mutual aid agreements between police and fire departments, but not specifically mitigation activities. Many communities report that there is an increase in staffing focused on municipal services and code enforcement. However, some local officials report minimal full-time staff to implement local government programs, and rely heavily on volunteers, outside agencies and professional consultants.

**Recommendations:** Demand for services continues to grow within the County. Many communities report that their year around population has grown significantly over the past 5 years. Many seasonal homeowners are now becoming permanent residents. This has created a demand for municipal services and an increase in staffing. The County and larger municipalities tend to possess a stronger administrative capability than smaller communities. This is primarily due to fiscal limitations, as smaller jurisdictions by nature have a limited tax base to support local government services. The development of local administrative capability could best be achieved through enhanced intergovernmental cooperation, outreach, training and mentoring for smaller jurisdictions as well as the sharing of resources, when appropriate.

Local governments with a need to enhance local internal staff's emergency management expertise should consider sending staff to the free or low-cost training seminars available through DEMA's Training Program and FEMA's Emergency Management Institute. In preparing local mitigation strategies, local governments should look to integrate hazard mitigation activities into routine governmental functions whenever possible, particularly when limited to only a few full-time employees.

### Political Capability

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One of the most difficult capabilities to evaluate involves the political will of a jurisdiction to enact meaningful policies and projects designed to reduce the impact of future hazard events. Due to the nature of the difficulties, political capabilities were discussed on a more informal nature.

In many cases, hazard mitigation initiatives may not be a local priority or can be mistakenly seen by local leaders as an impediment to other goals of the community. The local political climate must be considered in designing mitigation strategies, as it could be the most difficult hurdle to overcome in accomplishing their adoption or implementation.

Political capability was discussed in general terms. The discussions with showed that there is generally a *moderate* political capability of Sussex County's jurisdictions to implement mitigation strategies. Due to several coastal events such as Hurricane Sandy, coastal and riverine flooding and severe wind events, hazards and disasters have increased as a significant issue of concern in Sussex County. Local political climate is favorable for implementing mitigation actions that are consistent with sustainability and community growth.

An example of the political climate in favor of hazard mitigation can be found in the update of this plan. The planning team and Sussex EOC leadership met with both the County Planning and Zoning Commission and the County Council to discuss the planning process and value of hazard mitigation on community resiliency and growth.

## Capabilities Assessment

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**Recommendations:** Increasing local political capability to implement mitigation strategies is most often achieved through a coordinated approach to loss reduction that includes:

- Community outreach efforts designed to inform residents and businesses of the risk faced by natural hazards,
- Gaining community support through a wide range of local interest groups (particularly those that may be affected by proposed actions), and
- Informing and educating the elected and executive officials of the community in advance of the formal decision making process.

Identifying key stakeholders early in the process of designing and proposing mitigation strategies should generate community support. This will help eliminate or minimize potential impediments to acceptance before strategies become drafted or officially proposed.

Local elected and executive officials should become informed and educated on mitigation strategies in advance of any formal considerations or decisions. This will facilitate a greater understanding of specific mitigation objectives and expected outcomes.

### Conclusions on Local Capability

The capability of local governments in Sussex County varies greatly from jurisdiction to jurisdiction.

Sussex County's local governments should continue to work with each other beyond the development of this Plan in order to maximize existing resources and local capabilities. The City of Lewes has gained considerable knowledge and expertise in applying hazard mitigation principles through local government programs, and should serve as a mentor to its neighboring communities in Sussex County. As the above findings indicate, Sussex County has significantly more capability than its municipal jurisdictions and should serve as a clearinghouse for information while striving to enhance and maintain intergovernmental cooperation and coordination.

Plan provides the vehicle to begin this process. However, in order to succeed, it will require clearly articulating the benefits of participating in and sustaining the countywide mitigation planning process. One of the best ways to obtain local buy-in and long-term success is to identify and implement achievable mitigation actions (as listed in this Plan's *Mitigation Strategy*) that will facilitate continued intergovernmental coordination not only across the County, but with state and federal agencies as well.

The conclusions of the *Capability Assessment* and *Risk Assessment* serve as the foundation for a meaningful hazard mitigation strategy.

During the process of identifying the goals, objectives and mitigation actions, each jurisdiction must consider not only their level of hazard risk but also their existing capability to minimize or eliminate that risk.

In jurisdictions where the overall hazard risk is considered to be HIGH, and local capability is considered LIMITED, then specific mitigation actions that account for these conditions should

## Capabilities Assessment

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be considered. This may include less costly actions such as minor ordinance revisions or public awareness activities. Further, if necessary, specific capabilities may need to be improved in order to better address recurring threats. Similarly, in cases where the hazard vulnerability is LIMITED and overall capability is HIGH, more emphasis can be placed on actions that may impact future vulnerability such as guiding development away from known hazard areas.

There have been no major changes that warranted a change in the hazard risk or overall capability for the County (unincorporated areas) or municipalities.

## SECTION 6: MITIGATION STRATEGY

### Contents of this Section

- Requirement for the Planning Process
- Mitigation Goals and Objectives
- Potential Mitigation Actions Identified
- Mitigation Measures Prioritization and Implementation

### Requirement for Mitigation

**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.*

### Mitigation Goals, Objectives, and Actions

The intent of the *Mitigation Strategy* is to provide Sussex County and participating jurisdictions with the tools necessary to continue to reduce the impact of natural and human-caused hazards. In order to achieve these aims, this section covers the following components:

- Mitigation Goals
- Identification and Analysis of Mitigation Measures
- Mitigation Actions

## Mitigation Strategy

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This section contains goals, objectives, and action items for the Sussex County Multi-Jurisdictional All-Hazard Mitigation Plan. For the purposes of this Plan, the following definitions are proposed:

- **Goals** are general guidelines that explain what the County and participating municipalities want to achieve. Goals are expressed as broad policy statements representing desired long-term results.
- **Hazard Mitigation Policies** are defined as a course of action agreed to by members of the Planning Team
- **Mitigation Actions** are the specific steps (projects, policies, and programs) that advance a given objective. They are highly focused, specific, and measurable.

The hazard identification and risk assessment in Sections 3 and 4 consisted of identifying the hazards that affect Sussex County and the potential for damage to community assets that are vulnerable to the hazards. Section 5 identified the strengths and weaknesses of local capabilities. The goals and objectives described below were established by the Sussex County Hazard Mitigation Steering Committee and validated by the Sussex County Hazard Mitigation Working Group members in response to these assessment results. Many of the actions described below apply to the County and all participating municipalities.

The broad goals of the Sussex County Multi-Jurisdictional All-Hazard Mitigation Plan are as follows:

- **Goal 1:** Sussex County and participating municipalities will continue to adopt enhanced stormwater management practices.
- **Goal 2:** Sussex County and participating municipalities will continue to adopt and enforce codes and regulations designed to reduce the impact of natural hazards.
- **Goal 3:** Sussex County and participating municipalities will continue to retrofit and protect critical facilities and infrastructure from natural hazards.
- **Goal 4:** Sussex County and participating municipalities will continue to enhance education and outreach strategies to improve the dissemination of information to the public regarding hazards, including the steps that can be taken to reduce their impact.
- **Goal 5:** Sussex County and participating municipalities will continue to improve pre-event planning and preparedness activities.
- **Goal 6:** Sussex County and participating municipalities will continue to identify and implement sound hazard mitigation projects.

### *Identification and Analysis of Mitigation Measures*

In reformulating the Sussex County Mitigation Strategy, a wide range of activities was considered in order to help achieve the goals of participating jurisdictions. All actions chosen by County and municipal government officials fell into one of the broad categories of mitigation techniques listed below.

### Mitigation Techniques

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1. **Prevention:** Preventative activities are intended to keep hazard problems from getting worse. They are particularly effective in reducing a community's future vulnerability, especially in areas where development has not occurred or capital improvements have not been substantial. Examples of preventative activities include:
  - Planning and zoning
  - Hazard mapping
  - Open space preservation
  - Floodplain regulations
  - Stormwater management
  - Drainage system maintenance
  - Capital improvements programming
  - Shoreline / riverine / fault zone setbacks
  
2. **Property Protection:** Property protection measures enable structures to better withstand hazard events, remove structures from hazardous locations, or provide insurance to cover potential losses. Examples include:
  - Acquisition
  - Relocation
  - Building elevation
  - Critical facilities protection
  - Retrofitting (i.e., wind proofing, flood proofing, seismic design standards, etc.)
  - Insurance
  - Safe room construction
  
3. **Natural Resource Protection:** Natural resource protection activities reduce the impact of hazards by preserving or restoring the function of natural systems. Examples of natural systems that can be classified as high hazard areas include floodplains, wetlands and barrier islands. Thus, natural resource protection can serve the dual purpose of protecting lives and property while enhancing environmental goals such as improved water quality or recreational opportunities. Parks, recreation or conservation agencies and organizations often implement these measures. Examples include:
  - Floodplain protection
  - Beach and dune preservation
  - Riparian buffers
  - Fire resistant landscaping
  - Erosion and sediment control
  - Wetland restoration
  - Habitat preservation
  - Slope stabilization

## Mitigation Strategy

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4. **Structural Projects:** Structural mitigation projects are intended to lessen the impact of hazards by modifying the environment or hardening structures. Structural projects are usually designed by engineers and managed or maintained by public works staff. Examples include:
  - Reservoirs
  - Levees, dikes, floodwalls, or seawalls
  - Detention and retention basins
  - Channel modification
  - Beach nourishment
  - Storm sewer construction
  
5. **Emergency Services:** Although not typically considered a mitigation technique, emergency services minimize the impact of a hazard on people and property. Actions taken immediately prior to, during, or in response to a hazard event include:
  - Warning systems
  - Search and rescue
  - Evacuation planning and management
  - Flood control techniques
  
6. **Public Information and Awareness:** Public Information and awareness activities are used to advise residents, business owners, potential property buyers, and visitors about hazards and mitigation techniques they can use to protect themselves and their property. Examples of measures used to educate and inform the public include:
  - Outreach and education
  - Training
  - Speaker series, demonstration events
  - Real estate disclosure
  - Hazard expositions

Sussex County will continue to follow the guidelines set forth in the Hazard Mitigation Administrative Plan which detail these minimum project criteria:

- Have a beneficial impact upon the designated disaster area, whether or not located in the declared area,
- Be in conformance with 44 CFR Part 9, Floodplain Management and Protection of Wetlands, 44 CFR Part 10, Environmental Considerations, and Executive Orders,
- Solve a problem independently or constitute a functional portion of a solution where there is assurance that the project as a whole will be completed. Projects that merely identify or analyze hazards or problems are not eligible,
- Be cost-effective and substantially reduce the risk of future damage, hardship, loss, or suffering resulting from a major disaster; Benefit Cost Analysis will be developed per FEMA standards, and
- Not be eligible under another federal program or grant.

## Mitigation Strategy

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### National Flood Insurance Program, Floodplain Management, and Building Codes

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Improved floodplain management, including land use planning, zoning, and enforcement at the local level can reduce flood related damages for both existing buildings and new development, and are consistent with stated Goals and Objectives of this plan. The use of the National Flood Insurance Program (NFIP) is critical to the reduction of future flood damage costs to the taxpayer.

All developments, regardless of the location, require a permit to include buildings, fill, and any other type development. Under Delaware's *home rule* system, different offices in the various municipalities have authority over the necessary permits.

The NFIP requires that when the cost of reconstruction, rehabilitation, addition, or other improvements to a building equals or exceeds 50% of the fair market value, then the building must meet the same construction requirements as a new building. Substantially damaged buildings must be brought up to new construction standards. A residence or building damaged so that the cost of repairs equals or exceeds 50% of the structure's fair market value must also be elevated above the Base Flood Elevation (BFE) in flood zones where BFE's are available.

See **Table 6-1** for the dates on which of the municipalities in Sussex County joined the NFIP. Each participating municipality within Sussex County is expected to appoint a Floodplain Manager to enforce municipal floodplain ordinances. These ordinances are intended to addresses methods and practices to minimize flood damage to new and substantial home improvement projects, as well as addressing zoning and sub-division ordinances and state regulations as enforced through the Delaware Department of Environmental Protection.

**Table 6-1: National Flood Insurance Program**

Name of Community	Date Joined NFIP
Sussex County	10/06/76
Town of Bethany Beach	4/06/73
Town of Bethel	1/16/81
Town of Blades	1/16/81
Town of Bridgeville	1/07/77
Town of Dagsboro	6/01/81
Town of Delmar	<i>Not in NFIP</i>
Dewey Beach	6/18/82
Town of Ellendale	<i>Not in NFIP</i>
Town of Fenwick Island	3/23/73
Town of Frankford	9/16/81
Town of Georgetown	5/05/03
Town of Greenwood	2/24/78
Town of Henlopen Acres	8/15/78
Town of Laurel	1/16/81
City of Lewes	3/15/77

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Name of Community	Date Joined NFIP
Town of Millsboro	9/01/78
Town of Millville	9/25/81
Town of Milton	8/01/78
Town of Ocean View	9/03/80
City of Rehoboth Beach	3/30/73
City of Seaford	2/01/79
Town of Selbyville	7/16/91
Town of Slaughter Beach	7/02/80
Town of South Bethany	10/6/76

*Source: FEMA*

Within floodplain management as a whole, the education process must play an important role. An effective education program should be implemented to show citizens the importance of building codes and ordinances and how cost effective they could be in reducing future damages.

Established through the NFIP, the Community Rating System (CRS) is a program that counties and municipalities can elect to join. Once a jurisdiction has joined, participants residing in that jurisdiction receive a discount on their flood insurance premiums, **Table 6-2**. As a result of being part of the CRS, the jurisdiction would have to actively pursue public outreach programs. **Table 6-3** identifies the CRS participating communities within Sussex County. One of the requirements of CRS is an annual outreach project, such as a Repetitive Loss Outreach Program. This program would focus on repetitive loss areas within the jurisdiction and consist of three main components.

**Table 6-2: CRS Premium Discounts, By Class**

CRS Class	Premium Reduction
1	45%
2	40%
3	35%
4	30%
5	25%
6	20%
7	15%
8	10%
9	5%
10	0

*Source: FEMA*

**Table 6-3: CRS Communities in Sussex County**

## Mitigation Strategy

Jurisdiction	CRS Entry Date	Current CRS Class
Bethany Beach	5/1/09	8
Dewey Beach	10/1/94	8
Fenwick Island	10/1/94	8
Lewes	10/1/92	9
Rehoboth Beach	10/1/95	8
Seaford	10/1/96	9
South Bethany	10/1/07	8

Source: FEMA- <http://www.fema.gov/business/nfip/crs.shtm>

The first step in the Repetitive Loss Outreach Program is to advise the homeowners that they live in a repetitive loss area and could be subject to flooding. The second step is to give the homeowner appropriate property protection measure guidelines. The third is to make the homeowner aware of the basic facts about flood insurance.

The Delaware Unified Construction Code is the mandated construction code for all Delaware municipalities. The State of Delaware Department of Community Affairs issues licenses to all construction code and sub-code officials that enforce the state's Uniform Construction Code.

However, the State's Department of Environmental Protection is the lead state agency for the administration of the State's Floodplain Management Program. Each community that participates in the NFIP must adopt and enforce municipal floodplain management regulations that meet or exceed the minimum requirements of the NFIP as directed by the State's Floodplain Management Program. This requirement is in addition to the enforcement of the State Uniform Construction Code.

Each municipality in Sussex County that is a participating community in the NFIP Program is required to have both a well-trained municipal floodplain manager and construction code official. To ensure adequate enforcement of both codes, each community in Sussex County should encourage additional training opportunities for all code enforcement personnel and include the municipal floodplain manager.

Floodplain management and building codes assist the community with problems experienced from floods, hurricanes, tornadoes, and thunderstorms/lightning/high winds as well as other lower priority hazards.

Participation in the NFIP is based on a voluntary agreement between a community and FEMA. Compliance with the NFIP however, extends beyond mere participation in the program. The three basic components of the NFIP include, 1) Floodplain identification and mapping risk; 2) Responsible floodplain management; and 3) Flood insurance. **Table 6-4** identifies the NFIP requirements and documents how the County addresses these requirements. The table is based on a list of questions developed by DEMA.

## Mitigation Strategy

**Table 6-4: Sussex County NFIP Compliance**

1. Floodplain Identification and Mapping			
Requirement	SHMO Recommended Action	Yes/No	County Action
a. Does the County maintain a copy effective FIRM (flood insurance rate map) maps and FIS (flood insurance study) that is accessible to the public?	Place these documents in the local libraries.	Yes	Maintained on file by the Sussex County Department of Planning and Zoning.
b. Has the County adopted the most current DFIRM or FIRM and FIS?	State date of adoption, if done.	Yes	Jan 6, 2005
c. Does the County support request for map updates?	If yes, state how.	No	Map changes, revisions, and amendments are reviewed by the County CFM (Jeff Shockley), and submitted to FEMA for further study and determination.
d. Does the County share with FEMA any new technical or scientific data that could result in map revisions within 6 months of creation or identification of new data?	If yes, specify how.	No	Sussex County has not conducted any studies that have included new data for map revisions. Suggestions and ideas for certain areas have been offered.
e. Does the County provide assistance with local floodplain determinations?	If yes, specify how.	Yes	Sussex County Planning and Zoning Department assists property owners in identifying their location relative to the FIRMs.
f. Does the County maintain a record of approved Letters of Map Change?	If yes, specify the office that does it.	Yes	The Sussex County Department of Planning and Zoning maintain these files on record.
2. Floodplain Management			
Requirement	SHMO Recommended Action	Yes/No	County Action
a. Has the municipality adopted a compliant floodplain management ordinance that at a minimum regulates the following:	If yes answer, (1) - (4) below.	Yes	Yes
(1) Does the County issue permits for all proposed development in the SFHA?	If yes, specify the office.	Yes	The Department of Planning and Zoning Commission and Sussex County Council issue permits for proposed development and subdivision in the SFHA.

## Mitigation Strategy

<p>(2) Does the County obtain, review and utilize any Base Flood Elevation and floodway data, and require BFE data for subdivision proposals and other development proposals larger than 50 lots or 5 acres?</p>	<p>If yes, specify the office that does it.</p>	<p>Yes</p>	<p>The Sussex County Department of Planning and Zoning requires this for proposed subdivision application.</p>
<p>(3) Does the County identify measures to keep all new and substantially improved construction reasonably safe from flooding to or above the Base Flood Elevation, including anchoring, using flood resistant materials, designing or locating utilities and service facilities to prevent water damage?</p>	<p>If yes, specify the office that does it.</p>	<p>Yes</p>	<p>Inspection and enforcement done by the Sussex County Department of Planning and Zoning.</p>
<p>(4) Does the County document and maintain records of elevation data that document lowest floor elevation for new or substantially improved structures.</p>	<p>If yes, specify the office that does it.</p>	<p>Yes</p>	<p>Files on record and maintained by the Sussex County Department of Planning and Zoning.</p>
<p>b. If a compliant floodplain ordinance was adopted, does the County enforce the ordinance by monitoring compliance and taking remedial action to correct violations?</p>	<p>If yes, specify how.</p>	<p>Yes</p>	<p>Sussex County Planning and Zoning coordinates with DNREC and FEMA for community assessments; identifies properties in violation; and works with property owners to achieve compliance</p>

## Mitigation Strategy

3. Flood Insurance			
Requirement	SHMO Recommended Action	Yes/No	Sussex County Action
a. Does the County educate community members about the availability and value of flood insurance?	If yes, specify how. See Note 1.	No	Sussex County focuses primarily on proposed development and construction requirements within the floodplain. The flood insurance issues are directed to DNREC.
b. Does the County inform community property owners about changes to the DFIRM/FIRM that would impact their insurance rates?	If yes, specify how.	Yes	The public is notified when the maps are updated and prior to Sussex County adoption of the maps.
c. Does the County provide general assistance to community members relating to insurance issues?		Yes	Sussex County offers preliminary assistance relating to flood insurance issues, but directs on to DNREC for finalization.

### Potential Mitigation Actions Identified

Sussex County and its municipalities have identified several hazard mitigation actions that would benefit the County. These actions were identified in the HMSC and HMWG meetings, which included input from representatives of governmental organizations, local businesses, and private citizens. This was based in part on consideration of the range of potential mitigation actions for hazards faced by Sussex County and its constituent municipalities, which are described below.

#### **Public Awareness**

Insurance industry and emergency management research has demonstrated that awareness of hazards is not enough. People must know how to prepare for, respond to, and take preventive measures against threats from natural hazards. This research has also shown that a properly run local information program is more effective than national advertising or public campaigns.

Although concerted local, County, and statewide efforts to inform the public exist, lives and property continue to be threatened when segments of the population remain uninformed or choose to ignore the information available. Public education serves to assist the communities with problems experienced from floods, hurricanes, tornadoes, and thunderstorms / lightning / high winds as well as other lower priority hazards. Educating the public of these life and property saving techniques must remain a high priority item at the local, state, and federal level and is consistent with the goals of this plan.

Projects identified by the HMSC and HMWG are as follows:

- Develop an *All-Hazards* public education and outreach program for hazard mitigation and preparedness,
- Initiate a public awareness program on local TV/radio for hazard safety,
- Conduct evacuation exercises with and for local Office of Emergency Management (OEM) personnel and private citizens,

## Mitigation Strategy

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- Conduct yearly workshops related to FEMA hazard mitigation grant programs, including the Flood Mitigation Assistance (FMA) Grant Program, Hazard Mitigation Grant Program (HMGP), Pre-Disaster Mitigation (PDM) Grant Program, Severe Repetitive Loss (SRL) grant program, and Repetitive Flood Claims (RFC) Grant Program, with a focus on those aspects available to private firms and property owners, and
- Educate the public through Delaware Emergency Management Agency (DEMA) outreach programs and hazard mitigation workshops.

### Flood Mitigation Actions

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Retrofitting structures prone to periodic flooding is an effective mitigation technique to reduce the flood loss of property and is consistent with stated goals. Techniques include the elevation of structures, acquisition, mitigation reconstruction, dry flood-proofing, wet flood-proofing, drainage improvements, and installation of generators.

- **Elevation** involves raising a structure on a new foundation so that the lowest floor is above the Base Flood Elevation (BFE). Almost any structure regardless of type or size can be elevated.
- **Acquisition of structures** or *buyout* option is the most effective mitigation technique to reduce the loss of property due to flooding. The owners of repetitive flood loss structures sell their structure to the municipality on a cost share basis for the fair market value of the structure prior to the last flood event. The structure is removed / demolished and a deed restriction is placed on the property for perpetuity, thus eliminating the structure from future flood damage. This approach is most effective when flood-prone structures located within the same vicinity are grouped together and acquired. The remaining property can be converted into usable recreational space with minor structure restrictions.
- **Mitigation Reconstruction** is a component of the Severe Repetitive Loss (SRL) grant program that allows demolition and reconstruction of structures when traditional elevation cannot be implemented. This activity can be used for structures that were substantially damaged or destroyed. Currently, this is a pilot program utilized mainly on the Gulf Coast, but can be considered a potential approach to mitigation activities.
- **Dry flood-proofing** techniques include the building of floodwalls adjacent to existing walls, the installation of special doors to seal out floodwaters, and the installation of special backflow valves for water and sewer lines. Wet flood-proofing includes low cost mitigation measures such as raising air conditioners, heat pumps, and hot water heaters on platforms above the BFE.
- **Wet flood-proofing** includes measures applied to a structure that prevent or provide resistance to damage from flooding while allowing floodwaters to enter the structure or area. Generally, this includes properly anchoring the structure, using flood resistant materials below the BFE, protecting mechanical and utility equipment, and use of openings or breakaway walls. Application of wet flood-proofing as a flood protection technique under the NFIP is limited to enclosures below elevated residential and non-residential structures and to accessory and agricultural structures that have been issued variances by the municipality.

## Mitigation Strategy

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- Drainage is a time-tested technique to mitigate flood damage that improves the drainage capacity around roads and low-lying areas. Maintenance of drainage canals and laterals is essential to maximize their efficiency and continued long term effectiveness. Actions in general to reduce the effects of flooding are widening and deepening the earthen canals, cleaning of existing ditches, and replacing existing culverts, upgrading pumps, and installing check valves and inverts in certain culverts. Maintaining and improving drainage serves to assist the municipalities with problems experienced from floods and severe storms.
- Generators are another cost effective retrofitting technique. By providing power with generators during and after severe storms, many critical facilities may continue to provide necessary services to municipalities. The installation of generators serves to assist a municipality with problems experienced from floods, high wind, severe storms, earthquakes, and dam failure.

### Wind Retrofitting Mitigation Actions

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Structures can be retrofitted to withstand high winds by installing hurricane shutters, roof tie-downs, and other storm protection features. Protecting the interior of the structure and providing stability against wind hazards associated with hurricanes maintain the exterior integrity. These types of measures can be relatively inexpensive and simple to put in place.

Another retrofitting technique is to bury electric power lines to avoid tree limbs falling on them or from wind damage resulting in a break in service to the consumer. Burying electric power lines serves to assist the communities with problems experienced from floods, high winds, and severe storms.

### Early Warning Systems

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With sufficient warning of a flood, a community and its residents can take protective measures such as moving personal property, cars, and people out of harm's way. When a flood threat recognition system is combined with an emergency response plan that addresses the municipality's flood problems, considerable flood damage can be prevented. This system must be coupled to warning the general public, carrying out appropriate tasks, and coordinating the flood response plan with operators of critical facilities.

A comprehensive education and outreach program is critical to the success of early warning systems so that the general public, operators of critical facilities, and emergency response personnel will know what actions to take when warning is disseminated.

Early warning systems serve to assist municipalities with problems experienced from floods, high winds, severe storms, and dam failure, as well as other lower priority hazards.

### Earthquakes

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Significant seismic events, while not common to the region, do pose a potentially significant threat to Sussex County and the surrounding area. The most practical preventative action to be considered concerns appropriate building code enforcement. While this is not necessarily

## Mitigation Strategy

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practical for existing structures except for renovations or reconstruction, there are activities that can be taken to mitigate further exposure to risk.

For example, one technique is a building retrofit involving the use of reinforced concrete materials in combination with cross ties to provide current structures with additional stabilization. The addition of seismic stabilizer platforms for important or critical mechanicals within buildings will also significantly reduce adverse impacts.

### Dam and Levee Failure

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Mitigation for dam and levee failure is often similar to that which can be done for flooding; however, dam and levee failure has the potential to cause catastrophic damage for which the majority of flood mitigation measures would be ineffective. Some solutions include:

- **Educational Outreach:** Develop and conduct educational outreach programs on the associated risks that close proximity to dams and levees presents,
- **Building Codes:** Adopt building codes using a flood protection elevation, which is based on dam or levee failure water levels,
- **Warning Systems:** Install warning systems to prevent loss of life in the event of a dam or levee failure,
- **Land Use:** Avoid construction in areas located within a dam or levee high velocity inundation zone, and
- **Inundation Studies:** Conduct detailed studies to identify the inundation areas including potential water velocity and height.

### Wildfire

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The following mitigation measures can be applied to those areas of the County, which are designated as wildfire risk zones.

- **Educational Outreach:** Develop and conduct educational outreach programs on wildfire prevention including training on fire safe building for contractors and homeowners,
- **Retrofitting:** Existing buildings can be retrofitted to reduce their vulnerability to wildfires. Potential measures include covering roof vents with wire mesh to prevent entry of embers or flaming debris and replacing flammable roof materials such as wood or certain types of shingles. Fire resistant roofing materials include various tiles, fiberglass shingles, and single ply membranes,
- **Safety Zones:** Safety zones can be created around structures by reducing or eliminating brush, trees and vegetation around a home or facility. FEMA recommends using a 30' safety zone, including keeping grass below 2" tall and clearing all fallen leaves and branches promptly, and
- **Fire Breaks:** Roads and trails can be planned so as to serve a dual function as firebreaks. Firebreaks are areas of inflammable materials, which create a fuel break and do not allow fires to spread.

### *Mitigation Measures Prioritization and Implementation*

#### **County and Municipality-Specific Mitigation Actions**

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Strategies for hazard mitigation within Sussex County and the municipalities were identified to reduce damage to those areas and conform to the requirements of the Code of Federal Regulations. The mitigation action tables found in the **jurisdiction specific annexes** indicates the specific mitigation actions on a community-by-community basis including the rankings assigned to the projects by the municipalities.

Each participating municipality in Sussex County identified mitigation actions and programs based upon the risk assessment (**Section 4**) and capabilities assessment (**Section 5**). These are detailed in specific annex tables. In all cases, these actions support the goals of the plan, i.e., pursue mitigation projects including repetitive and severe repetitive loss properties and other appropriate hazard mitigation projects, programs, and activities.

## SECTION 7: PLAN MONITORING AND MAINTENANCE

### *Contents of this Section*

- Requirement for the Plan Monitoring and Maintenance
- Method for Monitoring the Plan
- Schedule for Monitoring the Plan
- Method and Schedule for Evaluation and Updating the Plan
- Update Implementation
- Other local Planning Mechanisms
- Continued Public Involvement

### *Requirement for the Planning Process*

**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.

### *Method for Monitoring the Plan*

This Director of the Emergency Operations Center will monitor the Plan for several related purposes:

- Maintain and update hazard and risk information,
- Ensure that mitigation projects and actions reflect the priorities of Sussex County and municipal stakeholders,
- Comply with Federal Emergency Management Agency (FEMA) and the State of Delaware requirements for plan maintenance, and
- Maintain Sussex County's eligibility for federal disaster assistance and mitigation grants.

The Director will continuously monitor the Plan with respect to the purposes noted above, according to the schedule described in Schedule for Monitoring the Plan, and with respect to the update triggers noted in the Method and Schedule for Updating the Plan section below.

Specifically, monitoring activities will consist of:

- Soliciting and reviewing reports from participating municipalities regarding status of implementation of action items from the Plan. Status reports will indicate if projects have been:
  - Scoped and/or documented for FEMA grant applications,

## Plan Monitoring and Maintenance

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- 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, and
  - (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 Plan updates on an annual (at a minimum) basis.
  - Preparing a report of the status of implementation of action items from the Plan and the availability of improved or revised data. The report will include recommendations to the Hazard Mitigation Working Group regarding the need and/or advantages of undertaking updates to all or part of the Plan prior to the five-year required update (see Method and Schedule for Updating the Plan).

### *Schedule for Monitoring the Plan*

Informal Plan monitoring activities will be ongoing. In addition to the FEMA mandated five-year update cycle, the Director or their designee (Coordinator) will perform monitoring activities for the Plan as described in Method for Monitoring the Plan every six months, or more often as circumstances require.

In addition to the scheduled reports, the Coordinator will convene meetings after damage-causing natural hazard events to review the effects of such events. Based on those effects, adjustments to the mitigation priorities identified in Section 6 may be made or additional event-specific actions identified.

### *Method and Schedule for Evaluation and Updating the Plan*

**[Note to Reviewers: The missing dates in this Section will be provided once these events have occurred]**

Comprehensive evaluation of and updates to this Plan will be undertaken on a five-year cycle. This Plan was adopted on [Insert Date], and thus must undergo a formal FEMA-compliant update process by [Insert Date + 5 years]. Approximately one year prior to the five-year anniversary of this Plan adoption or sooner, if circumstances require, the Director will initiate a comprehensive review of the Plan 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 Plan address current and expected conditions,
- Determining if there are any changes in risk factors and/or data that would be relevant to hazards in Sussex County,

## Plan Monitoring and Maintenance

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- 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, and
- Results in implementing the Plan per monitoring reports.

The Director will prepare a report (1) describing the updated requirements; (2) summarizing the staff evaluation of the Plan, highlighting areas that require updating and explaining the reasons why the updates are needed, and; (3) providing detailed recommendations about how the Plan should be updated, noting any technical work that may be required.

The report will sequentially be provided to the Sussex County Hazard Mitigation Working Group (HMWG) and Sussex County Council (Council) for consideration. The report will also be posted on the County website for public review and comment.

The Sussex County HMWG and the Sussex County Council will review the report and recommendations and advise the Director how to proceed on the individual recommendations for the updates. The Director will initiate activities to carry out the recommendations, and will prepare draft updates to the Plan on a schedule determined in cooperation with the Sussex County HMWG and the Council.

When the draft updates are completed, the Sussex County HMWG will be convened to conduct the comprehensive evaluation and revision. The Sussex County HMWG and Director will produce a final draft of the updated Plan for consideration by the Council. The Council will review the updated Plan, indicate any desired changes, approve and adopt the Plan in sufficient time to meet FEMA requirements.

### *Plan Amendment Process*

Upon the initiation of the amendment process, Sussex County and its municipalities will forward information on the proposed change to all interested parties including, but not limited to, all affected County and municipal departments, residents, and businesses. Information will also be forwarded to DEMA. This information will be disseminated in order to seek input on the proposed amendment for not less than a 45-day review and comment period. If no comments are received from the reviewing parties within the specified review period, such will be noted accordingly.

At the end of the 45-day review and comment period, the proposed amendment and all comments will be forwarded to Hazard Mitigation Working Group for consideration. The HMWG review the proposed amendment along with the comments received from other parties, and submit a recommendation to the appropriate governing body within 60 days.

In determining whether to recommend approval or denial of a Plan amendment request, the following factors will be considered:

- Errors or omissions made in the identification of issues or needs during the preparation of the Plan,

## Plan Monitoring and Maintenance

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- New issues or needs have been identified which were not adequately addressed in the Plan, and
- Changes in information, data, or assumptions from those on which the Plan was based.

Upon receiving the recommendation of the coordinator and the HMWG, the governing body will hold a public hearing. The governing body will review the recommendation (including the factors listed above) and any oral or written comments received at the public hearing. Following that review, the governing body will take one of the following actions:

- Adopt the proposed amendment as presented,
- Adopt the proposed amendment with modifications,
- Refer the amendments request back to the designee for further consideration, or
- Defer the amendment request for further consideration and/or hearing.

### ***Update Implementation***

Each jurisdiction participating in this Plan is responsible for implementing specific mitigation actions as prescribed in their locally adopted Mitigation Action Plan. In the Mitigation Action Plan, each proposed action is assigned to a specific local department or agency in order to increase accountability and the likelihood of implementation. This approach enables individual jurisdictions to update their unique mitigation strategy as needed without altering the broader focus of the countywide plan elements. The separate adoption of locally specific actions also ensures that each jurisdiction is not held responsible for the actions of every other jurisdiction involved in the planning process.

Each jurisdiction shall develop an updated implementation schedule as part of their local Mitigation Action Plan.

Sussex County and its jurisdictions will seek outside funding sources to implement mitigation projects. Whenever possible, a funding source has been identified for proposed actions listed in the Mitigation Action Plan.

It will be up to each participating jurisdiction to determine additional implementation procedures beyond their Mitigation Action Plan. This includes integrating the requirements of the All Hazard Mitigation Plan into other planning documents, processes or mechanisms such as comprehensive or capital improvement plans, when appropriate.

### ***Other Local Planning Mechanisms***

It should be noted that Sussex County has limited land use planning and zoning authority, so the County has few opportunities to incorporate this Plan into other local mechanisms, such as zoning and subdivision ordinances, or comprehensive land use plans. SCEOC will work with individual municipalities to incorporate the recommendations of the Plan into local comprehensive planning and capital improvement programs.

## Plan Monitoring and Maintenance

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Participating municipalities in this Plan will work to incorporate the goals of this Plan into the next update of relevant plans and regulations, including comprehensive plans, zoning codes, and capital improvement plans.

### *Continued Public Involvement*

Efforts to obtain public input was an integral part of the Plan Update and will continue to be essential as this Plan changes over time. As is the case with any officially adopted plan or ordinance, significant changes to this Plan shall require a public hearing.

Other efforts to involve the public in the maintenance, evaluation and revision process will be made as necessary. These efforts may include:

- Advertising meetings of the Hazard Mitigation Working Group in the local newspaper, public bulletin boards and/or City and County office buildings,
- Utilizing local media to update the public of any maintenance and/or periodic review activities taking place,
- Utilizing City and County Web sites to advertise any maintenance and/or periodic review activities taking place, and
- Keeping copies of the updated Plan in public libraries.

# APPENDIX A: MUNICIPAL MITIGATION ASSESSMENTS

## *Individual Jurisdiction Section Overview*

Due to the nature of the multi-jurisdiction plan and the government structure within the State of Delaware, each jurisdiction has an individual section in the plan. Each section outlines a background, capabilities, risk assessment, and mitigation actions for the respective jurisdiction. The mitigation actions are designed to complement the County-wide risk assessment while allowing the municipalities to provide any changes to hazards based on local impact.

## *Repetitive and Severe Repetitive loss properties*

The listing of repetitive loss and severe repetitive loss properties as denoted by the National Flood Insurance program are split out among the municipal sections based on where the property resides. Every property is included as a mitigation action for their respective municipality and is denoted as being one of those properties.

## *Mitigation Action Plan*

The mitigation actions outlined below are not prioritized within this plan. Instead, as funding and staff time become available, the actions are reviewed to determine which action is the most feasible. The decision upon which mitigation measures at the County level will be made by the Director of the Emergency Operations Center, or designee. Potential funding sources are outlined next to each mitigation action in the tables.

Criteria that are used to determining which mitigation action to pursue include:

- Funding and/or time available,
- Restrictions on allowed use of the funding,
- Number of mitigation goals met,
- Cost benefit review of the action,
- Ability of agencies involved to work on the action, and
- Ability for the County/municipality to administer the mitigation action.

## **Sussex County**

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### **General Profile**

Sussex County is the largest County in Delaware encompassing 1,196 square miles. The majority of Delaware beaches are located in the eastern portion of the state. Adjacent Counties are Kent County Delaware to the north, Cape May County New Jersey to the northeast, Worcester County Maryland to the south, Dorchester County Maryland to the southwest, Wicomico County Maryland to the southwest, and Caroline County Maryland to the northwest.

## Appendices

According to the 2010 Census, the County population is 197,145 residents.

There are three major north south highways within Sussex; US Route 13 in the west, US Route 113 in the middle, and State Route 1 along the coast.

Agriculture and commercial fishing drive Sussex County. The predominant economic driver in the state is agriculture with the largest poultry production within the United States. Most of the land is rural and there are but a few large population centers.

### Risk Assessment

Sussex County considers their top hazards to be flooding, wind related events and winter storms, drought, and extreme heat / cold.

### Capabilities

#### Plans and Programs in Place

Jurisdiction	HMP	DRP	CLUP	FMP	SMP	EOP	COOP	REP	SARA	TRANS	CIP	REG-PL	HPP	ZO	SO	FDPO	NFIP	CRS	BC
Sussex County	X	X	X	X		X		X	X	X	X	X	X	X	X	X	X		X

- **HMP** – Hazard Mitigation Plan
- **DRP** – Disaster Recovery Plan
- **CLUP** – Comprehensive Land Use Plan
- **FMP** – Floodplain Management Plan / Flood Mitigation Plan
- **SMP** – Stormwater Management Plan
- **EOP** – Emergency Operations Plan
- **COOP** – Continuity of Operations Plan
- **REP** – Radiological Emergency Plan
- **SARA** – SARA Title III Emergency Response Plan
- **TRANS** – Transportation Plan
- **CIP** – Capital Improvements Plan (that regulates infrastructure in hazard areas)
- **REG-PL** – Regional Planning
- **HPP** – Historic Preservation Plan
- **ZO** – Zoning Ordinance
- **SO** – Subdivision Ordinance
- **FDPO** – Flood Damage Prevention Ordinance
- **NFIP** – National Flood Insurance Program
- **CRS** – Community Rating System
- **BC** – Building Codes

## Appendices

The following indicates significant indicators for a local jurisdictions ability to implement mitigation strategy. Not all jurisdictions have all five subsections.

- B-1 - Local Comprehensive Plan Update
- B-2 - Building Code Effectiveness Grading Schedule (BCEGS)
- B-3 - National Flood Insurance Program participation
- B-4 - Community Rating System Participation
- B-5 - Self-assessment of Local Capability

### B-1: Local Comprehensive Plan Updates

Jurisdiction	Plan Status
N/A	N/A

### B-2: BCEGS Grades for Sussex County Jurisdictions

Jurisdiction	BCEGS Grade
Sussex County	8

### B-3: NFIP Participation in Sussex County

Jurisdiction	NFIP Entry Date
Sussex County	10/06/76

### B-4: CRS Communities in Sussex County

Jurisdiction	CRS Entry Date	Current CRS Class
N/A	N/A	N/A

### B-5: Self-Assessment of Local Capability

Jurisdiction	Technical Capability	Fiscal Capability	Administrative
Sussex County	M	M	M

*L=Low capability, M=Moderate capability, H=High capability*

### NFIP Registered Repetitive Loss Properties

Jurisdiction	Number of Properties	Number of Losses	Total Cost
<b>Repetitive Loss Properties</b>			
Assigned to Municipalities			
<b>Severe Repetitive Loss Properties</b>			
Assigned to Municipalities			

## Appendices

### Mitigation Actions Review

Project Description	Adopted	Priority	Timeline	Status	Estimated Cost	Potential Funding Source
<b>Previous Plan Mitigation Actions Review</b>						
Improve the County's Community Rating System rating. Review and update community plans and ordinances and incorporate updated information into the CRS update.	Yes	High	Short-term	Ongoing		FMA, HMGP, PDM
Assist residents with compliance with building codes requiring residents to elevate manufactured housing located on the coast to above the base flood elevation (BFE).	Yes	High	Ongoing	Ongoing		FMA, HMGP, PDM
Work with homeowners to identify ways to elevate flood-prone structures.	Yes	High	Ongoing	Ongoing		FMA, HMGP, PDM
Improve educational awareness through better notifications, training, and properly marked flood evacuation routes.	Yes	High	Short-term	Ongoing		FMA, HMGP, PDM
Distribute disaster preparedness and hazard mitigation-related information using brochures and website link.	Yes	Moderate	Ongoing	Ongoing	1200	FMA, HMGP, PDM, CDBG
Work with DeIDOT to install storm drain of culvert on 1100 Block of South Bayshore Drive in Broadkill Beach.	Yes	High	Short-term	Not started		FMA, HMGP, PDM
Work with DNREC and DeIDOT to endorse Federally funded restoration projects to restore portions of the Sussex County coastline that are experiencing significant coastal erosion, both from rising sea levels and coastal storms.	No	Moderate	Ongoing	Ongoing		FMA, HMGP, PDM, PS
Conduct a study to identify stormwater management systems that need to be retrofitted and channels that need to be improved in order to reduce flooding throughout the County.	No	Moderate	Short-term	Not started		FMA, HMGP, PDM
Work with DeIDOT to identify possible elevation alternatives for the rebuilding of SR 38 (Prime Hook Road).	No	Moderate	Short-term	Ongoing	1.45 million	HMGP, CDBG, PS
<b>Mitigation Actions Started / Completed since 2010 Plan Update</b>						
3 Repetitive Loss Property elevations	Yes	High	Ongoing	Ongoing	300,000	HMGP
<b>Potential / New Mitigation Actions For Consideration</b>						
Support additional Flood Management Study and/or Potential Elevations in the Mallard Lakes area.	No	High	Short term	Pending grant funding	2 million	FMA, HMGP, PDM

## Appendices

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Under timeline for completion, the County has identified the following parameters:

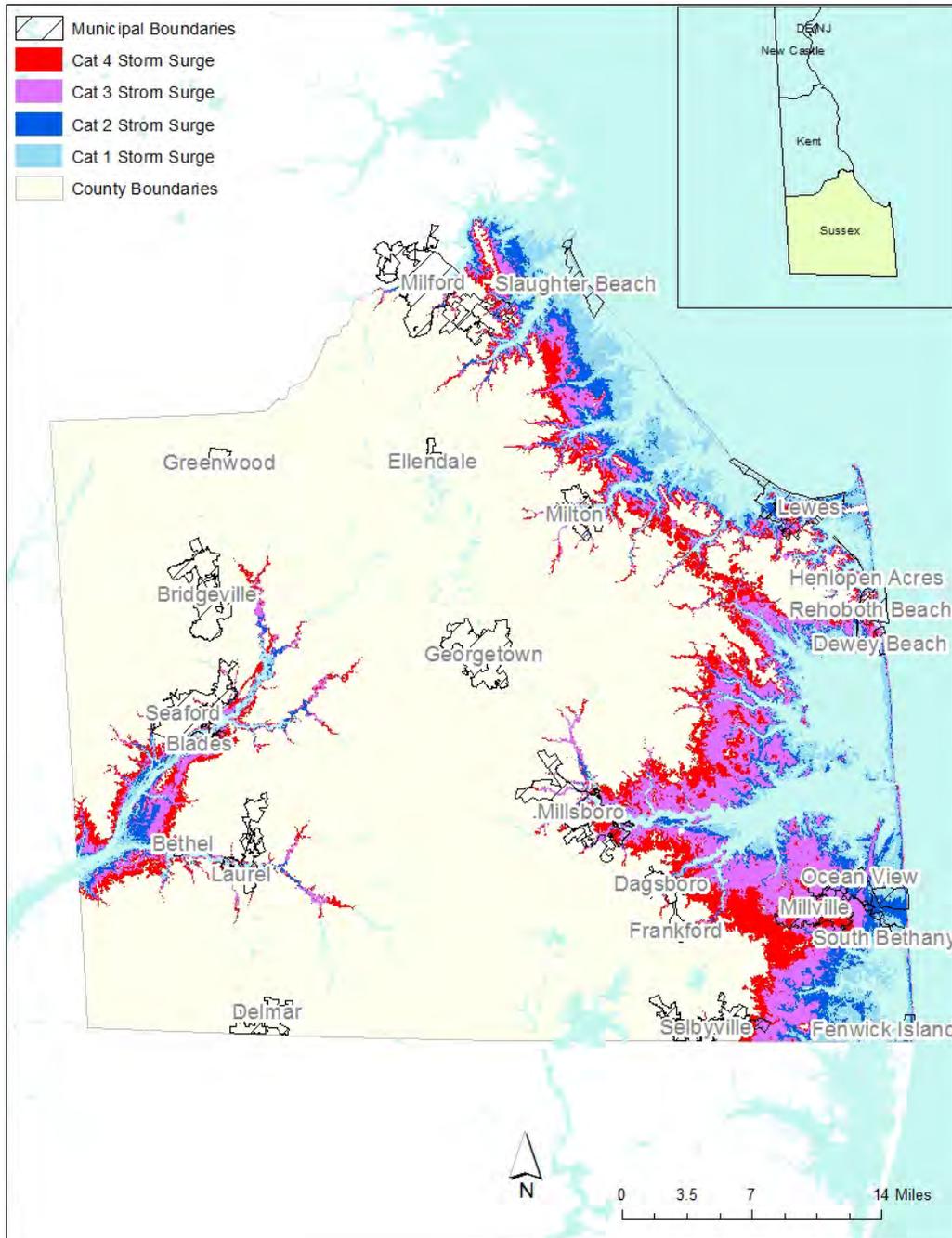
- **Ongoing:** Initiative is currently being implemented under existing programs and budgets.
- **Short-term:** Initiative can be completed within 1 to 5 years once funding has been secured.
- **Long-term:** Initiative will take 5 or more years to complete once funding has been secured.

Under the potential funding sources, the acronyms align with the following programs:

- **CDBG:** Community Development Block Grant Program
- **FMA:** Flood Mitigation Grant Program
- **HMEP:** Hazardous Materials Emergency Preparedness Grant
- **HMGP:** Hazard Mitigation Grant Program
- **HSGP:** Homeland Security Grant Program
- **PDM:** Pre-Disaster Mitigation Grant Program
- **PS:** Private Sector Grants
- **RERP:** Radiological Emergency Response Program

# Appendices

Figure A-1: County Flood Inundation Map



## Appendices

### Town of Bethany Beach

#### General Profile

The Town of Bethany Beach encompasses 1.2 square miles. The Delaware Seashore State Park, the Atlantic Ocean to the east, the Town of South Bethany to the south, and the City of Ocean View to the west border the town to the north.

According to the 2010 Census, the population of the Town of Bethany Beach is 1,122 but will swell to over 20,000 during the summer vacation season.

The Bethany Beach economy centers on the tourism and vacation industry. Agriculture and commercial fishing drive Sussex County.

#### Risk Assessment

The Town of Bethany Beach considers their top hazards to be flooding, wind related events and winter storms, and extreme heat / cold.

#### Capabilities

##### Plans and Programs in Place

Jurisdiction	HMP	DRP	CLUP	FMP	SMP	EOP	COOP	REP	SARA	TRANS	CIP	REG-PL	HPP	ZO	SO	FDPO	NFIP	CRS	BC	
Bethany Beach	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X

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| <ul style="list-style-type: none"> <li>▪ <b>HMP</b> – Hazard Mitigation Plan</li> <li>▪ <b>DRP</b> – Disaster Recovery Plan</li> <li>▪ <b>CLUP</b> – Comprehensive Land Use Plan</li> <li>▪ <b>FMP</b> – Floodplain Management Plan / Flood Mitigation Plan</li> <li>▪ <b>SMP</b> – Stormwater Management Plan</li> <li>▪ <b>EOP</b> – Emergency Operations Plan</li> <li>▪ <b>COOP</b> – Continuity of Operations Plan</li> <li>▪ <b>REP</b> – Radiological Emergency Plan</li> <li>▪ <b>SARA</b> – SARA Title III Emergency Response Plan</li> </ul> | <ul style="list-style-type: none"> <li>▪ <b>TRANS</b> – Transportation Plan</li> <li>▪ <b>CIP</b> – Capital Improvements Plan (that regulates infrastructure in hazard areas)</li> <li>▪ <b>REG-PL</b> – Regional Planning</li> <li>▪ <b>HPP</b> – Historic Preservation Plan</li> <li>▪ <b>ZO</b> – Zoning Ordinance</li> <li>▪ <b>SO</b> – Subdivision Ordinance</li> <li>▪ <b>FDPO</b> – Flood Damage Prevention Ordinance</li> <li>▪ <b>NFIP</b> – National Flood Insurance Program</li> <li>▪ <b>CRS</b> – Community Rating System</li> <li>▪ <b>BC</b> – Building Codes</li> </ul> |
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## Appendices

The following indicates significant indicators for a local jurisdictions ability to implement mitigation strategy. Not all jurisdictions have all five subsections.

- B-1 - Local Comprehensive Plan Update
- B-2 - Building Code Effectiveness Grading Schedule (BCEGS)
- B-3 - National Flood Insurance Program participation
- B-4 - Community Rating System Participation
- B-5 - Self-assessment of Local Capability

### B-1: Local Comprehensive Plan Updates

Jurisdiction	Plan Status
Bethany Beach	2010

### B-2: BCEGS Grades for Sussex County Jurisdictions

Jurisdiction	BCEGS Grade
Bethany Beach	<i>Declined Participation</i>

### B-3: NFIP Participation in Sussex County

Jurisdiction	NFIP Entry Date
Bethany Beach	4/06/73

### B-4: CRS Communities in Sussex County

Jurisdiction	CRS Entry Date	Current CRS Class
Bethany Beach	5/1/09	8

### B-5 Self-Assessment of Local Capability

Jurisdiction	Technical Capability	Fiscal Capability	Administrative
Bethany Beach	M	M	M

L=Low capability, M=Moderate capability, H=High capability

### NFIP Registered Repetitive Loss Properties

Jurisdiction	Number of Properties	Number of Losses	Total Cost
<b>Repetitive Loss Properties</b>			
N/A	N/A	N/A	N/A
<b>Severe Repetitive Loss Properties</b>			
Town of Bethany Beach	1	7	\$394,376
Town of Bethany Beach	1	5	\$110,440

## Appendices

### Mitigation Actions Review

Project Description	Adopted	Priority	Timeline	Status	Estimated Cost	Potential Funding Source
<b>Previous Plan Mitigation Actions Review</b>						
Improve existing drainage system throughout the Town, particularly east of Route 1 and also include a plan maintenance schedule.	Yes	High	Long term	In Progress	3.5 Million	HMGP, FMA, PDM, PS
Consider purchasing an inflatable dam for Loop and Assawoman Canal to protect against incoming tide waters.	Yes	Moderate	Short term	Delayed due to funding.		HMGP, FMA, PDM, PS
Continue to educate residents and improve public awareness on being better prepared to face hazards.	Yes	High	Short term	In Progress	1000	HMGP, FMA, PDM, PS, CDBG
Create 2 new outfalls leading from large ditch that runs from Route 26 behind Lake Bethany to the marsh and install flap gates.	No	High	Short term	Pending funding source	??	HMGP, FMA, PDM, PS
Conduct Phase 2 of Bethany West drainage improvements. Replace and upgrade existing storm-water system between Collins Street and Tudor Court along Halfmoon Drive including Tudor Court, Sandstone Court, and Pebble Court	No	High	Short term	Pending funding source		HMGP, FMA, PDM, PS
Conduct Phase 3 of Bethany West drainage improvements. Replace and upgrade existing storm-water facilities at West Side Development, enlarge outfall, replace driveway culverts, replace old pipe systems, re-grade ditches.	No	High	Short term	Pending funding source		HMGP, FMA, PDM, PS
<b>Mitigation Actions Started / Completed since 2010 Plan Update</b>						
<b>Potential / New Mitigation Actions For Consideration</b>						
Storm water runoff on Pennsylvania Ave from Garfield to 5th	No	High	Short term	Pending funding source	250,00	HMGP
Storm water management at 8 <sup>th</sup> Street and Evans Ave (low lying area)	No	High	Short term	Pending funding source	250,00	HMGP

## Appendices

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Under timeline for completion, the County has identified the following parameters:

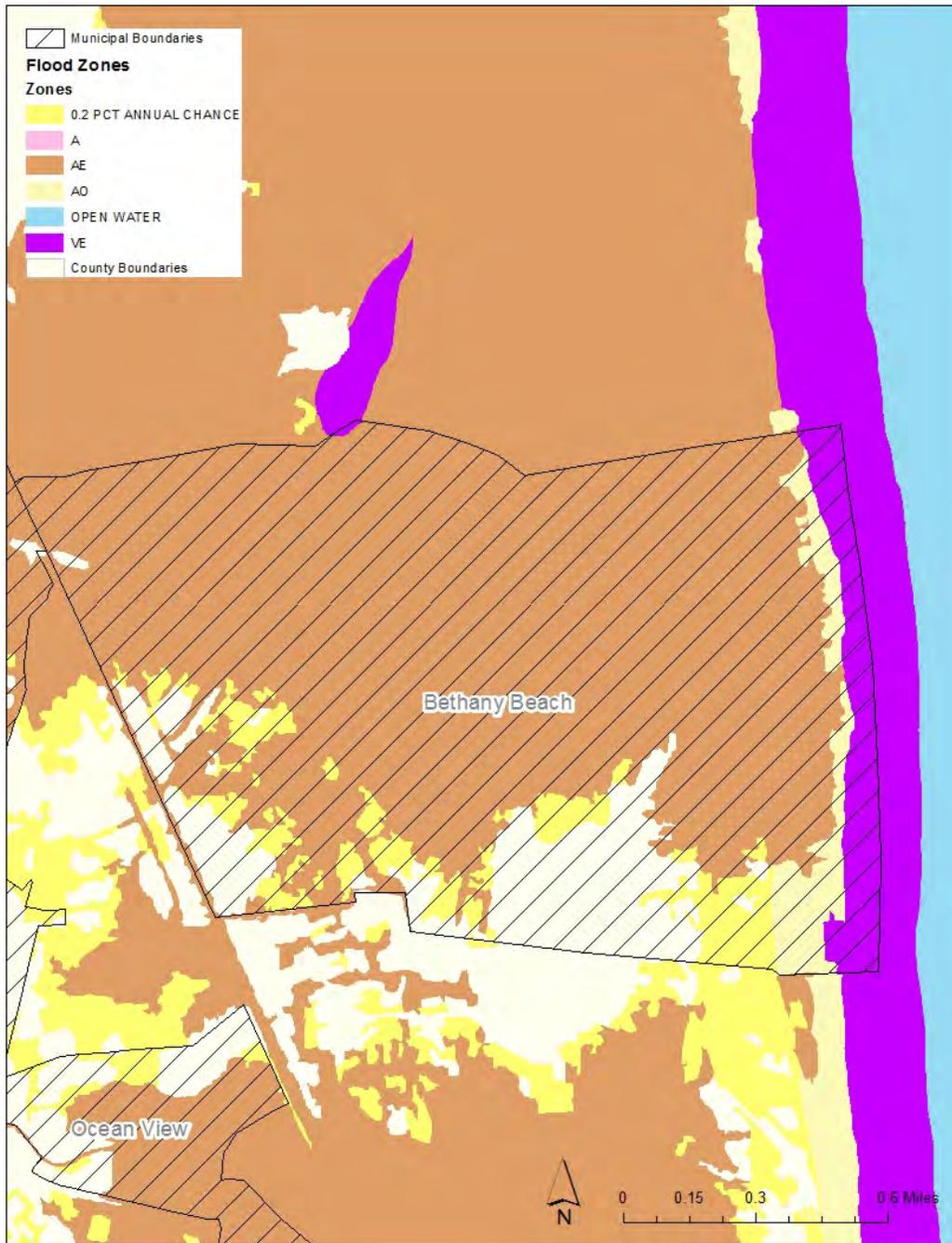
- **Ongoing:** Initiative is currently being implemented under existing programs and budgets.
- **Short-term:** Initiative can be completed within 1 to 5 years once funding has been secured.
- **Long-term:** Initiative will take 5 or more years to complete once funding has been secured.

Under the potential funding sources, the acronyms align with the following programs:

- **CDBG:** Community Development Block Grant Program
- **FMA:** Flood Mitigation Grant Program
- **HMEP:** Hazardous Materials Emergency Preparedness Grant

# Appendices

Figure A-2: Bethany Beach Flood Map



## Appendices

### Town of Bethel

#### General Profile

The Town of Bethel encompasses 1.2 square miles. The Delaware Seashore State Park, the Atlantic Ocean to the east, the Town of South Bethany to the south, and the City of Ocean View to the west border the town to the north.

According to the 2010 Census, the population of the Town of Bethel is 1,060 but will swell to over 16,000 during the summer vacation season.

The Bethel economy centers on the tourism and vacation industry.

#### Risk Assessment

The Town of Bethel considers their top hazards to be flooding, wind related events and winter storms, and extreme heat / cold.

#### Capabilities

**Plans and Programs in Place**

Jurisdiction	HMP	DRP	CLUP	FMP	SMP	EOP	COOP	REP	SARA	TRANS	CIP	REG-PL	HPP	ZO	SO	FDPO	NFIP	CRS	BC	
Bethel									X			X	X	X		X	X			X

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|--|--|
| <ul style="list-style-type: none"> <li>▪ <b>HMP</b> – Hazard Mitigation Plan</li> <li>▪ <b>DRP</b> – Disaster Recovery Plan</li> <li>▪ <b>CLUP</b> – Comprehensive Land Use Plan</li> <li>▪ <b>FMP</b> – Floodplain Management Plan / Flood Mitigation Plan</li> <li>▪ <b>SMP</b> – Stormwater Management Plan</li> <li>▪ <b>EOP</b> – Emergency Operations Plan</li> <li>▪ <b>COOP</b> – Continuity of Operations Plan</li> <li>▪ <b>REP</b> – Radiological Emergency Plan</li> <li>▪ <b>SARA</b> – SARA Title III Emergency Response Plan</li> </ul> | <ul style="list-style-type: none"> <li>▪ <b>TRANS</b> – Transportation Plan</li> <li>▪ <b>CIP</b> – Capital Improvements Plan (that regulates infrastructure in hazard areas)</li> <li>▪ <b>REG-PL</b> – Regional Planning</li> <li>▪ <b>HPP</b> – Historic Preservation Plan</li> <li>▪ <b>ZO</b> – Zoning Ordinance</li> <li>▪ <b>SO</b> – Subdivision Ordinance</li> <li>▪ <b>FDPO</b> – Flood Damage Prevention Ordinance</li> <li>▪ <b>NFIP</b> – National Flood Insurance Program</li> <li>▪ <b>CRS</b> – Community Rating System</li> <li>▪ <b>BC</b> – Building Codes</li> </ul> |
|--|--|

## Appendices

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- B-2 - Building Code Effectiveness Grading Schedule (BCEGS)
- B-3 - National Flood Insurance Program participation
- B-4 - Community Rating System Participation
- B-5 - Self-assessment of Local Capability

### B-1: Local Comprehensive Plan Updates

Jurisdiction	Plan Status
Bethel	Contacted

### B-2: BCEGS Grades for Sussex County Jurisdictions

Jurisdiction	BCEGS Grade
Bethel	8*

### B-3: NFIP Participation in Sussex County

Jurisdiction	NFIP Entry Date
Bethel	1/16/81

### B-4: CRS Communities in Sussex County

Jurisdiction	CRS Entry Date	Current CRS Class
N/A	N/A	N/A

### B-5: Self-Assessment of Local Capability

Jurisdiction	Technical Capability	Fiscal Capability	Administrative
Bethel	L	L	L

*L=Low capability, M=Moderate capability, H=High capability*

### NFIP Registered Repetitive Loss Properties

Jurisdiction	Number of Properties	Number of Losses	Total Cost
<b>Repetitive Loss Properties</b>			
N/A	N/A	N/A	N/A
<b>Severe Repetitive Loss Properties</b>			
N/A	N/A	N/A	N/A

## Appendices

### Mitigation Actions Review

Project Description	Adopted	Priority	Timeline	Status	Estimated Cost	Potential Funding Source
<b>Previous Plan Mitigation Actions Review</b>						
Educate the public regarding preparedness and protection measures.	Yes	High	Ongoing	Pending funding source	2,000	HMGP, FMA, PDM, CDBG
Review County Office of Emergency Services plans regarding protective measures and evacuation procedures for hazardous materials incidents and share this information with citizens. Information should include ways to elevate and/or harden oil and gas storage tanks to avoid spills and contamination of surrounding areas.	Yes	High	Short term	Pending funding source	2,000	CDBG, HSGP
Educate the public on the necessity of periodic well testing, especially during periods of drought.	Yes	High	Short term	Pending funding source	2,000	HMGP, FMA, PDM, CDBG
Educate the public regarding special needs populations in the event of winter storms.	Yes	High	Short term	Pending funding source	2,000	HMGP, FMA, PDM, CDBG
Educate the public concerning sheltering-in-place should a terrorist attack occur.	Yes	High	Short term	Pending funding source	2,000	CDBG, HSGP
Identify historic structures and develop mitigation strategies to protect any at-risk properties.	Yes	Moderate	Short term	Pending funding source	20,000	HMGP, FMA, PDM
<b>Mitigation Actions Started / Completed since 2010 Plan Update</b>						
<b>Potential / New Mitigation Actions For Consideration</b>						

## Appendices

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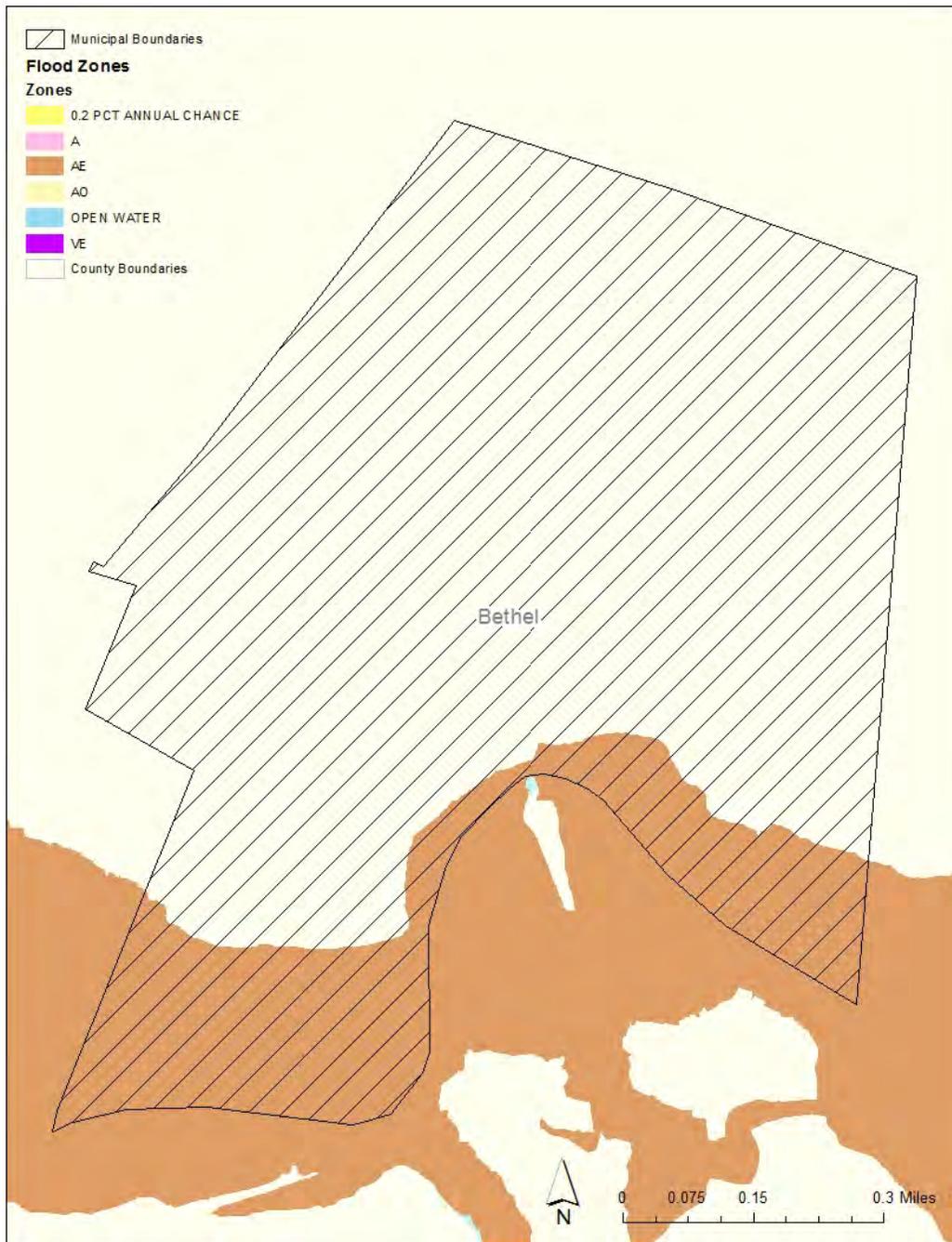
Under timeline for completion, the County has identified the following parameters:

- **Ongoing:** Initiative is currently being implemented under existing programs and budgets.
- **Short-term:** Initiative can be completed within 1 to 5 years once funding has been secured.
- **Long-term:** Initiative will take 5 or more years to complete once funding has been secured.

Under the potential funding sources, the acronyms align with the following programs:

- **CDBG:** Community Development Block Grant Program
- **FMA:** Flood Mitigation Grant Program
- **HMEP:** Hazardous Materials Emergency Preparedness Grant
- **HMGP:** Hazard Mitigation Grant Program
- **HSGP:** Homeland Security Grant Program
- **PDM:** Pre-Disaster Mitigation Grant Program
- **PS:** Private Sector Grants
- **RERP:** Radiological Emergency Response Program

Figure A-3: Bethel Flood Map



## Appendices

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### Town of Blades

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#### General Profile

The Town of Blades encompasses 0.4 square miles.

According to the 2010 Census, the population of the Town of Blades is 1241.

The Town of Blades economy centers on the tourism and vacation industry.

#### Risk Assessment

The Town of Blades considers their top hazards to be flooding, wind related events and winter storms, and extreme heat / cold.

#### Capabilities

**Plans and Programs in Place**

Jurisdiction	HMP	DRP	CLUP	FMP	SMP	EOP	COOP	REP	SARA	TRANS	CIP	REG-PL	HPP	ZO	SO	FDPO	NFIP	CRS	BC
Bethel			X						X					X	X	X	X		X

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|--|--|
| <ul style="list-style-type: none"> <li>▪ <b>HMP</b> – Hazard Mitigation Plan</li> <li>▪ <b>DRP</b> – Disaster Recovery Plan</li> <li>▪ <b>CLUP</b> – Comprehensive Land Use Plan</li> <li>▪ <b>FMP</b> – Floodplain Management Plan / Flood Mitigation Plan</li> <li>▪ <b>SMP</b> – Stormwater Management Plan</li> <li>▪ <b>EOP</b> – Emergency Operations Plan</li> <li>▪ <b>COOP</b> – Continuity of Operations Plan</li> <li>▪ <b>REP</b> – Radiological Emergency Plan</li> <li>▪ <b>SARA</b> – SARA Title III Emergency Response Plan</li> </ul> | <ul style="list-style-type: none"> <li>▪ <b>TRANS</b> – Transportation Plan</li> <li>▪ <b>CIP</b> – Capital Improvements Plan (that regulates infrastructure in hazard areas)</li> <li>▪ <b>REG-PL</b> – Regional Planning</li> <li>▪ <b>HPP</b> – Historic Preservation Plan</li> <li>▪ <b>ZO</b> – Zoning Ordinance</li> <li>▪ <b>SO</b> – Subdivision Ordinance</li> <li>▪ <b>FDPO</b> – Flood Damage Prevention Ordinance</li> <li>▪ <b>NFIP</b> – National Flood Insurance Program</li> <li>▪ <b>CRS</b> – Community Rating System</li> <li>▪ <b>BC</b> – Building Codes</li> </ul> |
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## Appendices

The following indicates significant indicators for a local jurisdictions ability to implement mitigation strategy. Not all jurisdictions have all five subsections.

- B-1 - Local Comprehensive Plan Update
- B-2 - Building Code Effectiveness Grading Schedule (BCEGS)
- B-3 - National Flood Insurance Program participation
- B-4 - Community Rating System Participation
- B-5 - Self-assessment of Local Capability

### B-1: Local Comprehensive Plan Updates

Jurisdiction	Plan Status
Blades	Certified 2008

### B-2: BCEGS Grades for Sussex County Jurisdictions

Jurisdiction	BCEGS Grade
Blades	Declined Participation

### B-3: NFIP Participation in Sussex County

Jurisdiction	NFIP Entry Date
Blades	1/16/81

### B-4: CRS Communities in Sussex County

Jurisdiction	CRS Entry Date	Current CRS Class
Blades	N/A	N/A

### B-5: Self-Assessment of Local Capability

Jurisdiction	Technical Capability	Fiscal Capability	Administrative
Blades	M	M	M

*L=Low capability, M=Moderate capability, H=High capability*

### NFIP Registered Repetitive Loss Properties

Jurisdiction	Number of Properties	Number of Losses	Total Cost
<b>Repetitive Loss Properties</b>			
N/A	N/A	N/A	N/A
<b>Severe Repetitive Loss Properties</b>			
N/A	N/A	N/A	N/A

## Appendices

### Mitigation Actions Review

Project Description	Adopted	Priority	Timeline	Status	Estimated Cost	Potential Funding Source
<b>Previous Plan Mitigation Actions Review</b>						
Upgrade stormwater drainage systems with existing underground pipes and outfall areas to help prevent future flooding.	Yes	High	When funds become available	Delayed		HMGP, FMA, PDM
Install new storm drains in strategic areas to allow removal of standing water during storms.	Yes	High	When funds become available	ongoing	2 million	HMGP, FMA, PDM
<b>Mitigation Actions Started / Completed since 2010 Plan Update</b>						
<b>Potential / New Mitigation Actions For Consideration</b>						
Storm water management upgrade: Enlarged and improved culverts West 3rd Street (150 ft)	No	High	Short term	Pending funding source	75,000	HMGP, FMA, PDM
Storm water management upgrade: East 2nd st - East 3rd street - culvert expansion and upgrade (150 ft)	No	High	Short term	Pending funding source		HMGP, FMA, PDM
Storm water management upgrade: Enforcement of building and zoning codes in support of new construction (Fire House)	No	High	Short term	Pending funding source		HMGP, FMA, PDM
Storm water management upgrade: Market Street Stormwater system upgrade	No	High	Short term	Pending funding source		HMGP, FMA, PDM
Blades storm water Management Project: 5Phase study completed	No	High	Short term	N/A	Completed	N/A
Blades storm water Management Project: Phase I - upgrade to culvert along Hollaway Street and West 2nd Street, West High Street	No	High	Short term	Pending funding source		HMGP, FMA, PDM
Blades storm water Management Project: Phases 2 thru 5 are pending funding	No	High	Short term	Pending funding source		HMGP, FMA, PDM

## Appendices

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Under timeline for completion, the County has identified the following parameters:

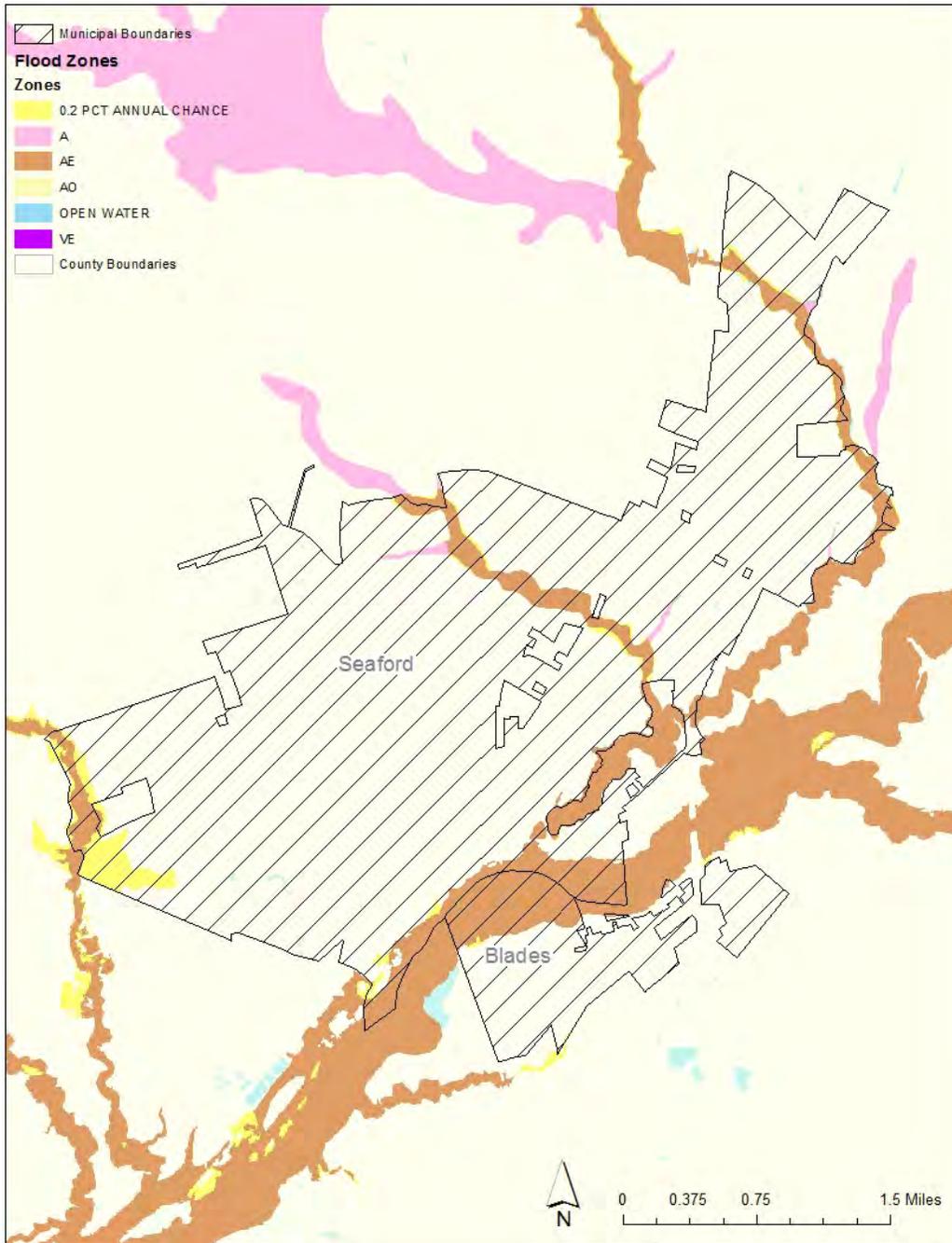
- **Ongoing:** Initiative is currently being implemented under existing programs and budgets.
- **Short-term:** Initiative can be completed within 1 to 5 years once funding has been secured.
- **Long-term:** Initiative will take 5 or more years to complete once funding has been secured.

Under the potential funding sources, the acronyms align with the following programs:

- **CDBG:** Community Development Block Grant Program
- **FMA:** Flood Mitigation Grant Program
- **HMEP:** Hazardous Materials Emergency Preparedness Grant
- **HMGP:** Hazard Mitigation Grant Program
- **HSGP:** Homeland Security Grant Program
- **PDM:** Pre-Disaster Mitigation Grant Program
- **PS:** Private Sector Grants
- **RERP:** Radiological Emergency Response Program

# Appendices

Figure A-4: Blades Flood Map



## Appendices

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### Town of Bridgeville

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#### General Profile

The Town of Bridgeville is the home to the Apple Scrapple Festival and the World Championship Punkin Chunkin and encompasses 0.8 square miles.

According to the 2010 Census, the population of the Town of Bridgeville is 2,048, but will swell to over 16,000 during the summer vacation season.

#### Risk Assessment

The Town of Bridgeville considers their top hazards to be wind related events and winter storms.

#### Capabilities

##### Plans and Programs in Place

Jurisdiction	HMP	DRP	CLUP	FMP	SMP	EOP	COOP	REP	SARA	TRANS	CIP	REG-PL	HPP	ZO	SO	FDPO	NFIP	CRS	BC
Bethel	X		X	X		X	X	X	X	X	X	X	X	X		X	X		X

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| <ul style="list-style-type: none"> <li>▪ <b>HMP</b> – Hazard Mitigation Plan</li> <li>▪ <b>DRP</b> – Disaster Recovery Plan</li> <li>▪ <b>CLUP</b> – Comprehensive Land Use Plan</li> <li>▪ <b>FMP</b> – Floodplain Management Plan / Flood Mitigation Plan</li> <li>▪ <b>SMP</b> – Stormwater Management Plan</li> <li>▪ <b>EOP</b> – Emergency Operations Plan</li> <li>▪ <b>COOP</b> – Continuity of Operations Plan</li> <li>▪ <b>REP</b> – Radiological Emergency Plan</li> <li>▪ <b>SARA</b> – SARA Title III Emergency Response Plan</li> </ul> | <ul style="list-style-type: none"> <li>▪ <b>TRANS</b> – Transportation Plan</li> <li>▪ <b>CIP</b> – Capital Improvements Plan (that regulates infrastructure in hazard areas)</li> <li>▪ <b>REG-PL</b> – Regional Planning</li> <li>▪ <b>HPP</b> – Historic Preservation Plan</li> <li>▪ <b>ZO</b> – Zoning Ordinance</li> <li>▪ <b>SO</b> – Subdivision Ordinance</li> <li>▪ <b>FDPO</b> – Flood Damage Prevention Ordinance</li> <li>▪ <b>NFIP</b> – National Flood Insurance Program</li> <li>▪ <b>CRS</b> – Community Rating System</li> <li>▪ <b>BC</b> – Building Codes</li> </ul> |
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## Appendices

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- B-3 - National Flood Insurance Program participation
- B-4 - Community Rating System Participation
- B-5 - Self-assessment of Local Capability

### B-1: Local Comprehensive Plan Updates

Jurisdiction	Plan Status
Bridgeville	2016

### B-2: BCEGS Grades for Sussex County Jurisdictions

Jurisdiction	BCEGS Grade
Bridgeville	8*

### B-3: NFIP Participation in Sussex County

Jurisdiction	NFIP Entry Date
Bridgeville	1/7/77

### B-4: CRS Communities in Sussex County

Jurisdiction	CRS Entry Date	Current CRS Class
Bridgeville	N/A	N/A

### B-5: Self-Assessment of Local Capability

Jurisdiction	Technical Capability	Fiscal Capability	Administrative
Bridgeville	M	L	M

*L=Low capability, M=Moderate capability, H=High capability*

### NFIP Registered Repetitive Loss Properties

Jurisdiction	Number of Properties	Number of Losses	Total Cost
<b>Repetitive Loss Properties</b>			
N/A	N/A	N/A	N/A
<b>Severe Repetitive Loss Properties</b>			
N/A	N/A	N/A	N/A

## Appendices

### Mitigation Actions Review

Project Description	Adopted	Priority	Timeline	Status	Estimated Cost	Potential Funding Source
<b>Previous Plan Mitigation Actions Review</b>						
Purchase mobile surveillance cameras for town use - protection for possible terrorist threats, drug activity, burglaries, etc.	No	High	Short term	Grant pending	45,000	HSGP
Currently the police department is housed separate from the other administrative offices in an old building. Relocate the police department and Town offices to one building to increase efficiency.	No	High	Short term	Architectural plans in place, awaiting funding		CDBG
<b>Mitigation Actions Started / Completed since 2010 Plan Update</b>						
<b>Potential / New Mitigation Actions For Consideration</b>						
Security fence at well-house and lift station	No	High	Short term	Pending funding	50,000	HSGP
Storm water management plan development with replacement timeline	No	High	Short term	Pending funding	150,000	HMGP, FMA, PDM

## Appendices

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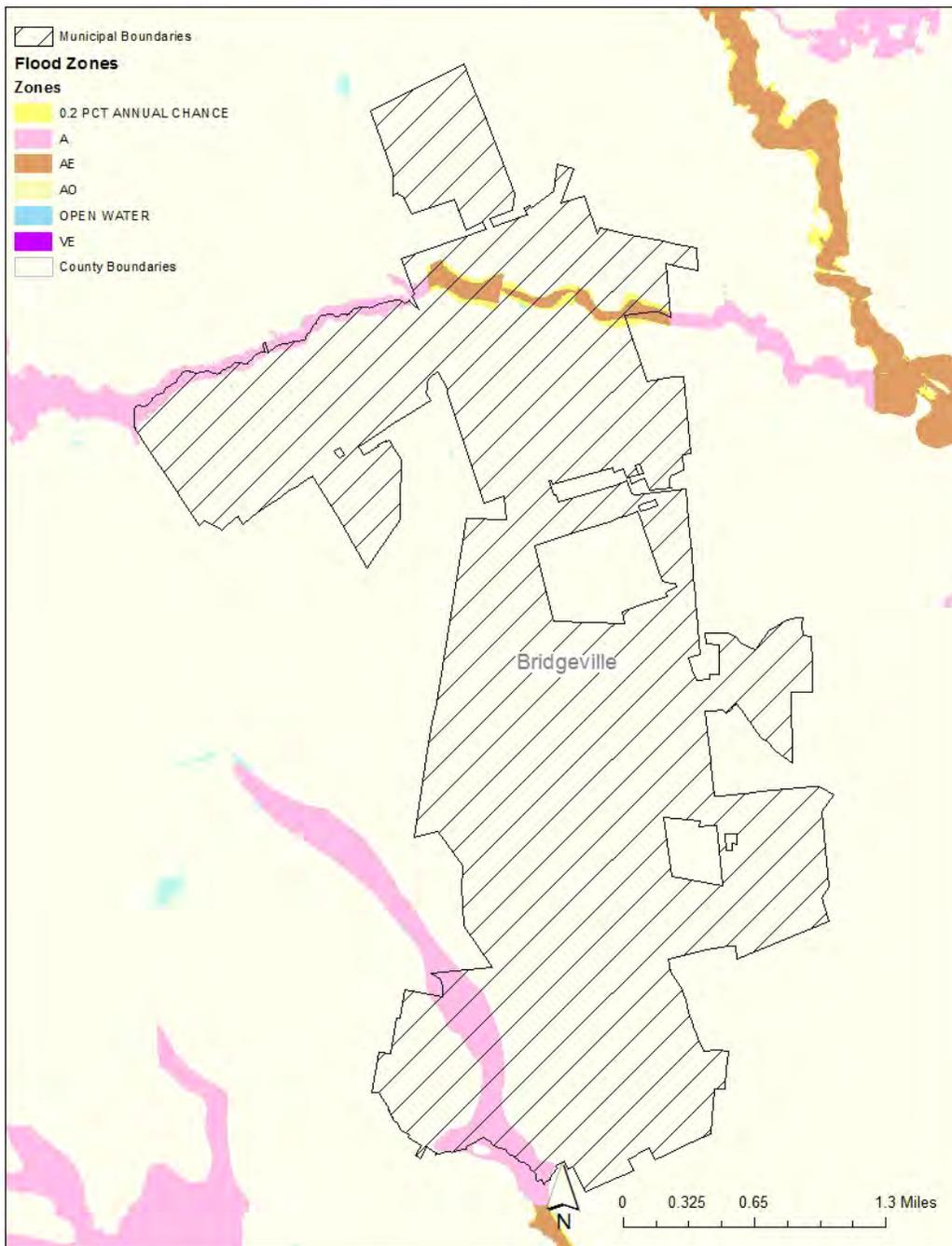
Under timeline for completion, the County has identified the following parameters:

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Under the potential funding sources, the acronyms align with the following programs:

- **CDBG:** Community Development Block Grant Program
- **FMA:** Flood Mitigation Grant Program
- **HMEP:** Hazardous Materials Emergency Preparedness Grant
- **HMGP:** Hazard Mitigation Grant Program
- **HSGP:** Homeland Security Grant Program
- **PDM:** Pre-Disaster Mitigation Grant Program
- **PS:** Private Sector Grants
- **RERP:** Radiological Emergency Response Program

Figure A-5: Bridgeville Flood Map



## Appendices

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### Town of Dagsboro

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#### General Profile

The Town of Dagsboro encompasses 1.3 square miles.

According to the 2010 Census, the population of the Town of Dagsboro is 805.

The Town of Dagsboro economy centers on the tourism and vacation industry.

#### Risk Assessment

The Town of Dagsboro considers their top hazards to be flooding, wind related events and winter storms, and extreme heat / cold.

#### Capabilities

**Plans and Programs in Place**

Jurisdiction	HMP	DRP	CLUP	FMP	SMP	EOP	COOP	REP	SARA	TRANS	CIP	REG-PL	HPP	ZO	SO	FDPO	NFIP	CRS	BC
Dagsboro			X						X		X	X		X	X	X	X		X

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| <ul style="list-style-type: none"> <li>▪ <b>HMP</b> – Hazard Mitigation Plan</li> <li>▪ <b>DRP</b> – Disaster Recovery Plan</li> <li>▪ <b>CLUP</b> – Comprehensive Land Use Plan</li> <li>▪ <b>FMP</b> – Floodplain Management Plan / Flood Mitigation Plan</li> <li>▪ <b>SMP</b> – Stormwater Management Plan</li> <li>▪ <b>EOP</b> – Emergency Operations Plan</li> <li>▪ <b>COOP</b> – Continuity of Operations Plan</li> <li>▪ <b>REP</b> – Radiological Emergency Plan</li> <li>▪ <b>SARA</b> – SARA Title III Emergency Response Plan</li> </ul> | <ul style="list-style-type: none"> <li>▪ <b>TRANS</b> – Transportation Plan</li> <li>▪ <b>CIP</b> – Capital Improvements Plan (that regulates infrastructure in hazard areas)</li> <li>▪ <b>REG-PL</b> – Regional Planning</li> <li>▪ <b>HPP</b> – Historic Preservation Plan</li> <li>▪ <b>ZO</b> – Zoning Ordinance</li> <li>▪ <b>SO</b> – Subdivision Ordinance</li> <li>▪ <b>FDPO</b> – Flood Damage Prevention Ordinance</li> <li>▪ <b>NFIP</b> – National Flood Insurance Program</li> <li>▪ <b>CRS</b> – Community Rating System</li> <li>▪ <b>BC</b> – Building Codes</li> </ul> |
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## Appendices

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- B-1 - Local Comprehensive Plan Update
- B-2 - Building Code Effectiveness Grading Schedule (BCEGS)
- B-3 - National Flood Insurance Program participation
- B-4 - Community Rating System Participation
- B-5 - Self-assessment of Local Capability

### B-1: Local Comprehensive Plan Updates

Jurisdiction	Plan Status
Dagsboro	Certified (2003)

### B-2: BCEGS Grades for Sussex County Jurisdictions

Jurisdiction	BCEGS Grade
Dagsboro	<i>Declined Participation</i>

### B-3: NFIP Participation in Sussex County

Jurisdiction	NFIP Entry Date
Dagsboro	6/1/81

### B-4: CRS Communities in Sussex County

Jurisdiction	CRS Entry Date	Current CRS Class
Dagsboro	N/A	N/A

### B-5: Self-Assessment of Local Capability

Jurisdiction	Technical Capability	Fiscal Capability	Administrative
Dagsboro	L	L	L

*L=Low capability, M=Moderate capability, H=High capability*

### NFIP Registered Repetitive Loss Properties

Jurisdiction	Number of Properties	Number of Losses	Total Cost
<b>Repetitive Loss Properties</b>			
N/A	N/A	N/A	N/A
<b>Severe Repetitive Loss Properties</b>			
N/A	N/A	N/A	N/A

## Appendices

### Mitigation Actions Review

Project Description	Adopted	Priority	Timeline	Status	Estimated Cost	Potential Funding Source
<b>Previous Plan Mitigation Actions Review</b>						
In coordination with Sussex County, fully participate in public outreach programs designed to promote hazard education and awareness for residents and businesses.	Yes	Moderate	Ongoing	Pending funding source	1,200	HMGP, FMA, PDM
<b>Mitigation Actions Started / Completed since 2010 Plan Update</b>						
<b>Potential / New Mitigation Actions For Consideration</b>						

Under timeline for completion, the County has identified the following parameters:

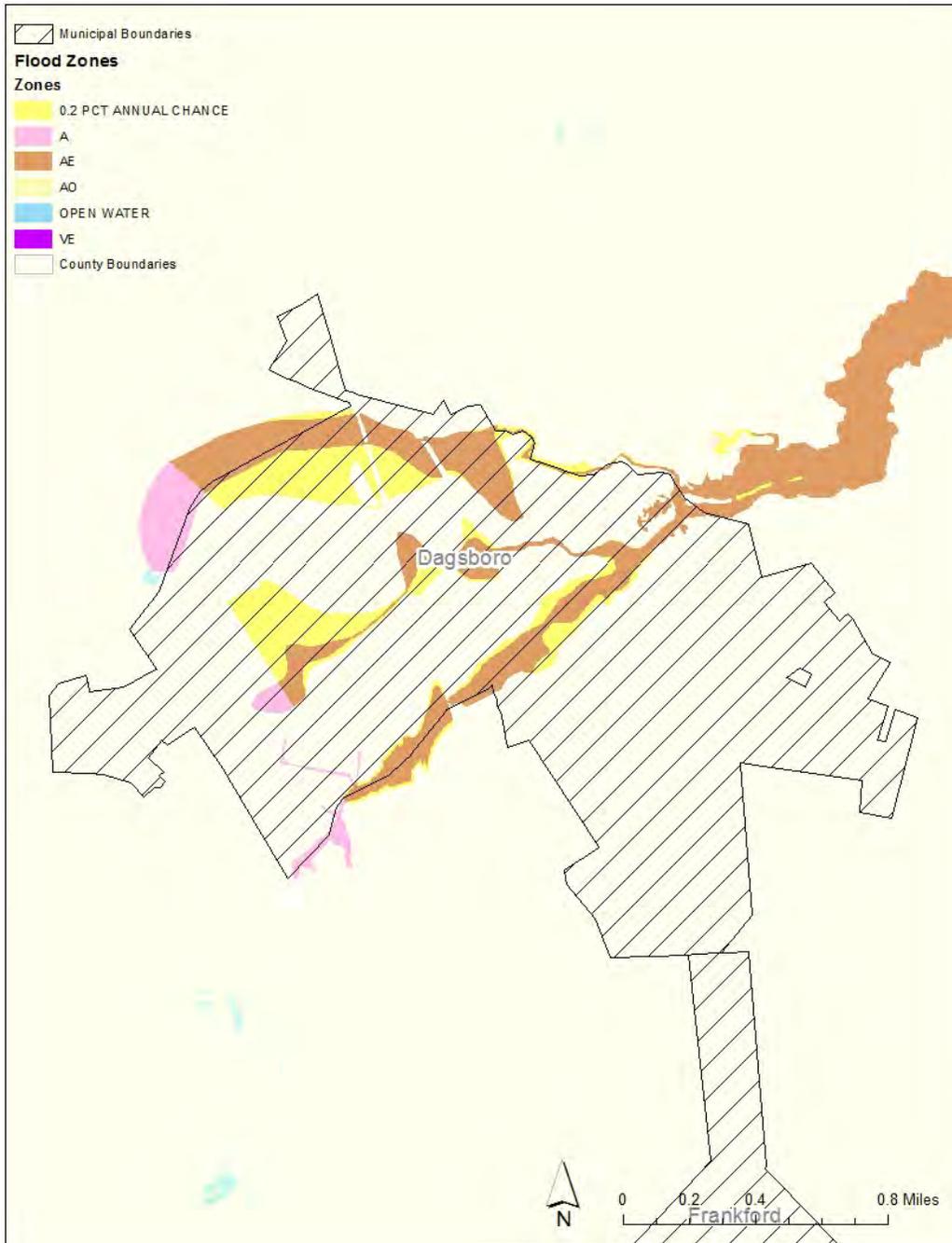
- **Ongoing:** Initiative is currently being implemented under existing programs and budgets.
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Under the potential funding sources, the acronyms align with the following programs:

- **CDBG:** Community Development Block Grant Program
- **FMA:** Flood Mitigation Grant Program
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- **HMGP:** Hazard Mitigation Grant Program
- **HSGP:** Homeland Security Grant Program
- **PDM:** Pre-Disaster Mitigation Grant Program
- **PS:** Private Sector Grants
- **RERP:** Radiological Emergency Response Program

# Appendices

Figure A-6: Dagsboro Flood Map



## Appendices

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### Town of Delmar

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#### General Profile

The Town of Delmar is located on the Maryland State border and encompasses 0.9 square miles. The town is mirrored by its twin city of Delmar Maryland.

According to the 2010 Census, the population of the Town of Delmar is 1597 (Delaware side only). Combined with the Maryland Delmar, the population is 4,600.

#### Risk Assessment

The Town of Delmar considers their top hazards to be wind related events and winter storms.

#### Capabilities

**Plans and Programs in Place**

Jurisdiction	HMP	DRP	CLUP	FMP	SMP	EOP	COOP	REP	SARA	TRANS	CIP	REG-PL	HPP	ZO	SO	FDPO	NFIP	CRS	BC
Delmar			X		X	X	X		X	X	X			X	X	X	X		X

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| <ul style="list-style-type: none"> <li>▪ <b>HMP</b> – Hazard Mitigation Plan</li> <li>▪ <b>DRP</b> – Disaster Recovery Plan</li> <li>▪ <b>CLUP</b> – Comprehensive Land Use Plan</li> <li>▪ <b>FMP</b> – Floodplain Management Plan / Flood Mitigation Plan</li> <li>▪ <b>SMP</b> – Stormwater Management Plan</li> <li>▪ <b>EOP</b> – Emergency Operations Plan</li> <li>▪ <b>COOP</b> – Continuity of Operations Plan</li> <li>▪ <b>REP</b> – Radiological Emergency Plan</li> <li>▪ <b>SARA</b> – SARA Title III Emergency Response Plan</li> </ul> | <ul style="list-style-type: none"> <li>▪ <b>TRANS</b> – Transportation Plan</li> <li>▪ <b>CIP</b> – Capital Improvements Plan (that regulates infrastructure in hazard areas)</li> <li>▪ <b>REG-PL</b> – Regional Planning</li> <li>▪ <b>HPP</b> – Historic Preservation Plan</li> <li>▪ <b>ZO</b> – Zoning Ordinance</li> <li>▪ <b>SO</b> – Subdivision Ordinance</li> <li>▪ <b>FDPO</b> – Flood Damage Prevention Ordinance</li> <li>▪ <b>NFIP</b> – National Flood Insurance Program</li> <li>▪ <b>CRS</b> – Community Rating System</li> <li>▪ <b>BC</b> – Building Codes</li> </ul> |
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## Appendices

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- B-1 - Local Comprehensive Plan Update
- B-2 - Building Code Effectiveness Grading Schedule (BCEGS)
- B-3 - National Flood Insurance Program participation
- B-4 - Community Rating System Participation
- B-5 - Self-assessment of Local Capability

### B-1: Local Comprehensive Plan Updates

Jurisdiction	Plan Status
Delmar	Complete (2005)

### B-2: BCEGS Grades for Sussex County Jurisdictions

Jurisdiction	BCEGS Grade
Delmar	<i>Not Evaluated</i>

### B-3: NFIP Participation in Sussex County

Jurisdiction	NFIP Entry Date
Delmar	<i>Not in NFIP</i>

### B-4: CRS Communities in Sussex County

Jurisdiction	CRS Entry Date	Current CRS Class
Delmar	N/A	N/A

### B-5: Self-Assessment of Local Capability

Jurisdiction	Technical Capability	Fiscal Capability	Administrative
Delmar	L	L	L

*L=Low capability, M=Moderate capability, H=High capability*

### NFIP Registered Repetitive Loss Properties

Jurisdiction	Number of Properties	Number of Losses	Total Cost
<b>Repetitive Loss Properties</b>			
N/A	N/A	N/A	N/A
<b>Severe Repetitive Loss Properties</b>			
N/A	N/A	N/A	N/A

## Appendices

### Mitigation Actions Review

Project Description	Adopted	Priority	Timeline	Status	Estimated Cost	Potential Funding Source
<b>Previous Plan Mitigation Actions Review</b>						
Conduct a vulnerability assessment of wastewater and stormwater management systems throughout the Town.	Yes	High	3-5 years	Completed	10,000	N/A
Develop an Emergency Operations Plan to include identifying additional local hazards.	Yes	High	12-24 months	Completed	2,000	N/A
<b>Mitigation Actions Started / Completed since 2010 Plan Update</b>						
<b>Potential / New Mitigation Actions For Consideration</b>						
Develop a disaster recovery plan	No	Medium	Short term	Pending funding source	2,000	CDBG, HSGP
Community outreach program development to include web based preparedness.		Medium	Short term	Pending funding source	2,500	HMGP, FMA, PDM, CDBG
GPS tracking for snow removal vehicles		Low	Short term	Pending funding source	3.500	CDBG, HSGP, PS

## Appendices

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Under timeline for completion, the County has identified the following parameters:

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- **Long-term:** Initiative will take 5 or more years to complete once funding has been secured.

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- **HSGP:** Homeland Security Grant Program
- **PDM:** Pre-Disaster Mitigation Grant Program
- **PS:** Private Sector Grants
- **RERP:** Radiological Emergency Response Program

## Appendices

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### Dewey Beach

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#### General Profile

The Town of Dewey Beach is a coastal town that encompasses 0.3 square miles.

According to the 2010 Census, the population of the Town of Dewey Beach is 341.

The Town of Dewey Beach economy centers on the tourism and vacation industry.

#### Risk Assessment

The Town of Dewey Beach considers their top hazards to be flooding, wind related events and winter storms, and extreme heat / cold.

#### Capabilities

**Plans and Programs in Place**

Jurisdiction	HMP	DRP	CLUP	FMP	SMP	EOP	COOP	REP	SARA	TRANS	CIP	REG-PL	HPP	ZO	SO	FDPO	NFIP	CRS	BC
Dewey Beach			X	X					X			X		X	X	X	X	X	X

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| <ul style="list-style-type: none"> <li>▪ <b>HMP</b> – Hazard Mitigation Plan</li> <li>▪ <b>DRP</b> – Disaster Recovery Plan</li> <li>▪ <b>CLUP</b> – Comprehensive Land Use Plan</li> <li>▪ <b>FMP</b> – Floodplain Management Plan / Flood Mitigation Plan</li> <li>▪ <b>SMP</b> – Stormwater Management Plan</li> <li>▪ <b>EOP</b> – Emergency Operations Plan</li> <li>▪ <b>COOP</b> – Continuity of Operations Plan</li> <li>▪ <b>REP</b> – Radiological Emergency Plan</li> <li>▪ <b>SARA</b> – SARA Title III Emergency Response Plan</li> </ul> | <ul style="list-style-type: none"> <li>▪ <b>TRANS</b> – Transportation Plan</li> <li>▪ <b>CIP</b> – Capital Improvements Plan (that regulates infrastructure in hazard areas)</li> <li>▪ <b>REG-PL</b> – Regional Planning</li> <li>▪ <b>HPP</b> – Historic Preservation Plan</li> <li>▪ <b>ZO</b> – Zoning Ordinance</li> <li>▪ <b>SO</b> – Subdivision Ordinance</li> <li>▪ <b>FDPO</b> – Flood Damage Prevention Ordinance</li> <li>▪ <b>NFIP</b> – National Flood Insurance Program</li> <li>▪ <b>CRS</b> – Community Rating System</li> <li>▪ <b>BC</b> – Building Codes</li> </ul> |
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## Appendices

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- B-3 - National Flood Insurance Program participation
- B-4 - Community Rating System Participation
- B-5 - Self-assessment of Local Capability

### B-1: Local Comprehensive Plan Updates

Jurisdiction	Plan Status
Dewey Beach	In Progress

### B-2: BCEGS Grades for Sussex County Jurisdictions

Jurisdiction	BCEGS Grade
Dewey Beach	8*

### B-3: NFIP Participation in Sussex County

Jurisdiction	NFIP Entry Date
Dewey Beach	6/18/82

### B-4: CRS Communities in Sussex County

Jurisdiction	CRS Entry Date	Current CRS Class
Dewey Beach	10/1/94	8

### B-5: Self-Assessment of Local Capability

Jurisdiction	Technical Capability	Fiscal Capability	Administrative
Dewey Beach	H	H	L

*L=Low capability, M=Moderate capability, H=High capability*

### NFIP Registered Repetitive Loss Properties

Jurisdiction	Number of Properties	Number of Losses	Total Cost
<b>Repetitive Loss Properties</b>			
N/A	N/A	N/A	N/A
<b>Severe Repetitive Loss Properties</b>			
Dewey Beach	1	5	\$211,718
Dewey Beach	1	4	\$64,997

## Appendices

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Jurisdiction	Number of Properties	Number of Losses	Total Cost
Dewey Beach	1	4	\$84,004

## Appendices

### Mitigation Actions Review

Project Description	Adopted	Priority	Timeline	Status	Estimated Cost	Potential Funding Source
<b>Previous Plan Mitigation Actions Review</b>						
Develop a Disaster Warning System to notify the community of an impending disaster.	No	High	Short term	Not started	500,00	HMGP, FMA, PDM, CDBG
Consider reconstructing the Rehoboth Bay shoreline which has been eroded due to heavy flooding from seawater and drainage from Nor' Easter storms.	No	Moderate	Short term	Not started	1 million	HMGP, FMA, PDM, USACE
Prepare and stock handouts of what to do in case of a disaster.	No	High	Short term	Not started	1,500	HMGP, FMA, PDM, CDBG
Prepare an update to the Town's Emergency Operation Plan.	No	High	Short term	Not started	25,000	CDBG, HSGP
<b>Mitigation Actions Started / Completed since 2010 Plan Update</b>						
<b>Potential / New Mitigation Actions For Consideration</b>						

## Appendices

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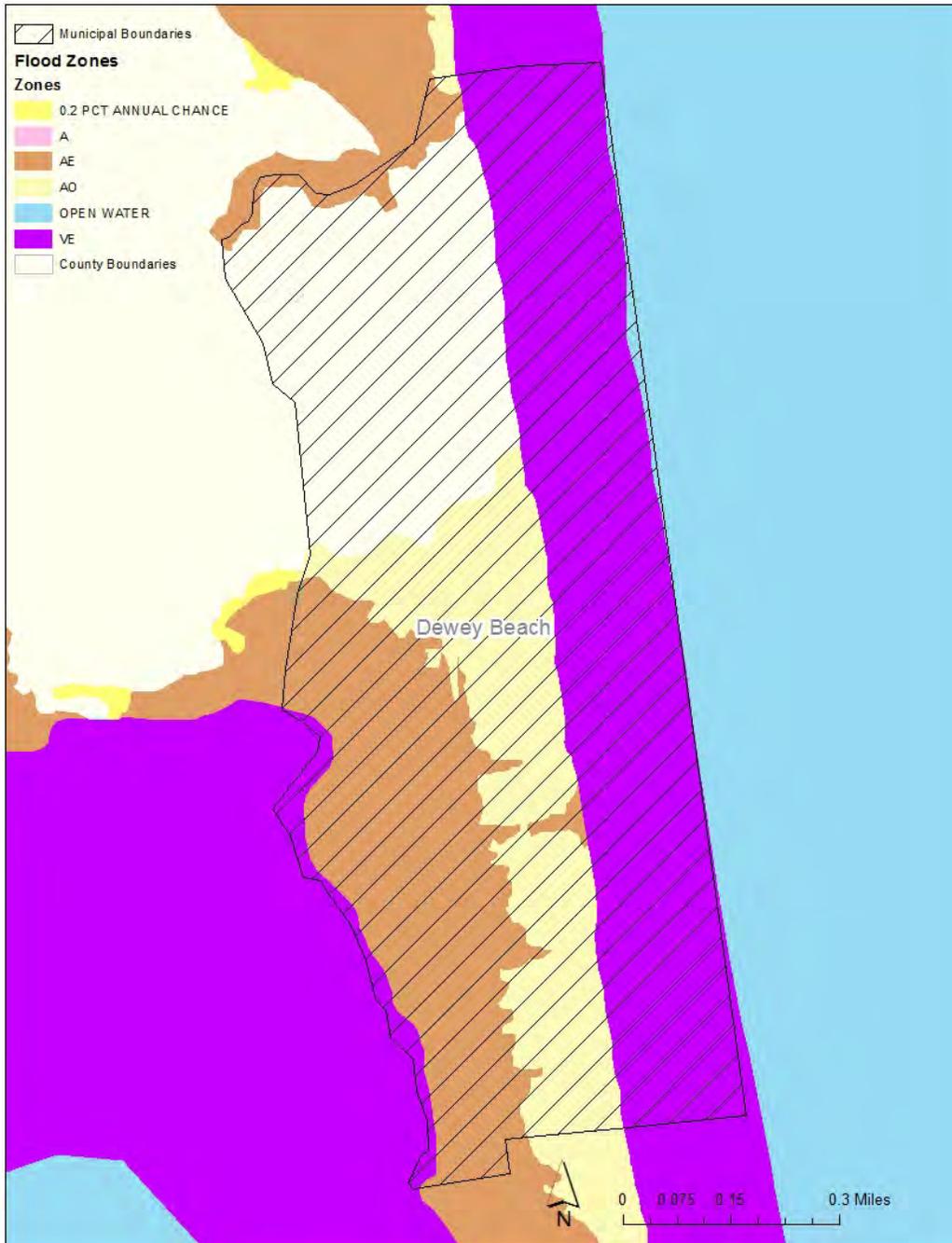
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- **Ongoing:** Initiative is currently being implemented under existing programs and budgets.
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- **Long-term:** Initiative will take 5 or more years to complete once funding has been secured.

Under the potential funding sources, the acronyms align with the following programs:

- **CDBG:** Community Development Block Grant Program
- **FMA:** Flood Mitigation Grant Program
- **HMEP:** Hazardous Materials Emergency Preparedness Grant
- **HMGP:** Hazard Mitigation Grant Program
- **HSGP:** Homeland Security Grant Program
- **PDM:** Pre-Disaster Mitigation Grant Program
- **PS:** Private Sector Grants
- **RERP:** Radiological Emergency Response Program

Figure A-7: Dewey Beach Flood Map



## Appendices

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### Town of Ellendale

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#### General Profile

The Town of Ellendale is the Gateway to Delaware's Resort Beaches and encompasses 0.3 square miles.

According to the 2010 Census, the population of the Town of Ellendale is 381.

The Town of Ellendale economy centers on the rail hub located there and the health care industry.

#### Risk Assessment

The Town of Ellendale considers their top hazards to be flooding, wind related events and winter storms, and extreme heat / cold.

#### Capabilities

**Plans and Programs in Place**

Jurisdiction	HMP	DRP	CLUP	FMP	SMP	EOP	COOP	REP	SARA	TRANS	CIP	REG-PL	HPP	ZO	SO	FDPO	NFIP	CRS	BC	
Ellendale			X						X					X	X					X

- |  |  |
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| <ul style="list-style-type: none"> <li>▪ <b>HMP</b> – Hazard Mitigation Plan</li> <li>▪ <b>DRP</b> – Disaster Recovery Plan</li> <li>▪ <b>CLUP</b> – Comprehensive Land Use Plan</li> <li>▪ <b>FMP</b> – Floodplain Management Plan / Flood Mitigation Plan</li> <li>▪ <b>SMP</b> – Stormwater Management Plan</li> <li>▪ <b>EOP</b> – Emergency Operations Plan</li> <li>▪ <b>COOP</b> – Continuity of Operations Plan</li> <li>▪ <b>REP</b> – Radiological Emergency Plan</li> <li>▪ <b>SARA</b> – SARA Title III Emergency Response Plan</li> </ul> | <ul style="list-style-type: none"> <li>▪ <b>TRANS</b> – Transportation Plan</li> <li>▪ <b>CIP</b> – Capital Improvements Plan (that regulates infrastructure in hazard areas)</li> <li>▪ <b>REG-PL</b> – Regional Planning</li> <li>▪ <b>HPP</b> – Historic Preservation Plan</li> <li>▪ <b>ZO</b> – Zoning Ordinance</li> <li>▪ <b>SO</b> – Subdivision Ordinance</li> <li>▪ <b>FDPO</b> – Flood Damage Prevention Ordinance</li> <li>▪ <b>NFIP</b> – National Flood Insurance Program</li> <li>▪ <b>CRS</b> – Community Rating System</li> <li>▪ <b>BC</b> – Building Codes</li> </ul> |
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## Appendices

The following indicates significant indicators for a local jurisdictions ability to implement mitigation strategy. Not all jurisdictions have all five subsections.

- B-1 - Local Comprehensive Plan Update
- B-2 - Building Code Effectiveness Grading Schedule (BCEGS)
- B-3 - National Flood Insurance Program participation
- B-4 - Community Rating System Participation
- B-5 - Self-assessment of Local Capability

### B-1: Local Comprehensive Plan Updates

Jurisdiction	Plan Status
Ellendale	2009

### B-2: BCEGS Grades for Sussex County Jurisdictions

Jurisdiction	BCEGS Grade
Ellendale	8*

### B-3: NFIP Participation in Sussex County

Jurisdiction	NFIP Entry Date
Ellendale	<i>Not in NFIP</i>

### B-4: CRS Communities in Sussex County

Jurisdiction	CRS Entry Date	Current CRS Class
Ellendale	N/A	N/A

### B-5: Self-Assessment of Local Capability

Jurisdiction	Technical Capability	Fiscal Capability	Administrative
Ellendale	L	L	L

*L=Low capability, M=Moderate capability, H=High capability*

### NFIP Registered Repetitive Loss Properties

Jurisdiction	Number of Properties	Number of Losses	Total Cost
<b>Repetitive Loss Properties</b>			
N/A	N/A	N/A	N/A
<b>Severe Repetitive Loss Properties</b>			
N/A	N/A	N/A	N/A

## Appendices

### Mitigation Actions Review

Project Description	Adopted	Priority	Timeline	Status	Estimated Cost	Potential Funding Source
<b>Previous Plan Mitigation Actions Review</b>						
Evaluate the Town's storm drainage systems to identify problem areas.	No	High	Short term	Pending funding source	20,000	HMGP, FMA, PDM
Continue to educate residents and improve public awareness on being better prepared to face hazards.	No	High	Ongoing	Not started	1,000	Self-funding
<b>Mitigation Actions Started / Completed since 2010 Plan Update</b>						
<b>Potential / New Mitigation Actions For Consideration</b>						

Under timeline for completion, the County has identified the following parameters:

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- **PS:** Private Sector Grants
- **RERP:** Radiological Emergency Response Program

## Appendices

### Town of Fenwick Island

#### General Profile

The Town of Fenwick Island is directly across from Ocean City Maryland and encompasses 0.5 square miles. The town does not sit on a barrier island but on a narrow peninsula which resembles a barrier island.

According to the 2010 Census, the population of the Town of Fenwick Island is 379 but will swell to over 5,000 during the summer season.

The Town of Fenwick Island economy centers on the tourism and vacation industry.

#### Risk Assessment

The Town of Fenwick Island considers their top hazards to be flooding, wind related events and winter storms, and extreme heat / cold.

#### Capabilities

**Plans and Programs in Place**

Jurisdiction	HMP	DRP	CLUP	FMP	SMP	EOP	COOP	REP	SARA	TRANS	CIP	REG-PL	HPP	ZO	SO	FDPO	NFIP	CRS	BC
Fenwick Island	X		X	X	X	X			X		X	X		X	X	X	X	X	X

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| <ul style="list-style-type: none"> <li>▪ <b>HMP</b> – Hazard Mitigation Plan</li> <li>▪ <b>DRP</b> – Disaster Recovery Plan</li> <li>▪ <b>CLUP</b> – Comprehensive Land Use Plan</li> <li>▪ <b>FMP</b> – Floodplain Management Plan / Flood Mitigation Plan</li> <li>▪ <b>SMP</b> – Stormwater Management Plan</li> <li>▪ <b>EOP</b> – Emergency Operations Plan</li> <li>▪ <b>COOP</b> – Continuity of Operations Plan</li> <li>▪ <b>REP</b> – Radiological Emergency Plan</li> <li>▪ <b>SARA</b> – SARA Title III Emergency Response Plan</li> </ul> | <ul style="list-style-type: none"> <li>▪ <b>TRANS</b> – Transportation Plan</li> <li>▪ <b>CIP</b> – Capital Improvements Plan (that regulates infrastructure in hazard areas)</li> <li>▪ <b>REG-PL</b> – Regional Planning</li> <li>▪ <b>HPP</b> – Historic Preservation Plan</li> <li>▪ <b>ZO</b> – Zoning Ordinance</li> <li>▪ <b>SO</b> – Subdivision Ordinance</li> <li>▪ <b>FDPO</b> – Flood Damage Prevention Ordinance</li> <li>▪ <b>NFIP</b> – National Flood Insurance Program</li> <li>▪ <b>CRS</b> – Community Rating System</li> <li>▪ <b>BC</b> – Building Codes</li> </ul> |
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- B-3 - National Flood Insurance Program participation
- B-4 - Community Rating System Participation
- B-5 - Self-assessment of Local Capability

### B-1: Local Comprehensive Plan Updates

Jurisdiction	Plan Status
Fenwick Island	2011 Update, 2016 Update In-Progress

### B-2: BCEGS Grades for Sussex County Jurisdictions

Jurisdiction	BCEGS Grade
Fenwick Island	8*

### B-3: NFIP Participation in Sussex County

Jurisdiction	NFIP Entry Date
Fenwick Island	3/23/73

### B-4: CRS Communities in Sussex County

Jurisdiction	CRS Entry Date	Current CRS Class
Fenwick Island	10/1/94	8

### B-5: Self-Assessment of Local Capability

Jurisdiction	Technical Capability	Fiscal Capability	Administrative
Fenwick Island	M	M	M

*L=Low capability, M=Moderate capability, H=High capability*

### NFIP Registered Repetitive Loss Properties

Jurisdiction	Number of Properties	Number of Losses	Total Cost
<b>Repetitive Loss Properties</b>			
Fenwick Island	1	2	\$57,259
	1	2	\$57,877
<b>Severe Repetitive Loss Properties</b>			
Fenwick Island	1	4	\$60,185

## Appendices

### Mitigation Actions Review

Project Description	Adopted	Priority	Timeline	Status	Estimated Cost	Potential Funding Source
<b>Previous Plan Mitigation Actions Review</b>						
Continue retrofitting drainage system and back water valves.	Yes	High	Short term	phase 1 complete, phase 2 continuing.	45,000	HMGP, FMA, PDM
Educate property owners of water runoff-to bulkhead should be the responsibility of the homeowner.	Yes	Moderate	Ongoing	Continuing	Administrative	N/A
Adopt a stormwater management ordinance that regulates private property water runoff.	Yes	Moderate	Ongoing	Completed	2,500	Self-funding
Re-grade street ends at intersections along Bunting Avenue to direct the flow of water towards Coastal Highway.	No	Moderate	Short term	Completed	55,000	HMGP, FMA, PDM
<b>Mitigation Actions Started / Completed since 2010 Plan Update</b>						
West Dagsboro Street upgrade and improvement of stormwater management culverts - 1000 ft	Yes	High	N/A	Completed	130,000	N/A
North Schultz Road upgrade and improvement of stormwater management culverts - 40 ft	Yes	High	N/A	Completed	50,00	N/A
Bay Street upgrade and improvement of stormwater management culverts - 500 ft	Yes	High	N/A	Completed	65,000	N/A
1 NFIP House Elevations	Yes	High	N/A	ongoing	62,000	N/A
Implemented freeboard into zoning ordinance	Yes	High	N/A	Completed	Self-funding	N/A
<b>Potential / New Mitigation Actions For Consideration</b>						
Upgrade Bayside row drainage and run off	Yes	High	Short term	Pending funding source	60,000	HMGP, FMA, PDM
Develop disaster preparedness outreach program	No	Moderate	Short term	Awaiting staff and opportunity	2,000	HMGP, FMA, PDM

## Appendices

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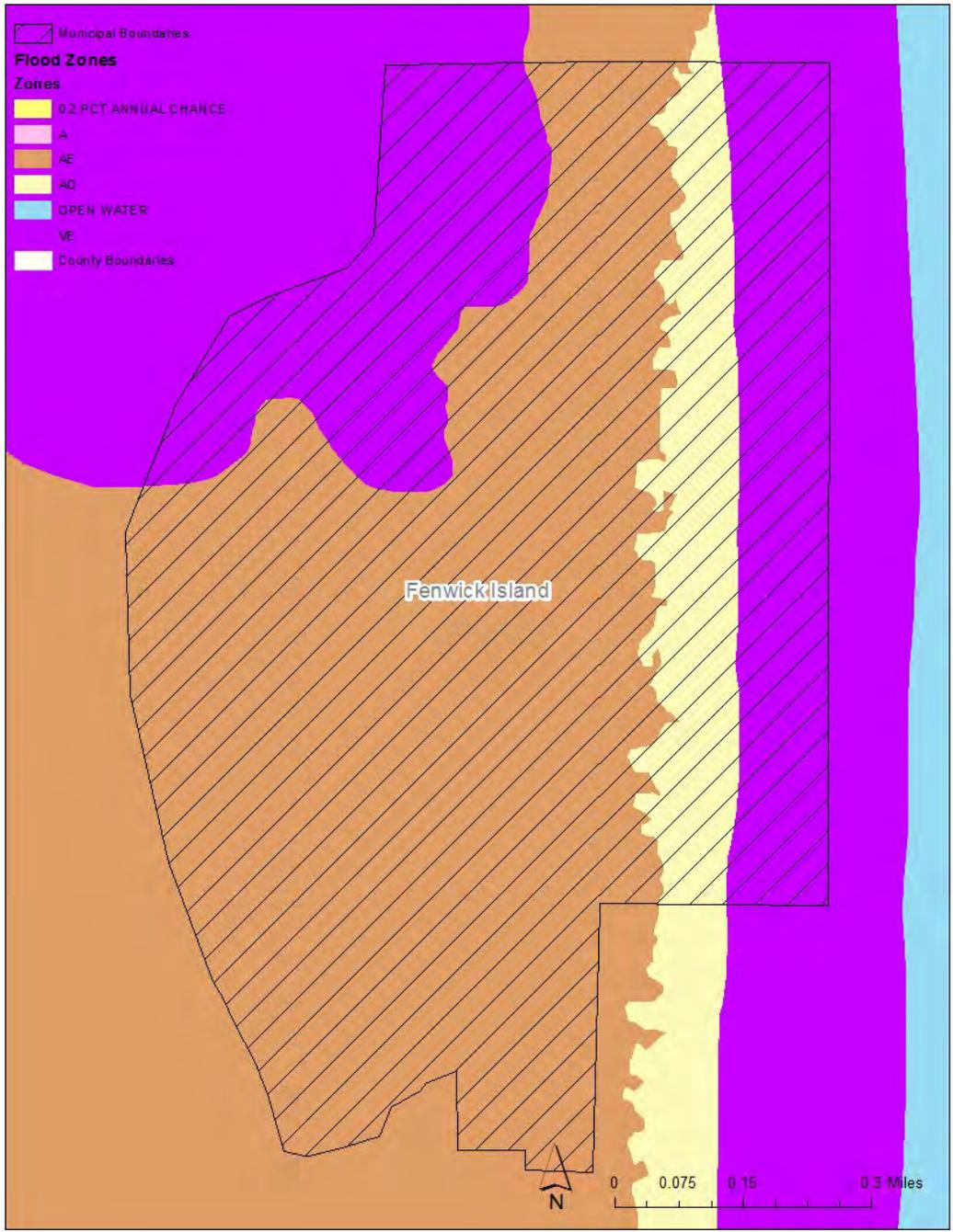
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- **HSGP:** Homeland Security Grant Program
- **PDM:** Pre-Disaster Mitigation Grant Program
- **PS:** Private Sector Grants
- **RERP:** Radiological Emergency Response Program

Figure A-8: Fenwick Island Flood Map



## Appendices

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### Town of Frankford

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#### General Profile

The Town of Frankford is located on US Route 113 and encompasses 0.7 square miles.

According to the 2010 Census, the population of the Town of Frankford is 847.

The Town of Frankford economy centers on the tourism and vacation industry.

#### Risk Assessment

The Town of Frankford considers their top hazards to be flooding, wind related events and winter storms, and extreme heat / cold.

#### Capabilities

**Plans and Programs in Place**

Jurisdiction	HMP	DRP	CLUP	FMP	SMP	EOP	COOP	REP	SARA	TRANS	CIP	REG-PL	HPP	ZO	SO	FDPO	NFIP	CRS	BC
Frankford			X	X					X		X		X	X	X	X	X		X

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|--|--|
| <ul style="list-style-type: none"> <li>▪ <b>HMP</b> – Hazard Mitigation Plan</li> <li>▪ <b>DRP</b> – Disaster Recovery Plan</li> <li>▪ <b>CLUP</b> – Comprehensive Land Use Plan</li> <li>▪ <b>FMP</b> – Floodplain Management Plan / Flood Mitigation Plan</li> <li>▪ <b>SMP</b> – Stormwater Management Plan</li> <li>▪ <b>EOP</b> – Emergency Operations Plan</li> <li>▪ <b>COOP</b> – Continuity of Operations Plan</li> <li>▪ <b>REP</b> – Radiological Emergency Plan</li> <li>▪ <b>SARA</b> – SARA Title III Emergency Response Plan</li> </ul> | <ul style="list-style-type: none"> <li>▪ <b>TRANS</b> – Transportation Plan</li> <li>▪ <b>CIP</b> – Capital Improvements Plan (that regulates infrastructure in hazard areas)</li> <li>▪ <b>REG-PL</b> – Regional Planning</li> <li>▪ <b>HPP</b> – Historic Preservation Plan</li> <li>▪ <b>ZO</b> – Zoning Ordinance</li> <li>▪ <b>SO</b> – Subdivision Ordinance</li> <li>▪ <b>FDPO</b> – Flood Damage Prevention Ordinance</li> <li>▪ <b>NFIP</b> – National Flood Insurance Program</li> <li>▪ <b>CRS</b> – Community Rating System</li> <li>▪ <b>BC</b> – Building Codes</li> </ul> |
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## Appendices

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- B-2 - Building Code Effectiveness Grading Schedule (BCEGS)
- B-3 - National Flood Insurance Program participation
- B-4 - Community Rating System Participation
- B-5 - Self-assessment of Local Capability

### B-1: Local Comprehensive Plan Updates

Jurisdiction	Plan Status
Frankford	Complete (2009)

### B-2: BCEGS Grades for Sussex County Jurisdictions

Jurisdiction	BCEGS Grade
Frankford	8*

### B-3: NFIP Participation in Sussex County

Jurisdiction	NFIP Entry Date
Frankford	9/16/81

### B-4: CRS Communities in Sussex County

Jurisdiction	CRS Entry Date	Current CRS Class
Frankford	N/A	N/A

### B-5: Self-Assessment of Local Capability

Jurisdiction	Technical Capability	Fiscal Capability	Administrative
Frankford	M	L	M

*L=Low capability, M=Moderate capability, H=High capability*

### NFIP Registered Repetitive Loss Properties

Jurisdiction	Number of Properties	Number of Losses	Total Cost
<b>Repetitive Loss Properties</b>			
N/A	N/A	N/A	N/A
<b>Severe Repetitive Loss Properties</b>			
N/A	N/A	N/A	N/A

## Appendices

### Mitigation Actions Review

Project Description	Adopted	Priority	Timeline	Status	Estimated Cost	Potential Funding Source
<b>Previous Plan Mitigation Actions Review</b>						
Identify private and county owned ditches, determine drainage patterns and what should be done to reduce flood related impacts.	Yes	High	Short term	Delayed	50,000	HMGP, FMA, PDM
Conduct stormwater drainage assessment for the Town.	Yes	High	Short term	Delayed	40,000	HMGP, FMA, PDM
Create and distribute material targeted to Frankford residents to include contact numbers and "What to do in the event of information.	Yes	High	As funds become available	Not started	1,200	HMGP, FMA, PDM, CDBG
Update the county's web page to address emergency contact information for individuals and departments specific to the Town of Frankford.	Yes	Moderate	As funds become available	Not started	Administrative costs	N/A
<b>Mitigation Actions Started / Completed since 2010 Plan Update</b>						
<b>Potential / New Mitigation Actions For Consideration</b>						

## Appendices

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Under timeline for completion, the County has identified the following parameters:

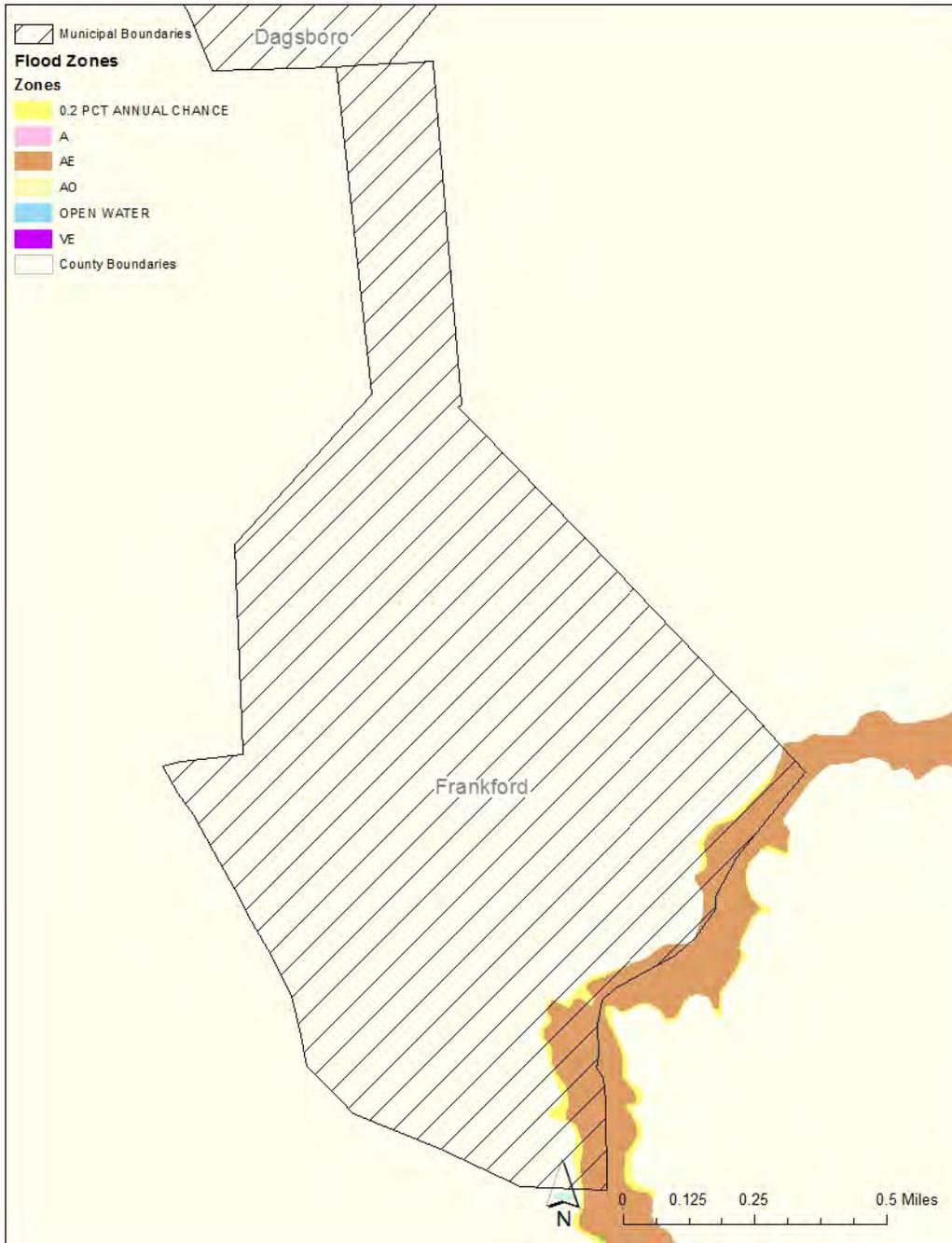
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- **HMGP:** Hazard Mitigation Grant Program
- **HSGP:** Homeland Security Grant Program
- **PDM:** Pre-Disaster Mitigation Grant Program
- **PS:** Private Sector Grants
- **RERP:** Radiological Emergency Response Program

# Appendices

Figure A-9: Frankford Flood Map



## Appendices

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### Town of Georgetown

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#### General Profile

The Town of Georgetown is the county seat of government and encompasses 4.1 square miles.

According to the 2010 Census, the population of the Town of Georgetown is 6,422.

The Town of Georgetown economy centers on the poultry industry that surrounds the area.

#### Risk Assessment

The Town of Town of Georgetown considers their top hazards to be flooding, wind related events and winter storms, and extreme heat / cold.

#### Capabilities

**Plans and Programs in Place**

Jurisdiction	HMP	DRP	CLUP	FMP	SMP	EOP	COOP	REP	SARA	TRANS	CIP	REG-PL	HPP	ZO	SO	FDPO	NFIP	CRS	BC
Georgetown			X	X					X		X	X		X	X	X	X		X

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| <ul style="list-style-type: none"> <li>▪ <b>HMP</b> – Hazard Mitigation Plan</li> <li>▪ <b>DRP</b> – Disaster Recovery Plan</li> <li>▪ <b>CLUP</b> – Comprehensive Land Use Plan</li> <li>▪ <b>FMP</b> – Floodplain Management Plan / Flood Mitigation Plan</li> <li>▪ <b>SMP</b> – Stormwater Management Plan</li> <li>▪ <b>EOP</b> – Emergency Operations Plan</li> <li>▪ <b>COOP</b> – Continuity of Operations Plan</li> <li>▪ <b>REP</b> – Radiological Emergency Plan</li> <li>▪ <b>SARA</b> – SARA Title III Emergency Response Plan</li> </ul> | <ul style="list-style-type: none"> <li>▪ <b>TRANS</b> – Transportation Plan</li> <li>▪ <b>CIP</b> – Capital Improvements Plan (that regulates infrastructure in hazard areas)</li> <li>▪ <b>REG-PL</b> – Regional Planning</li> <li>▪ <b>HPP</b> – Historic Preservation Plan</li> <li>▪ <b>ZO</b> – Zoning Ordinance</li> <li>▪ <b>SO</b> – Subdivision Ordinance</li> <li>▪ <b>FDPO</b> – Flood Damage Prevention Ordinance</li> <li>▪ <b>NFIP</b> – National Flood Insurance Program</li> <li>▪ <b>CRS</b> – Community Rating System</li> <li>▪ <b>BC</b> – Building Codes</li> </ul> |
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- B-4 - Community Rating System Participation
- B-5 - Self-assessment of Local Capability

### B-1: Local Comprehensive Plan Updates

Jurisdiction	Plan Status
Georgetown	Certified (2010)

### B-2: BCEGS Grades for Sussex County Jurisdictions

Jurisdiction	BCEGS Grade
Georgetown	8*

### B-3: NFIP Participation in Sussex County

Jurisdiction	NFIP Entry Date
Georgetown	5/5/03

### B-4: CRS Communities in Sussex County

Jurisdiction	CRS Entry Date	Current CRS Class
Georgetown	N/A	N/A

### B-5: Self-Assessment of Local Capability

Jurisdiction	Technical Capability	Fiscal Capability	Administrative
Georgetown	L	M	L

*L=Low capability, M=Moderate capability, H=High capability*

### NFIP Registered Repetitive Loss Properties

Jurisdiction	Number of Properties	Number of Losses	Total Cost
<b>Repetitive Loss Properties</b>			
N/A	N/A	N/A	N/A
<b>Severe Repetitive Loss Properties</b>			
N/A	N/A	N/A	N/A

## Appendices

### Mitigation Actions Review

Project Description	Adopted	Priority	Timeline	Status	Estimated Cost	Potential Funding Source
<b>Previous Plan Mitigation Actions Review</b>						
Establish critical facility emergency back-up power (police and fire stations).	Yes	High	Short term	Pending funding source	45,000	HMGP, FMA, PDM
Develop a brochure for the public dealing with emergency situations.	Yes	Moderate	Short term	Pending funding source	1,500	HMGP, FMA, PDM
Develop corrective actions for Route 9, Route 113 and Route 18/404 that tend to bottleneck during the evacuation of residents, college students and transients.	Yes	Low	Short term	Pending funding source	15,000	CDBG, HSGP
Tree cutback/trimming to clear power lines to protect against wind related tree impacts to said power lines	Yes	High	N/A	complete	N/A	N/A
<b>Mitigation Actions Started / Completed since 2010 Plan Update</b>						
<b>Potential / New Mitigation Actions For Consideration</b>						
Hurricane Info outreach education program (multi-lingual)	No	High	Short term	Pending	2500	HMGP, FMA, PDM
Hazard related warning system	No	High	Short term	Pending	15,000	HMGP, FMA, PDM

## Appendices

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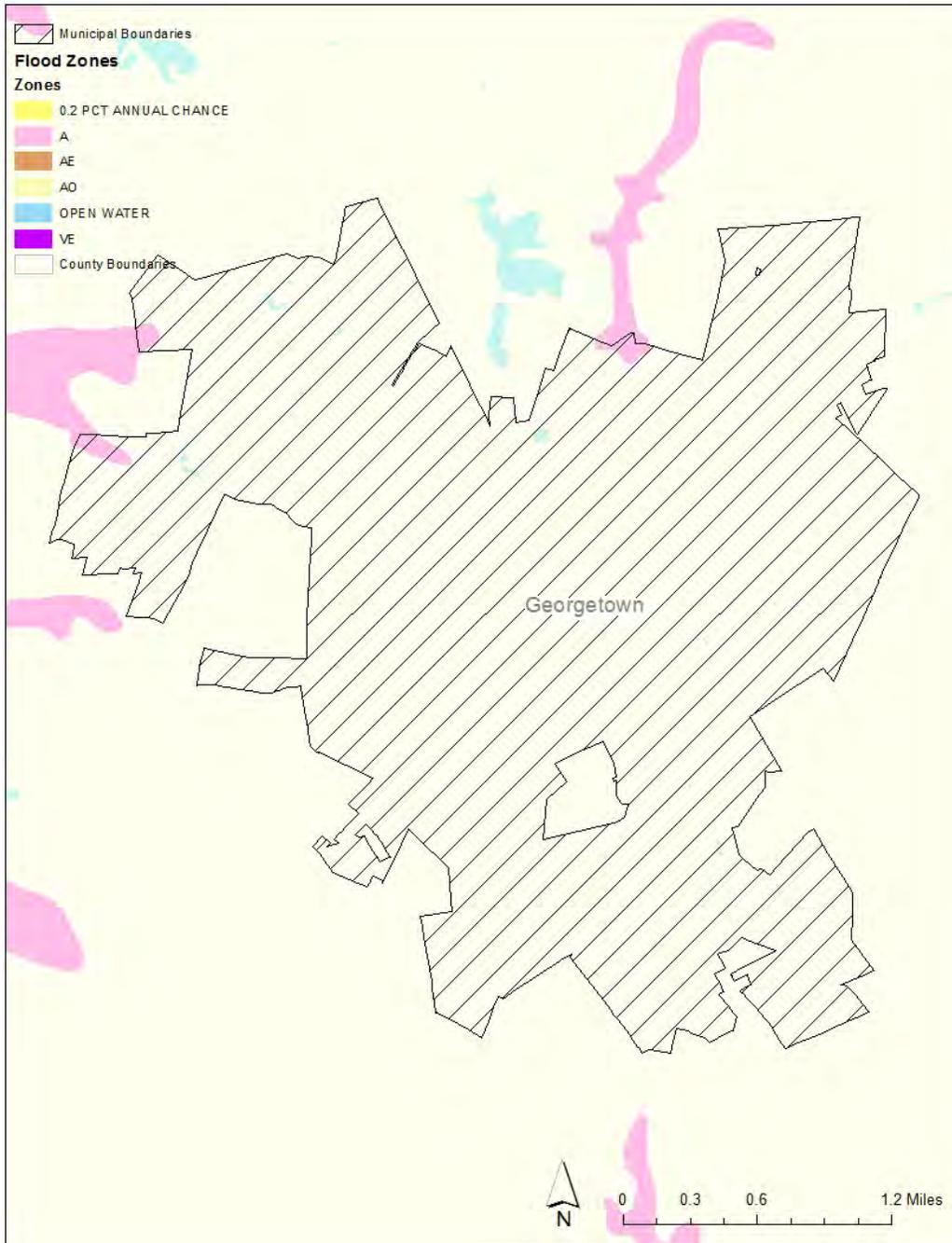
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- **PDM:** Pre-Disaster Mitigation Grant Program
- **PS:** Private Sector Grants
- **RERP:** Radiological Emergency Response Program

# Appendices

Figure A-10: Georgetown Flood Map



## Appendices

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### Town of Greenwood

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#### General Profile

The Town of Greenwood is encompasses 0.7 square miles.

According to the 2010 Census, the population of the Town of Greenwood is 973.

#### Risk Assessment

The Town of Greenwood considers their top hazards to be flooding, wind related events and winter storms, and extreme heat / cold.

#### Capabilities

**Plans and Programs in Place**

Jurisdiction	HMP	DRP	CLUP	FMP	SMP	EOP	COOP	REP	SARA	TRANS	CIP	REG-PL	HPP	ZO	SO	FDPO	NFIP	CRS	BC
Greenwood			X	X					X					X	X	X	X		X

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|--|--|
| <ul style="list-style-type: none"> <li>▪ <b>HMP</b> – Hazard Mitigation Plan</li> <li>▪ <b>DRP</b> – Disaster Recovery Plan</li> <li>▪ <b>CLUP</b> – Comprehensive Land Use Plan</li> <li>▪ <b>FMP</b> – Floodplain Management Plan / Flood Mitigation Plan</li> <li>▪ <b>SMP</b> – Stormwater Management Plan</li> <li>▪ <b>EOP</b> – Emergency Operations Plan</li> <li>▪ <b>COOP</b> – Continuity of Operations Plan</li> <li>▪ <b>REP</b> – Radiological Emergency Plan</li> <li>▪ <b>SARA</b> – SARA Title III Emergency Response Plan</li> </ul> | <ul style="list-style-type: none"> <li>▪ <b>TRANS</b> – Transportation Plan</li> <li>▪ <b>CIP</b> – Capital Improvements Plan (that regulates infrastructure in hazard areas)</li> <li>▪ <b>REG-PL</b> – Regional Planning</li> <li>▪ <b>HPP</b> – Historic Preservation Plan</li> <li>▪ <b>ZO</b> – Zoning Ordinance</li> <li>▪ <b>SO</b> – Subdivision Ordinance</li> <li>▪ <b>FDPO</b> – Flood Damage Prevention Ordinance</li> <li>▪ <b>NFIP</b> – National Flood Insurance Program</li> <li>▪ <b>CRS</b> – Community Rating System</li> <li>▪ <b>BC</b> – Building Codes</li> </ul> |
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- B-5 - Self-assessment of Local Capability

### B-1: Local Comprehensive Plan Updates

Jurisdiction	Plan Status
Greenwood	Complete (2013)

### B-2: BCEGS Grades for Sussex County Jurisdictions

Jurisdiction	BCEGS Grade
Greenwood	8*

### B-3: NFIP Participation in Sussex County

Jurisdiction	NFIP Entry Date
Greenwood	2/24/78

### B-4: CRS Communities in Sussex County

Jurisdiction	CRS Entry Date	Current CRS Class
Greenwood	N/A	N/A

### B-5: Self-Assessment of Local Capability

Jurisdiction	Technical Capability	Fiscal Capability	Administrative
Greenwood	M	M	M

*L=Low capability, M=Moderate capability, H=High capability*

### NFIP Registered Repetitive Loss Properties

Jurisdiction	Number of Properties	Number of Losses	Total Cost
<b>Repetitive Loss Properties</b>			
N/A	N/A	N/A	N/A
<b>Severe Repetitive Loss Properties</b>			
N/A	N/A	N/A	N/A

## Appendices

### Mitigation Actions Review

Project Description	Adopted	Priority	Timeline	Status	Estimated Cost	Potential Funding Source
<b>Previous Plan Mitigation Actions Review</b>						
Dredge Cart Branch ditch.	Yes	High	Short term	Complete 2013	\$750,000	N/A
<b>Mitigation Actions Started / Completed since 2010 Plan Update</b>						
<b>Potential / New Mitigation Actions For Consideration</b>						
Market Street (Addix Ave) storm water management upgrade, piping diameter upgrades (increase) to facilitate run off flow.	No	Medium	Long term	Pending funding source	\$500,00	HMGP, FMA, PDM
Market & Sussex storm water management upgrade, piping diameter up-grades(increase) to facilitate run off flow.	No	Medium	Long term	Pending funding source	\$500,00	HMGP, FMA, PDM

## Appendices

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Under timeline for completion, the County has identified the following parameters:

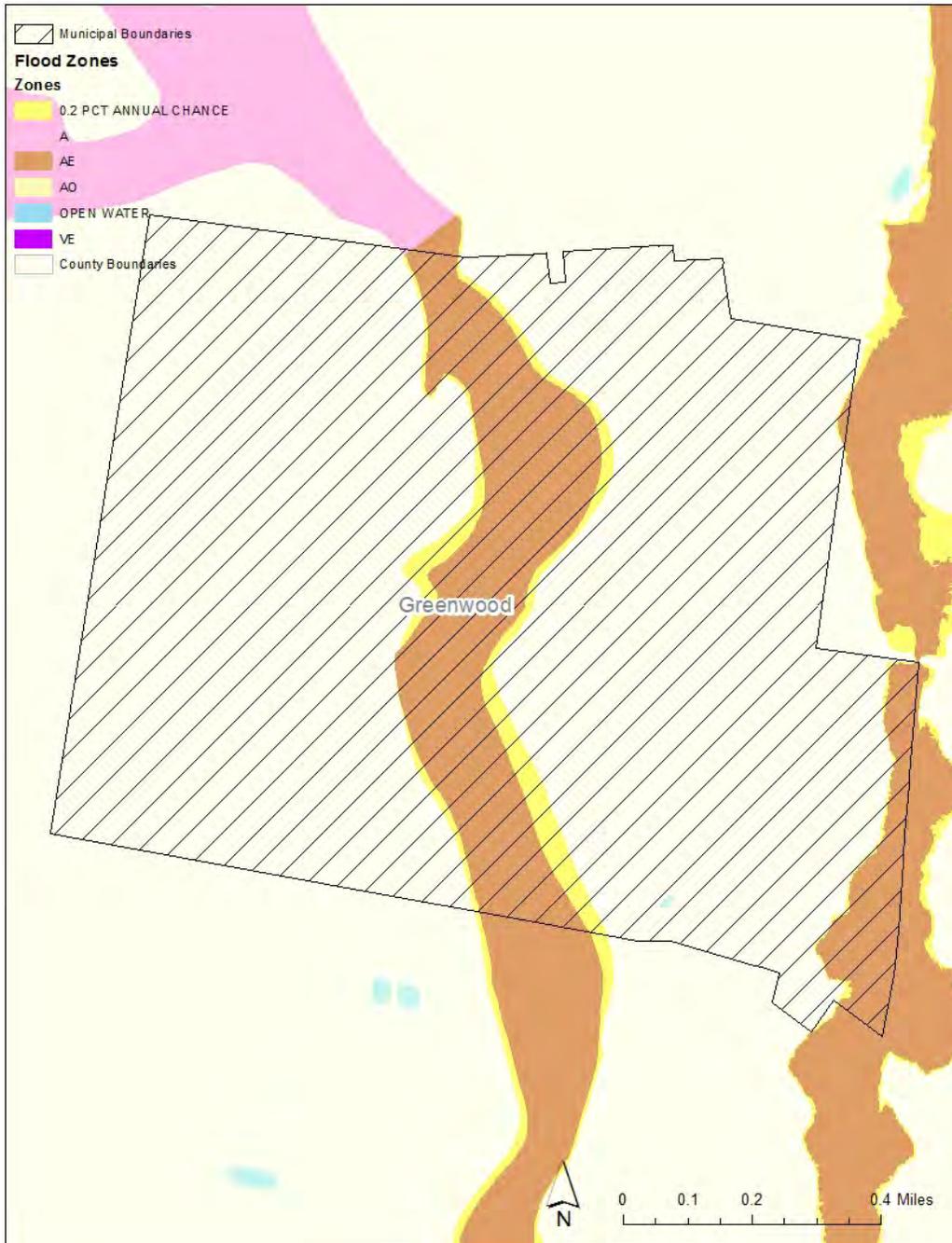
- **Ongoing:** Initiative is currently being implemented under existing programs and budgets.
- **Short-term:** Initiative can be completed within 1 to 5 years once funding has been secured.
- **Long-term:** Initiative will take 5 or more years to complete once funding has been secured.

Under the potential funding sources, the acronyms align with the following programs:

- **CDBG:** Community Development Block Grant Program
- **FMA:** Flood Mitigation Grant Program
- **HMEP:** Hazardous Materials Emergency Preparedness Grant
- **HMGP:** Hazard Mitigation Grant Program
- **HSGP:** Homeland Security Grant Program
- **PDM:** Pre-Disaster Mitigation Grant Program
- **PS:** Private Sector Grants
- **RERP:** Radiological Emergency Response Program

# Appendices

Figure A-11: Greenwood Flood Map



## Appendices

### Town of Henlopen Acres

#### General Profile

The Town of Henlopen Acres is the smallest incorporated town in Delaware and encompasses 0.3 square miles. The town borders the Atlantic Ocean to the northeast, Rehoboth Beach to the southeast and unincorporated sections of Sussex County on the west and north.

According to the 2010 Census, the population of the Town of Henlopen Acres is 122 but will swell to over 16,000 during the summer vacation season.

The Henlopen Acres economy centers on the vacation home and rentals industry.

#### Risk Assessment

The Town of Henlopen Acres considers their top hazards to be wind related events, and flooding.

#### Capabilities

**Plans and Programs in Place**

Jurisdiction	HMP	DRP	CLUP	FMP	SMP	EOP	COOP	REP	SARA	TRANS	CIP	REG-PL	HPP	ZO	SO	FDPO	NFIP	CRS	BC
Henlopen Acres		X	X	X	X	X	X		X		X	X		X	X	X	X		X

- |  |  |
|--|--|
| <ul style="list-style-type: none"> <li>▪ <b>HMP</b> – Hazard Mitigation Plan</li> <li>▪ <b>DRP</b> – Disaster Recovery Plan</li> <li>▪ <b>CLUP</b> – Comprehensive Land Use Plan</li> <li>▪ <b>FMP</b> – Floodplain Management Plan / Flood Mitigation Plan</li> <li>▪ <b>SMP</b> – Stormwater Management Plan</li> <li>▪ <b>EOP</b> – Emergency Operations Plan</li> <li>▪ <b>COOP</b> – Continuity of Operations Plan</li> <li>▪ <b>REP</b> – Radiological Emergency Plan</li> <li>▪ <b>SARA</b> – SARA Title III Emergency Response Plan</li> </ul> | <ul style="list-style-type: none"> <li>▪ <b>TRANS</b> – Transportation Plan</li> <li>▪ <b>CIP</b> – Capital Improvements Plan (that regulates infrastructure in hazard areas)</li> <li>▪ <b>REG-PL</b> – Regional Planning</li> <li>▪ <b>HPP</b> – Historic Preservation Plan</li> <li>▪ <b>ZO</b> – Zoning Ordinance</li> <li>▪ <b>SO</b> – Subdivision Ordinance</li> <li>▪ <b>FDPO</b> – Flood Damage Prevention Ordinance</li> <li>▪ <b>NFIP</b> – National Flood Insurance Program</li> <li>▪ <b>CRS</b> – Community Rating System</li> <li>▪ <b>BC</b> – Building Codes</li> </ul> |
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## Appendices

The following indicates significant indicators for a local jurisdictions ability to implement mitigation strategy. Not all jurisdictions have all five subsections.

- B-1 - Local Comprehensive Plan Update
- B-2 - Building Code Effectiveness Grading Schedule (BCEGS)
- B-3 - National Flood Insurance Program participation
- B-4 - Community Rating System Participation
- B-5 - Self-assessment of Local Capability

### B-1: Local Comprehensive Plan Updates

Jurisdiction	Plan Status
Henlopen Acres	2016

### B-2: BCEGS Grades for Sussex County Jurisdictions

Jurisdiction	BCEGS Grade
Henlopen Acres	8*

### B-3: NFIP Participation in Sussex County

Jurisdiction	NFIP Entry Date
Henlopen Acres	8/15/78

### B-4: CRS Communities in Sussex County

Jurisdiction	CRS Entry Date	Current CRS Class
Henlopen Acres	N/A	N/A

### B-5: Self-Assessment of Local Capability

Jurisdiction	Technical Capability	Fiscal Capability	Administrative
Henlopen Acres	M	M	M

*L=Low capability, M=Moderate capability, H=High capability*

### NFIP Registered Repetitive Loss Properties

Jurisdiction	Number of Properties	Number of Losses	Total Cost
<b>Repetitive Loss Properties</b>			
N/A	N/A	N/A	N/A
<b>Severe Repetitive Loss Properties</b>			
N/A	N/A	N/A	N/A

## Appendices

### Mitigation Actions Review

Project Description	Adopted	Priority	Timeline	Status	Estimated Cost	Potential Funding Source
<b>Previous Plan Mitigation Actions Review</b>						
Develop a marina plan for the Town.	Yes	High	Ongoing	Completed	1,000	N/A
Develop an Emergency Management Plan for the Town.	Yes	Moderate	Ongoing	Completed	3,000	N/A
Maintain beach dune system.	Yes	Moderate	Ongoing	Ongoing		HMGP, FMA, PDM
<b>Mitigation Actions Started / Completed since 2010 Plan Update</b>						
<b>Potential / New Mitigation Actions For Consideration</b>						
Risk and vulnerability assessment of town hall	No	Moderate	Ongoing	Pending funding source	3,000	HMGP, FMA, PDM, CDBG
Back-up generator for town hall	No	Moderate	Short term	Pending funding source	145,000	HMGP, HSGP
Instillation of backflow valves on storm water management system	No	High	Short term	Pending funding source	15,000	HMGP, FMA, PDM, CDBG

## Appendices

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Under timeline for completion, the County has identified the following parameters:

- **Ongoing:** Initiative is currently being implemented under existing programs and budgets.
- **Short-term:** Initiative can be completed within 1 to 5 years once funding has been secured.
- **Long-term:** Initiative will take 5 or more years to complete once funding has been secured.

Under the potential funding sources, the acronyms align with the following programs:

- **CDBG:** Community Development Block Grant Program
- **FMA:** Flood Mitigation Grant Program
- **HMEP:** Hazardous Materials Emergency Preparedness Grant
- **HMGP:** Hazard Mitigation Grant Program
- **HSGP:** Homeland Security Grant Program
- **PDM:** Pre-Disaster Mitigation Grant Program
- **PS:** Private Sector Grants
- **RERP:** Radiological Emergency Response Program

## Appendices

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### Town of Laurel

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#### General Profile

The Town of Laurel is located on the Atlantic Coastal Plain in southwestern Delaware and encompasses 1.7 square miles.

According to the 2010 Census, the population of the Town of Laurel is 3,708.

The Town of Laurel economy centers on the tourism and vacation industry.

#### Risk Assessment

The Town of Laurel considers their top hazards to be flooding and wind related events.

#### Capabilities

**Plans and Programs in Place**

Jurisdiction	HMP	DRP	CLUP	FMP	SMP	EOP	COOP	REP	SARA	TRANS	CIP	REG-PL	HPP	ZO	SO	FDPO	NFIP	CRS	BC
Laurel			X		X				X		X			X	X	X	X		X

- |  |  |
|--|--|
| <ul style="list-style-type: none"> <li>▪ <b>HMP</b> – Hazard Mitigation Plan</li> <li>▪ <b>DRP</b> – Disaster Recovery Plan</li> <li>▪ <b>CLUP</b> – Comprehensive Land Use Plan</li> <li>▪ <b>FMP</b> – Floodplain Management Plan / Flood Mitigation Plan</li> <li>▪ <b>SMP</b> – Stormwater Management Plan</li> <li>▪ <b>EOP</b> – Emergency Operations Plan</li> <li>▪ <b>COOP</b> – Continuity of Operations Plan</li> <li>▪ <b>REP</b> – Radiological Emergency Plan</li> <li>▪ <b>SARA</b> – SARA Title III Emergency Response Plan</li> </ul> | <ul style="list-style-type: none"> <li>▪ <b>TRANS</b> – Transportation Plan</li> <li>▪ <b>CIP</b> – Capital Improvements Plan (that regulates infrastructure in hazard areas)</li> <li>▪ <b>REG-PL</b> – Regional Planning</li> <li>▪ <b>HPP</b> – Historic Preservation Plan</li> <li>▪ <b>ZO</b> – Zoning Ordinance</li> <li>▪ <b>SO</b> – Subdivision Ordinance</li> <li>▪ <b>FDPO</b> – Flood Damage Prevention Ordinance</li> <li>▪ <b>NFIP</b> – National Flood Insurance Program</li> <li>▪ <b>CRS</b> – Community Rating System</li> <li>▪ <b>BC</b> – Building Codes</li> </ul> |
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## Appendices

The following indicates significant indicators for a local jurisdictions ability to implement mitigation strategy. Not all jurisdictions have all five subsections.

- B-1 - Local Comprehensive Plan Update
- B-2 - Building Code Effectiveness Grading Schedule (BCEGS)
- B-3 - National Flood Insurance Program participation
- B-4 - Community Rating System Participation
- B-5 - Self-assessment of Local Capability

### B-1: Local Comprehensive Plan Updates

Jurisdiction	Plan Status
Laurel	2011

### B-2: BCEGS Grades for Sussex County Jurisdictions

Jurisdiction	BCEGS Grade
Laurel	6

### B-3: NFIP Participation in Sussex County

Jurisdiction	NFIP Entry Date
Laurel	1/18/81

### B-4: CRS Communities in Sussex County

Jurisdiction	CRS Entry Date	Current CRS Class
Laurel	N/A	N/A

### B-5: Self-Assessment of Local Capability

Jurisdiction	Technical Capability	Fiscal Capability	Administrative
Laurel	L	L	M

*L=Low capability, M=Moderate capability, H=High capability*

### NFIP Registered Repetitive Loss Properties

Jurisdiction	Number of Properties	Number of Losses	Total Cost
<b>Repetitive Loss Properties</b>			
N/A	N/A	N/A	N/A
<b>Severe Repetitive Loss Properties</b>			
N/A	N/A	N/A	N/A

## Appendices

### Mitigation Actions Review

Project Description	Adopted	Priority	Timeline	Status	Estimated Cost	Potential Funding Source
<b>Previous Plan Mitigation Actions Review</b>						
Create a service road to the wastewater manholes on West Sixth Street.	Yes	High	Short term	Delayed due to funding.	40,000	
Replace bulkhead on the north side of Broad Creek, between Popular Street and the railroad bridge.	Yes	High	Short term	Delayed due to funding.	500,000	HMGP, FMA, PDM
Consider closing the well at 10th & Deshields street and replace waterlines on 10th Street.	Yes	Moderate	Ongoing	Complete pending closeout	N/A	N/A
Relocate the Town Hall, Public Works and Police Departments.	Yes	Low	Short term	Delayed due to funding.	1 million	HMGP, FMA, PDM
<b>Mitigation Actions Started / Completed since 2010 Plan Update</b>						
<b>Potential / New Mitigation Actions For Consideration</b>						
Segregate storm water system from sanitary system.	Yes	High	Short term	Pending funding source	1 million	HMGP, FMA, PDM. CDBG

## Appendices

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Under timeline for completion, the County has identified the following parameters:

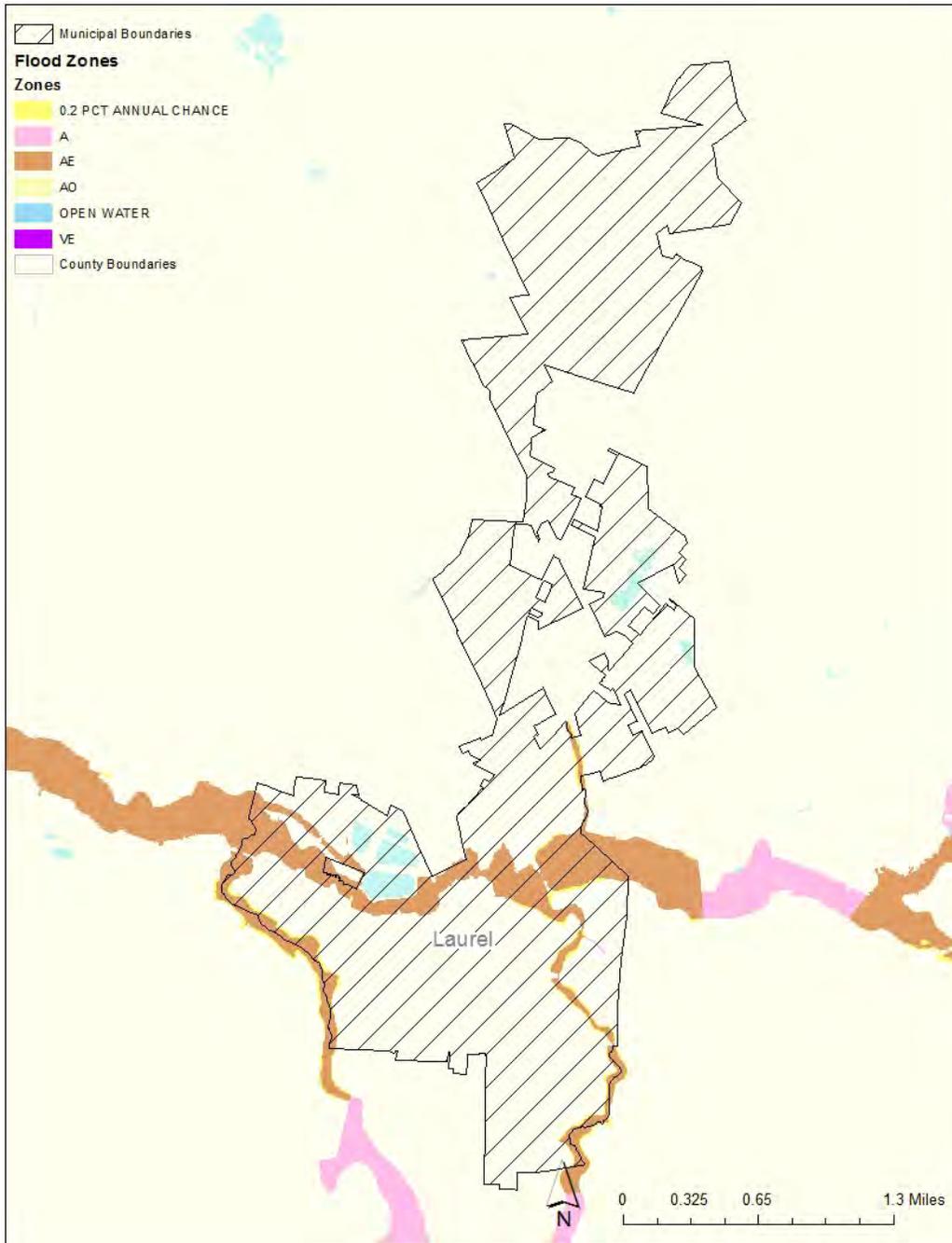
- **Ongoing:** Initiative is currently being implemented under existing programs and budgets.
- **Short-term:** Initiative can be completed within 1 to 5 years once funding has been secured.
- **Long-term:** Initiative will take 5 or more years to complete once funding has been secured.

Under the potential funding sources, the acronyms align with the following programs:

- **CDBG:** Community Development Block Grant Program
- **FMA:** Flood Mitigation Grant Program
- **HMEP:** Hazardous Materials Emergency Preparedness Grant
- **HMGP:** Hazard Mitigation Grant Program
- **HSGP:** Homeland Security Grant Program
- **PDM:** Pre-Disaster Mitigation Grant Program
- **PS:** Private Sector Grants
- **RERP:** Radiological Emergency Response Program

# Appendices

Figure A-12: Laurel Flood Map



## Appendices

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### City of Lewes

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#### General Profile

The City of Lewes is located on the Delaware Bay directly across from Cape May New Jersey and encompasses 4.3 square miles.

According to the 2010 Census, the population of the City of Lewes is 2,747.

The City of Lewes economy centers on the tourism and vacation industry.

#### Risk Assessment

The City of Lewes considers their top hazards to be flooding, wind related events and winter storms, and extreme heat / cold.

#### Capabilities

**Plans and Programs in Place**

Jurisdiction	HMP	DRP	CLUP	FMP	SMP	EOP	COOP	REP	SARA	TRANS	CIP	REG-PL	HPP	ZO	SO	FDPO	NFIP	CRS	BC	
Lewes	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

- **HMP** – Hazard Mitigation Plan
- **DRP** – Disaster Recovery Plan
- **CLUP** – Comprehensive Land Use Plan
- **FMP** – Floodplain Management Plan / Flood Mitigation Plan
- **SMP** – Stormwater Management Plan
- **EOP** – Emergency Operations Plan
- **COOP** – Continuity of Operations Plan
- **REP** – Radiological Emergency Plan
- **SARA** – SARA Title III Emergency Response Plan
- **TRANS** – Transportation Plan
- **CIP** – Capital Improvements Plan (that regulates infrastructure in hazard areas)
- **REG-PL** – Regional Planning
- **HPP** – Historic Preservation Plan
- **ZO** – Zoning Ordinance
- **SO** – Subdivision Ordinance
- **FDPO** – Flood Damage Prevention Ordinance
- **NFIP** – National Flood Insurance Program
- **CRS** – Community Rating System
- **BC** – Building Codes

## Appendices

The following indicates significant indicators for a local jurisdictions ability to implement mitigation strategy. Not all jurisdictions have all five subsections.

- B-1 - Local Comprehensive Plan Update
- B-2 - Building Code Effectiveness Grading Schedule (BCEGS)
- B-3 - National Flood Insurance Program participation
- B-4 - Community Rating System Participation
- B-5 - Self-assessment of Local Capability

### B-1: Local Comprehensive Plan Updates

Jurisdiction	Plan Status
Lewes	Updated 2010. 2015 Update in process

### B-2: BCEGS Grades for Sussex County Jurisdictions

Jurisdiction	BCEGS Grade
Lewes	9

### B-3: NFIP Participation in Sussex County

Jurisdiction	NFIP Entry Date
Lewes	<u>3/15/77</u>

### B-4: CRS Communities in Sussex County

Jurisdiction	CRS Entry Date	Current CRS Class
Laurel	N/A	N/A

### B-5: Self-Assessment of Local Capability

Jurisdiction	Technical Capability	Fiscal Capability	Administrative
Lewes	M	M	M

*L=Low capability, M=Moderate capability, H=High capability*

### NFIP Registered Repetitive Loss Properties

Jurisdiction	Number of Properties	Number of Losses	Total Cost
<b>Repetitive Loss Properties</b>			
N/A	N/A	N/A	N/A
<b>Severe Repetitive Loss Properties</b>			
N/A	N/A	N/A	N/A

## Appendices

### Mitigation Actions Review

Project Description	Adopted	Priority	Timeline	Status	Estimated Cost	Potential Funding Source
<b>Previous Plan Mitigation Actions Review</b>						
Review and update evacuation and notification procedures for the City.	Yes	High	Short term	Pending funding source	Staff costs	CDBG
Improve stormwater management throughout the City.	Yes	Moderate	Short term	in progress		HMGP, FMA, PDM, CDBG
Increase participation in the National Flood Insurance Program.	Yes	Moderate	Short term	Unknown	Staff costs	
Minimize damages from high wind events.	Yes	Moderate	Ongoing	ongoing	25,000	HMGP, FMA, PDM
Implement Continue application and improvement of hazard mitigation education community outreach program.	Yes	Moderate	Ongoing	ongoing	5000	
Reduce vulnerability to wildfires.	Yes	Moderate	Short term	ongoing	N/A	N/A
Continue data acquisition and enhancements to the GIS.	Yes	Moderate	Short term	complete	Staff costs	
Enlist the services of City service organizations in implementing a disaster preparedness outreach program.	No	High	Ongoing	Pending funding source	2,000	HMGP, FMA, PDM
Facilitate the coordination of response procedures related to events.	No	High	Short term	Pending funding source	Staff costs	HMGP, FMA, PDM
<b>Mitigation Actions Started / Completed since 2010 Plan Update</b>						
Study to determine evacuation route elevations to identify flood prone sections/areas.	Yes	High	N/A	Completed Sept 2015	10,000	N/A
Adoption of International Building Codes	Yes	High	N/A	Completed 2014	No cost	N/A
<b>Potential / New Mitigation Actions For Consideration</b>						

## Appendices

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Under timeline for completion, the County has identified the following parameters:

- **Ongoing:** Initiative is currently being implemented under existing programs and budgets.
- **Short-term:** Initiative can be completed within 1 to 5 years once funding has been secured.
- **Long-term:** Initiative will take 5 or more years to complete once funding has been secured.

Under the potential funding sources, the acronyms align with the following programs:

- **CDBG:** Community Development Block Grant Program
- **FMA:** Flood Mitigation Grant Program
- **HMEP:** Hazardous Materials Emergency Preparedness Grant
- **HMGP:** Hazard Mitigation Grant Program
- **HSGP:** Homeland Security Grant Program
- **PDM:** Pre-Disaster Mitigation Grant Program
- **PS:** Private Sector Grants
- **RERP:** Radiological Emergency Response Program

# Appendices

Figure A-13: Lewes Flood Map



## Appendices

### Town of Millsboro

#### General Profile

The Town of Millsboro encompasses 1.9 square miles. The town is located at the head of the Indian River Bay.

According to the 2010 Census, the population of the Town of Millsboro is 3877 (63% projected growth).

The Millsboro economy centers on the tourism and vacation industry.

#### Risk Assessment

The Town of Millsboro considers their top hazards to be flooding, wind related events and winter storms, and extreme heat / cold.

#### Capabilities

**Plans and Programs in Place**

Jurisdiction	HMP	DRP	CLUP	FMP	SMP	EOP	COOP	REP	SARA	TRANS	CIP	REG-PL	HPP	ZO	SO	FDPO	NFIP	CRS	BC	
Millsboro			X						X					X	X	X	X			X

- **HMP** – Hazard Mitigation Plan
- **DRP** – Disaster Recovery Plan
- **CLUP** – Comprehensive Land Use Plan
- **FMP** – Floodplain Management Plan / Flood Mitigation Plan
- **SMP** – Stormwater Management Plan
- **EOP** – Emergency Operations Plan
- **COOP** – Continuity of Operations Plan
- **REP** – Radiological Emergency Plan
- **SARA** – SARA Title III Emergency Response Plan
- **TRANS** – Transportation Plan
- **CIP** – Capital Improvements Plan (that regulates infrastructure in hazard areas)
- **REG-PL** – Regional Planning
- **HPP** – Historic Preservation Plan
- **ZO** – Zoning Ordinance
- **SO** – Subdivision Ordinance
- **FDPO** – Flood Damage Prevention Ordinance
- **NFIP** – National Flood Insurance Program
- **CRS** – Community Rating System
- **BC** – Building Codes

## Appendices

The following indicates significant indicators for a local jurisdictions ability to implement mitigation strategy. Not all jurisdictions have all five subsections.

- B-1 - Local Comprehensive Plan Update
- B-2 - Building Code Effectiveness Grading Schedule (BCEGS)
- B-3 - National Flood Insurance Program participation
- B-4 - Community Rating System Participation
- B-5 - Self-assessment of Local Capability

### B-1: Local Comprehensive Plan Updates

Jurisdiction	Plan Status
Millsboro	2012

### B-2: BCEGS Grades for Sussex County Jurisdictions

Jurisdiction	BCEGS Grade
Millsboro	7

### B-3: NFIP Participation in Sussex County

Jurisdiction	NFIP Entry Date
Millsboro	9/01/78

### B-4: CRS Communities in Sussex County

Jurisdiction	CRS Entry Date	Current CRS Class
Millsboro	N/A	N/A

### B-5: Self-Assessment of Local Capability

Jurisdiction	Technical Capability	Fiscal Capability	Administrative
Millsboro	M	M	M

*L=Low capability, M=Moderate capability, H=High capability*

### NFIP Registered Repetitive Loss Properties

Jurisdiction	Number of Properties	Number of Losses	Total Cost
<b>Repetitive Loss Properties</b>			
Town of Millsboro	1	2	\$13,082
Town of Millsboro	1	2	\$57,757
<b>Severe Repetitive Loss Properties</b>			
Town of Millsboro	1	2	\$28,226

## Appendices

### Mitigation Actions Review

Project Description	Adopted	Priority	Timeline	Status	Estimated Cost	Potential Funding Source
<b>Previous Plan Mitigation Actions Review</b>						
Improve storm-water drainage within the Town. (Wilson Highway and Progress)	Yes	High	Short term	In progress	500,000	HMGP, FMA, PDM
Conduct a study to identify roads that need to be elevated and culverts that need to be widened.	Yes	Moderate	Short term	Completed	100,000	HMGP, FMA, PDM
Retrofit two pump stations.	Yes	Moderate	Short term	Ongoing	500,000	HMGP, FMA, PDM
<b>Mitigation Actions Started / Completed since 2010 Plan Update</b>						
<b>Potential / New Mitigation Actions For Consideration</b>						
Mitchel Street study to evaluate potential bulkhead instillation.	No	High	Ongoing	Pending funding source	100,000	HMGP, FMA, PDM
Develop storm-water management plan	No	High	Ongoing	Pending funding source	150,000	HMGP, FMA, PDM
Cuplin Park (Indian Rive) bulkhead upgrade	No	High	Ongoing	Pending study		HMGP, FMA, PDM

## Appendices

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Under timeline for completion, the County has identified the following parameters:

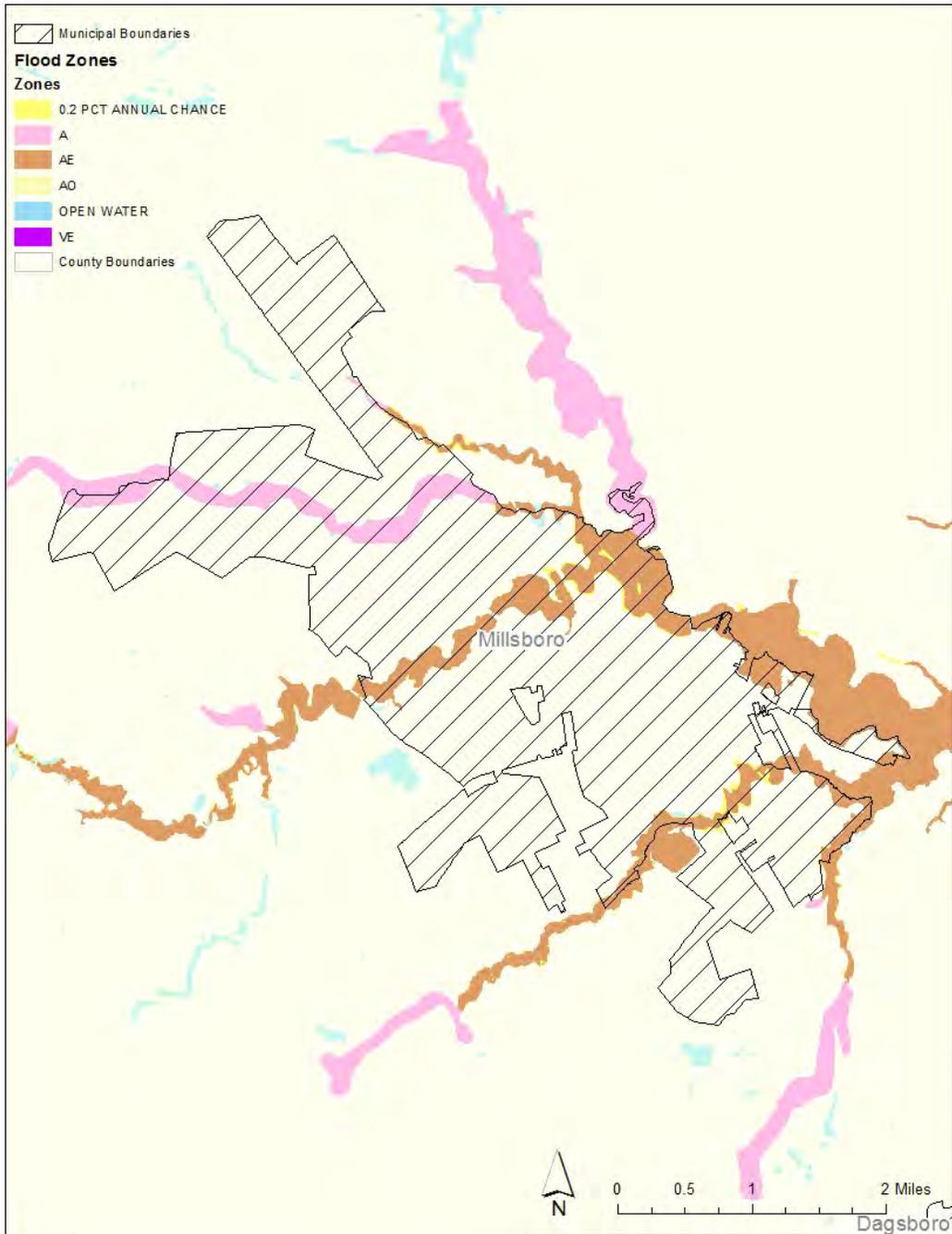
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- **Short-term:** Initiative can be completed within 1 to 5 years once funding has been secured.
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Under the potential funding sources, the acronyms align with the following programs:

- **CDBG:** Community Development Block Grant Program
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- **HMEP:** Hazardous Materials Emergency Preparedness Grant
- **HMGP:** Hazard Mitigation Grant Program
- **HSGP:** Homeland Security Grant Program
- **PDM:** Pre-Disaster Mitigation Grant Program
- **PS:** Private Sector Grants
- **RERP:** Radiological Emergency Response Program

# Appendices

Figure A-14: Millsboro Flood Map



## Appendices

### Town of Millville

#### General Profile

The Town of Millville encompasses ½ square mile. The town is bordered to the north, west, and south by unincorporated sections of Sussex County. The Atlantic Ocean and the Town of Ocean View are located to the east of Millville.

According to the 2010 Census, the population of the Town of Millville is 544 but will swell to over 5,000 during the summer vacation season.

The Millville economy centers on the tourism and vacation industry.

#### Risk Assessment

The Town of Millville considers their top hazards to be flooding, wind related events and winter storms, and extreme heat / cold.

#### Capabilities

**Plans and Programs in Place**

Jurisdiction	HMP	DRP	CLUP	FMP	SMP	EOP	COOP	REP	SARA	TRANS	CIP	REG-PL	HPP	ZO	SO	FDPO	NFIP	CRS	BC
Millville			X	X					X			X	X	X	X	X	X		X

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|--|--|
| <ul style="list-style-type: none"> <li>▪ <b>HMP</b> – Hazard Mitigation Plan</li> <li>▪ <b>DRP</b> – Disaster Recovery Plan</li> <li>▪ <b>CLUP</b> – Comprehensive Land Use Plan</li> <li>▪ <b>FMP</b> – Floodplain Management Plan / Flood Mitigation Plan</li> <li>▪ <b>SMP</b> – Stormwater Management Plan</li> <li>▪ <b>EOP</b> – Emergency Operations Plan</li> <li>▪ <b>COOP</b> – Continuity of Operations Plan</li> <li>▪ <b>REP</b> – Radiological Emergency Plan</li> <li>▪ <b>SARA</b> – SARA Title III Emergency Response Plan</li> </ul> | <ul style="list-style-type: none"> <li>▪ <b>TRANS</b> – Transportation Plan</li> <li>▪ <b>CIP</b> – Capital Improvements Plan (that regulates infrastructure in hazard areas)</li> <li>▪ <b>REG-PL</b> – Regional Planning</li> <li>▪ <b>HPP</b> – Historic Preservation Plan</li> <li>▪ <b>ZO</b> – Zoning Ordinance</li> <li>▪ <b>SO</b> – Subdivision Ordinance</li> <li>▪ <b>FDPO</b> – Flood Damage Prevention Ordinance</li> <li>▪ <b>NFIP</b> – National Flood Insurance Program</li> <li>▪ <b>CRS</b> – Community Rating System</li> <li>▪ <b>BC</b> – Building Codes</li> </ul> |
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## Appendices

The following indicates significant indicators for a local jurisdictions ability to implement mitigation strategy. Not all jurisdictions have all five subsections.

- B-1 - Local Comprehensive Plan Update
- B-2 - Building Code Effectiveness Grading Schedule (BCEGS)
- B-3 - National Flood Insurance Program participation
- B-4 - Community Rating System Participation
- B-5 - Self-assessment of Local Capability

### B-1: Local Comprehensive Plan Updates

Jurisdiction	Plan Status
Millville	2011

### B-2: BCEGS Grades for Sussex County Jurisdictions

Jurisdiction	BCEGS Grade
Millville	8*

### B-3: NFIP Participation in Sussex County

Jurisdiction	NFIP Entry Date
Millville	9/25/81

### B-4: CRS Communities in Sussex County

Jurisdiction	CRS Entry Date	Current CRS Class
Millsboro	N/A	N/A

### B-5: Self-Assessment of Local Capability

Jurisdiction	Technical Capability	Fiscal Capability	Administrative
Millsboro	L	L	L

*L=Low capability, M=Moderate capability, H=High capability*

### NFIP Registered Repetitive Loss Properties

Jurisdiction	Number of Properties	Number of Losses	Total Cost
<b>Repetitive Loss Properties</b>			
N/A	N/A	N/A	N/A
<b>Severe Repetitive Loss Properties</b>			
N/A	N/A	N/A	N/A

## Appendices

### Mitigation Actions Review

Project Description	Adopted	Priority	Timeline	Status	Estimated Cost	Potential Funding Source
<b>Previous Plan Mitigation Actions Review</b>						
Retrofit the Millville Town Hall to include back up power supply. Install a propane powered generator.	Yes	High	Short term	Completed	360,000	N/A
Conduct an assessment of all culverts to include proper size and design based on current infrastructure and future development.	Yes	Moderate	Short term	Completed by DelDot	N/A	N/A
<b>Mitigation Actions Started / Completed since 2010 Plan Update</b>						
<b>Potential / New Mitigation Actions For Consideration</b>						
Develop mitigation (wind loads) outreach program specifically targeting Millville by the Sea development	No	Moderate	Short term	Pending funding source	2,000	HMGP, FMA, PDM, CDBG
Improve and upgrade water flow and discharge capacities of tax ditches town wide	No	Moderate	Short term	Pending funding source	150,000	HMGP, FMA, PDM

## Appendices

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Under timeline for completion, the County has identified the following parameters:

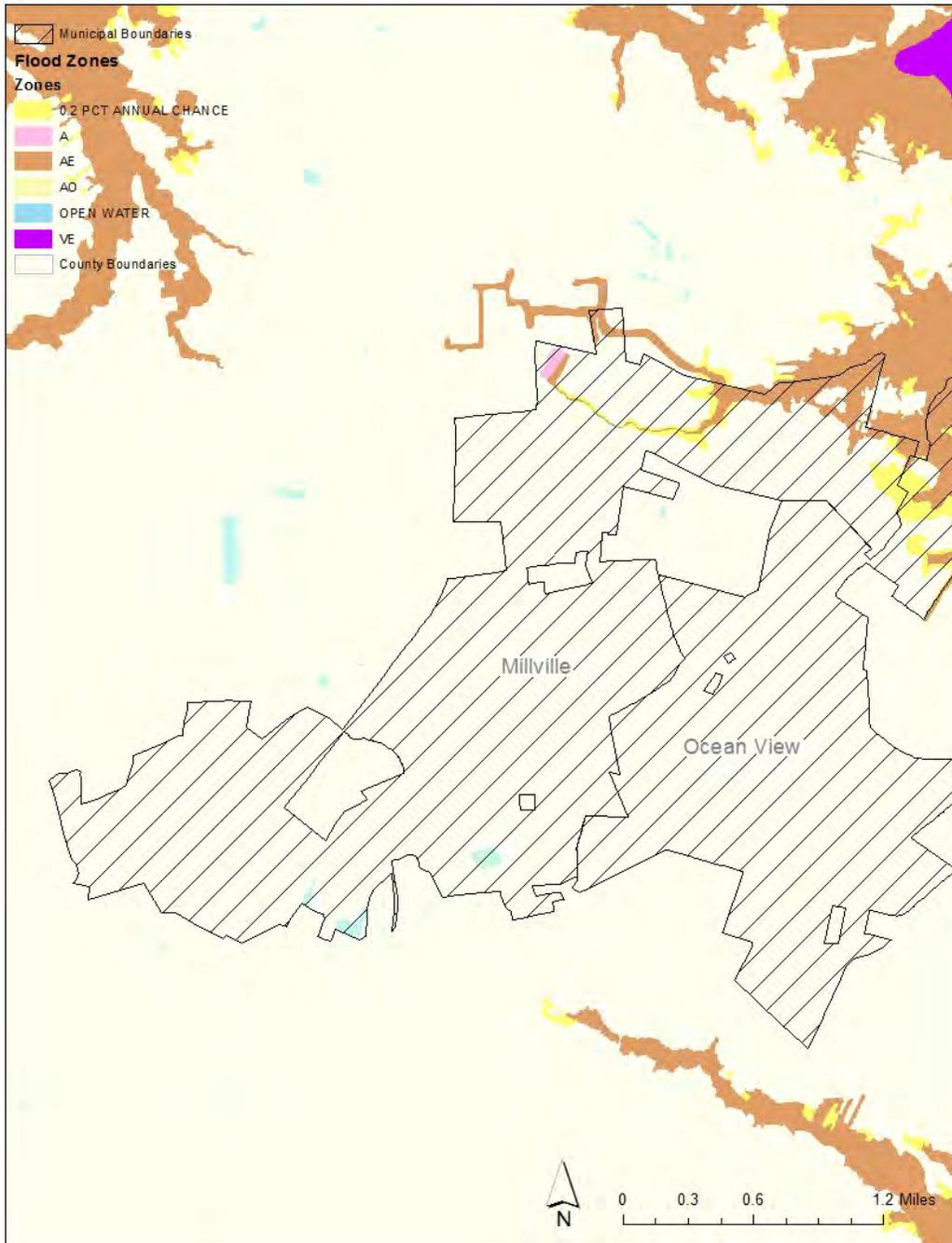
- **Ongoing:** Initiative is currently being implemented under existing programs and budgets.
- **Short-term:** Initiative can be completed within 1 to 5 years once funding has been secured.
- **Long-term:** Initiative will take 5 or more years to complete once funding has been secured.

Under the potential funding sources, the acronyms align with the following programs:

- **CDBG:** Community Development Block Grant Program
- **FMA:** Flood Mitigation Grant Program
- **HMEP:** Hazardous Materials Emergency Preparedness Grant
- **HMGP:** Hazard Mitigation Grant Program
- **HSGP:** Homeland Security Grant Program
- **PDM:** Pre-Disaster Mitigation Grant Program
- **PS:** Private Sector Grants
- **RERP:** Radiological Emergency Response Program

# Appendices

Figure A-15: Millville Flood Map



## Appendices

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### Town of Milton

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#### General Profile

The Town of Milton is located on the Delmarva Peninsula and encompasses 1.2 square miles.

According to the 2010 Census, the population of the Town of Milton is 2,576.

The Town of Milton economy centers on the tourism, vacation, and retail industry.

#### Risk Assessment

The Town of Milton considers their top hazards to be flooding, wind related events, winter storms, and extreme heat / cold.

#### Capabilities

**Plans and Programs in Place**

Jurisdiction	HMP	DRP	CLUP	FMP	SMP	EOP	COOP	REP	SARA	TRANS	CIP	REG-PL	HPP	ZO	SO	FDPO	NFIP	CRS	BC
Milton			X	X									X	X	X	X	X		X

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|--|--|
| <ul style="list-style-type: none"> <li>▪ <b>HMP</b> – Hazard Mitigation Plan</li> <li>▪ <b>DRP</b> – Disaster Recovery Plan</li> <li>▪ <b>CLUP</b> – Comprehensive Land Use Plan</li> <li>▪ <b>FMP</b> – Floodplain Management Plan / Flood Mitigation Plan</li> <li>▪ <b>SMP</b> – Stormwater Management Plan</li> <li>▪ <b>EOP</b> – Emergency Operations Plan</li> <li>▪ <b>COOP</b> – Continuity of Operations Plan</li> <li>▪ <b>REP</b> – Radiological Emergency Plan</li> <li>▪ <b>SARA</b> – SARA Title III Emergency Response Plan</li> </ul> | <ul style="list-style-type: none"> <li>▪ <b>TRANS</b> – Transportation Plan</li> <li>▪ <b>CIP</b> – Capital Improvements Plan (that regulates infrastructure in hazard areas)</li> <li>▪ <b>REG-PL</b> – Regional Planning</li> <li>▪ <b>HPP</b> – Historic Preservation Plan</li> <li>▪ <b>ZO</b> – Zoning Ordinance</li> <li>▪ <b>SO</b> – Subdivision Ordinance</li> <li>▪ <b>FDPO</b> – Flood Damage Prevention Ordinance</li> <li>▪ <b>NFIP</b> – National Flood Insurance Program</li> <li>▪ <b>CRS</b> – Community Rating System</li> <li>▪ <b>BC</b> – Building Codes</li> </ul> |
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## Appendices

The following indicates significant indicators for a local jurisdictions ability to implement mitigation strategy. Not all jurisdictions have all five subsections.

- B-1 - Local Comprehensive Plan Update
- B-2 - Building Code Effectiveness Grading Schedule (BCEGS)
- B-3 - National Flood Insurance Program participation
- B-4 - Community Rating System Participation
- B-5 - Self-assessment of Local Capability

### B-1: Local Comprehensive Plan Updates

Jurisdiction	Plan Status
Milton	2010

### B-2: BCEGS Grades for Sussex County Jurisdictions

Jurisdiction	BCEGS Grade
Milton	8*

### B-3: NFIP Participation in Sussex County

Jurisdiction	NFIP Entry Date
Milton	8/1/78

### B-4: CRS Communities in Sussex County

Jurisdiction	CRS Entry Date	Current CRS Class
Milton	N/A	N/A

### B-5: Self-Assessment of Local Capability

Jurisdiction	Technical Capability	Fiscal Capability	Administrative
Milton	L	M	L

*L=Low capability, M=Moderate capability, H=High capability*

### NFIP Registered Repetitive Loss Properties

Jurisdiction	Number of Properties	Number of Losses	Total Cost
<b>Repetitive Loss Properties</b>			
Town of Milton	1	2	\$188,072
<b>Severe Repetitive Loss Properties</b>			
Town of Milton	1	5	\$405,659

## Appendices

### Mitigation Actions Review

Project Description	Adopted	Priority	Timeline	Status	Estimated Cost	Potential Funding Source
<b>Previous Plan Mitigation Actions Review</b>						
Promote emergency preparedness information.	Yes	Moderate	Short term	Ongoing	No cost	HMGP, FMA, PDM, CDBG
Secure water towers and wellheads by enclosing them with approximately 1,200 feet of fence.	Yes	Moderate	Short term	Completed	35,000	DEMA
Join the Community Rating System.	Yes	Moderate	Short term	Delayed due to staffing	Administrative costs	N/A
Conduct a study to identify measures to mitigate flooding in down town area	No	High	Short term	Pending funding source	150,000	HMGP, FMA, PDM, CDBG
<b>Mitigation Actions Started / Completed since 2010 Plan Update</b>						
Route 5 storm-water management strategy study	Yes		N/A	Completed	30,000	Coastal Management Grant
<b>Potential / New Mitigation Actions For Consideration</b>						
Modify floodplain management plan to include critical infrastructure protection strategies for police and fire facilities.	No	High	Short term	Pending funding source	Administrative costs	HMGP, FMA, PDM, CDBG

## Appendices

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Under timeline for completion, the County has identified the following parameters:

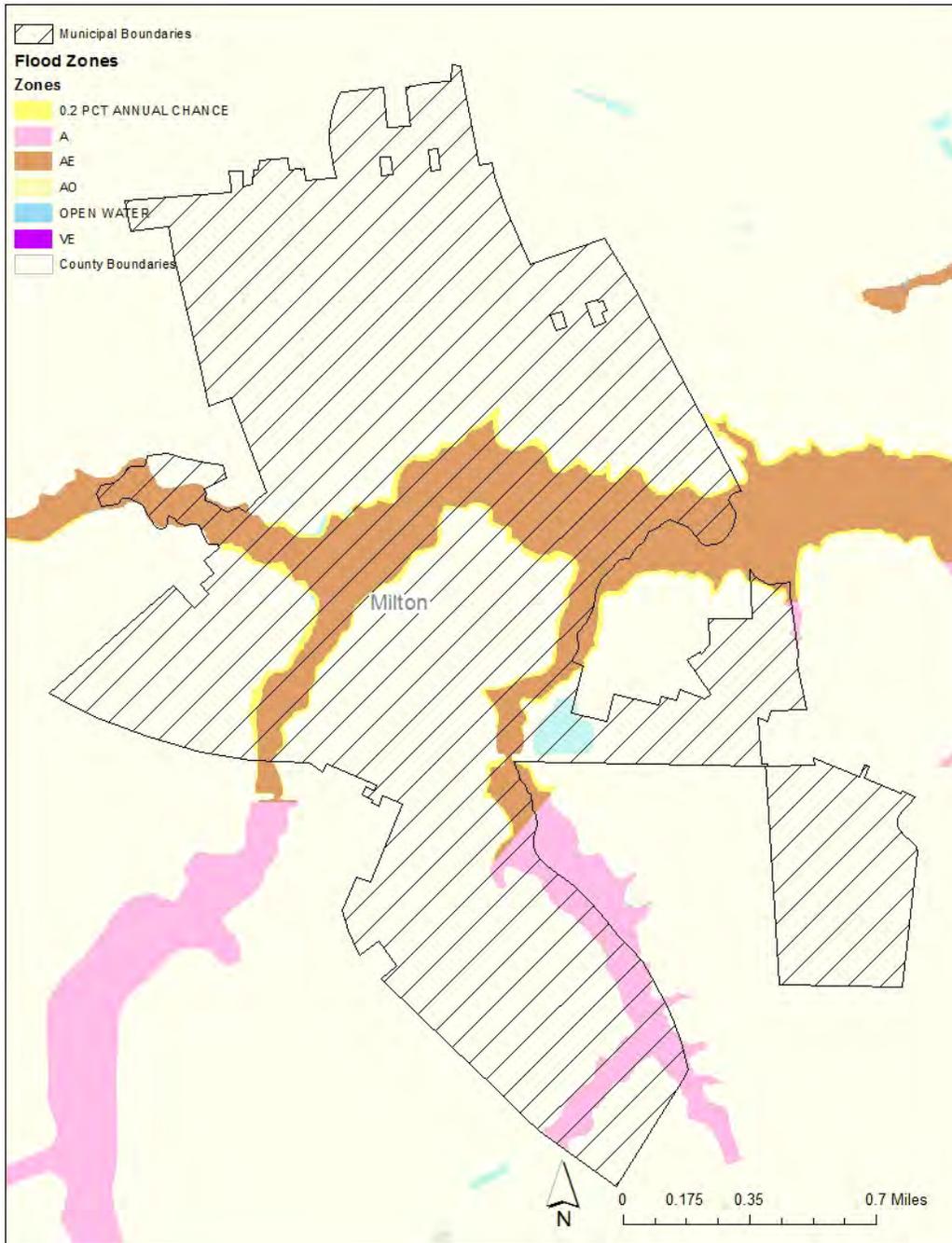
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- **CDBG:** Community Development Block Grant Program
- **FMA:** Flood Mitigation Grant Program
- **HMEP:** Hazardous Materials Emergency Preparedness Grant
- **HMGP:** Hazard Mitigation Grant Program
- **HSGP:** Homeland Security Grant Program
- **PDM:** Pre-Disaster Mitigation Grant Program
- **PS:** Private Sector Grants
- **RERP:** Radiological Emergency Response Program

# Appendices

Figure A-16: Milton Flood Map



## Appendices

### Town of Ocean View

#### General Profile

The Town of Ocean View is located to the east of the Atlantic Ocean, south of Indian River Bay. Bethany Beach borders to the to the east, Millville is on the west border, and unincorporated sections of Sussex County border the south.

According to the 2010 Census, the population of the Town of Ocean View is 1,882.

The Town of Ocean View economy centers on the tourism and vacation industry.

#### Risk Assessment

The Town of Ocean View considers their top hazards to be flooding, wind related events and winter storms, and extreme heat / cold.

#### Capabilities

**Plans and Programs in Place**

Jurisdiction	HMP	DRP	CLUP	FMP	SMP	EOP	COOP	REP	SARA	TRANS	CIP	REG-PL	HPP	ZO	SO	FDPO	NFIP	CRS	BC	
Ocean View	X		X	X		X			X		X	X		X	X	X	X			X

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- B-4 - Community Rating System Participation
- B-5 - Self-assessment of Local Capability

### B-1: Local Comprehensive Plan Updates

Jurisdiction	Plan Status
Ocean View	Revised 2012

### B-2: BCEGS Grades for Sussex County Jurisdictions

Jurisdiction	BCEGS Grade
Ocean View	8*

### B-3: NFIP Participation in Sussex County

Jurisdiction	NFIP Entry Date
Ocean View	9/3/80

### B-4: CRS Communities in Sussex County

Jurisdiction	CRS Entry Date	Current CRS Class
Ocean view	N/A	N/A

### B-5: Self-Assessment of Local Capability

Jurisdiction	Technical Capability	Fiscal Capability	Administrative
Ocean View	L	M	L

*L=Low capability, M=Moderate capability, H=High capability*

### NFIP Registered Repetitive Loss Properties

Jurisdiction	Number of Properties	Number of Losses	Total Cost
<b>Repetitive Loss Properties</b>			
N/A	N/A	N/A	N/A
<b>Severe Repetitive Loss Properties</b>			
N/A	N/A	N/A	N/A

## Appendices

### Mitigation Actions Review

Project Description	Adopted	Priority	Timeline	Status	Estimated Cost	Potential Funding Source
<b>Previous Plan Mitigation Actions Review</b>						
Improve the Town's stormwater management system in some of the older sections of the Town (County Village, County Estates, Meyle Estates, Corner of Daisy and Woodland Avenue, West View Development, and Cottages on Whites Creek). These improvements would include engineering costs to redesign or improve the drainage systems, and the costs to reconstruct and repair swales, drains and culvert piping, and ditches.	Yes	High	Ongoing	In Progress Partially complete	750,000 done / outstanding work 3 million	
Implement public education and awareness activities to advise residents and visitors about hazards, hazardous areas and mitigation techniques they can use to protect about hazards, hazardous areas and mitigation techniques they can use to protect themselves and their property.	Yes	Moderate	Ongoing	In Progress	5,000	HMGP, FMS, PDM, CDBG
Purchase and install GIS to map hazardous areas and events.	Yes	Low	Short term	in progress/development	10,000	
Adopt a building code ordinance for the Town.	Yes	Low	Short term	Complete, adaptations in Progress	N/A	N/A
<b>Mitigation Actions Started / Completed since 2010 Plan Update</b>						
<b>Potential / New Mitigation Actions For Consideration</b>						
Storm water management projects (3) drainage for roads	Yes	High	Short term	Pending funding source	750,000	HMGP, FMS, PDM
(3) shovel ready stormwater management projects awaiting easement rights.	Yes	High	Short term	Pending funding source	1.5 million	HMGP, FMS, PDM
Stormwater Drainage pipe system install: Central Ave - 100 feet (Banks Bennetts Tax Ditch floods)	Yes	High	Short term	Pending funding source	500,000	HMGP, FMS, PDM
Stormwater Drainage pipe system install: Hudson Ave - - 100 feet (Banks Bennetts Tax Ditch floods)	Yes	High	Short term	Pending funding source	500,000	HMGP, FMS, PDM

## Appendices

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Under timeline for completion, the County has identified the following parameters:

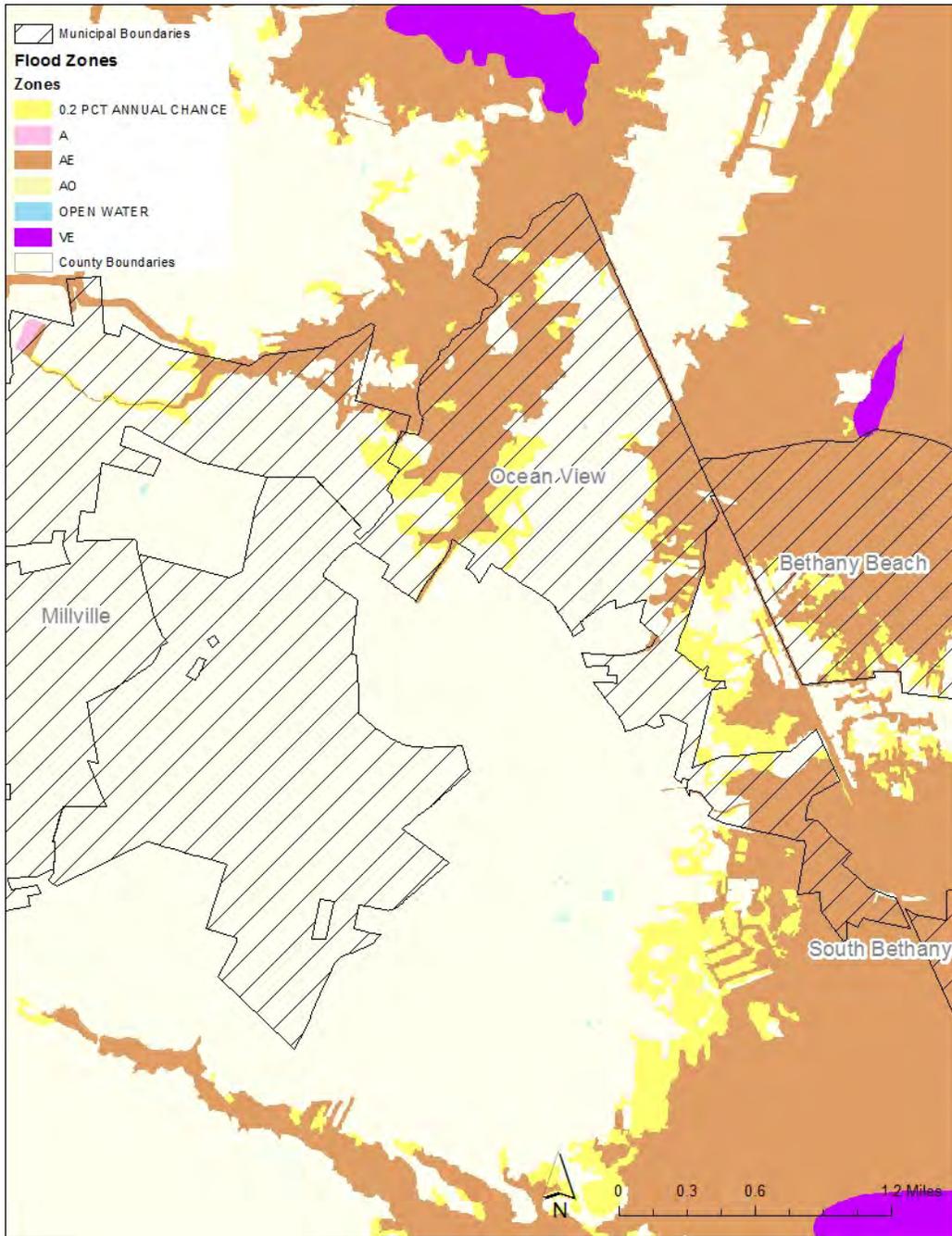
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- **HMGP:** Hazard Mitigation Grant Program
- **HSGP:** Homeland Security Grant Program
- **PDM:** Pre-Disaster Mitigation Grant Program
- **PS:** Private Sector Grants
- **RERP:** Radiological Emergency Response Program

# Appendices

Figure A-17: Ocean View Flood Map



## Appendices

### City of Rehoboth Beach

#### General Profile

The City of Rehoboth is one of the principal cities of Delaware. The city is located along the Atlantic coast of Delaware and encompasses 1.6 square miles. Henlopen Acres and unincorporated sections of Sussex County to the west border the city to the north. Dewey Beach borders the city to the south and the Atlantic Ocean to the east.

According to the 2010 Census, the population of Rehoboth Beach is 1,327 but will swell to over 25,000 during the summer vacation season.

The City of Rehoboth's economy centers on the tourism and vacation industry.

#### Risk Assessment

The City of Rehoboth considers their top hazards to be flooding, wind related events and winter storms, and extreme heat / cold.

#### Capabilities

**Plans and Programs in Place**

Jurisdiction	HMP	DRP	CLUP	FMP	SMP	EOP	COOP	REP	SARA	TRANS	CIP	REG-PL	HPP	ZO	SO	FDPO	NFIP	CRS	BC
Rehoboth Beach		X	X	X	X	X	X		X		X		X	X	X	X	X	X	X

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| <ul style="list-style-type: none"> <li>▪ <b>HMP</b> – Hazard Mitigation Plan</li> <li>▪ <b>DRP</b> – Disaster Recovery Plan</li> <li>▪ <b>CLUP</b> – Comprehensive Land Use Plan</li> <li>▪ <b>FMP</b> – Floodplain Management Plan / Flood Mitigation Plan</li> <li>▪ <b>SMP</b> – Stormwater Management Plan</li> <li>▪ <b>EOP</b> – Emergency Operations Plan</li> <li>▪ <b>COOP</b> – Continuity of Operations Plan</li> <li>▪ <b>REP</b> – Radiological Emergency Plan</li> <li>▪ <b>SARA</b> – SARA Title III Emergency Response Plan</li> </ul> | <ul style="list-style-type: none"> <li>▪ <b>TRANS</b> – Transportation Plan</li> <li>▪ <b>CIP</b> – Capital Improvements Plan (that regulates infrastructure in hazard areas)</li> <li>▪ <b>REG-PL</b> – Regional Planning</li> <li>▪ <b>HPP</b> – Historic Preservation Plan</li> <li>▪ <b>ZO</b> – Zoning Ordinance</li> <li>▪ <b>SO</b> – Subdivision Ordinance</li> <li>▪ <b>FDPO</b> – Flood Damage Prevention Ordinance</li> <li>▪ <b>NFIP</b> – National Flood Insurance Program</li> <li>▪ <b>CRS</b> – Community Rating System</li> <li>▪ <b>BC</b> – Building Codes</li> </ul> |
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## Appendices

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- B-1 - Local Comprehensive Plan Update
- B-2 - Building Code Effectiveness Grading Schedule (BCEGS)
- B-3 - National Flood Insurance Program participation
- B-4 - Community Rating System Participation
- B-5 - Self-assessment of Local Capability

### B-1: Local Comprehensive Plan Updates

Jurisdiction	Plan Status
Rehoboth Beach	Revised 2014

### B-2: BCEGS Grades for Sussex County Jurisdictions

Jurisdiction	BCEGS Grade
Rehoboth Beach	6

### B-3: NFIP Participation in Sussex County

Jurisdiction	NFIP Entry Date
Rehoboth Beach	3/30/73

### B-4: CRS Communities in Sussex County

Jurisdiction	CRS Entry Date	Current CRS Class
Rehoboth Beach	N/A	N/A

### B-5: Self-Assessment of Local Capability

Jurisdiction	Technical Capability	Fiscal Capability	Administrative
Rehoboth Beach	H	M	H

*L=Low capability, M=Moderate capability, H=High capability*

### NFIP Registered Repetitive Loss Properties

Jurisdiction	Number of Properties	Number of Losses	Total Cost
<b>Repetitive Loss Properties</b>			
City of Rehoboth Beach	1	2	\$77,137
<b>Severe Repetitive Loss Properties</b>			
City of Rehoboth Beach	1	4	\$150,295
City of Rehoboth Beach	1	6	\$119,278
City of Rehoboth Beach	1	4	\$108,445
City of Rehoboth Beach	1	5	\$77,558

## Appendices

### Mitigation Actions Review

Project Description	Adopted	Priority	Timeline	Status	Estimated Cost	Potential Funding Source
<b>Previous Plan Mitigation Actions Review</b>						
Build retaining wall along boardwalk to prevent damage to businesses, the boardwalk and our street ends.	Yes	High	N/A	Completed		USACE, DENREC
Conduct drainage improvements on First Street to increase efficiency by increasing piping capacity.	No	Moderate	N/A	Completed		HMGP, FMA, PDM
<b>Mitigation Actions Started / Completed since 2010 Plan Update</b>						
<b>Potential / New Mitigation Actions For Consideration</b>						
Storm-water management system town wide	Yes	High	Short-term	Pending funding source	9 million	HMGP, FMA, PDM
Elevation and engineering study for barrier protection on County Road 300. (In A/V Zone)	No	High	Short-term	Pending funding source		HMGP, FMA, PDM
Wilmington and Delaware Ave storm-water management study	Yes	High	Short-term	Pending funding source	50,000	HMGP, FMA, PDM
Develop multi-lingual community outreach	No	High	Short-term	Pending funding source		HMGP, FMA, PDM, CDBG

## Appendices

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Under timeline for completion, the County has identified the following parameters:

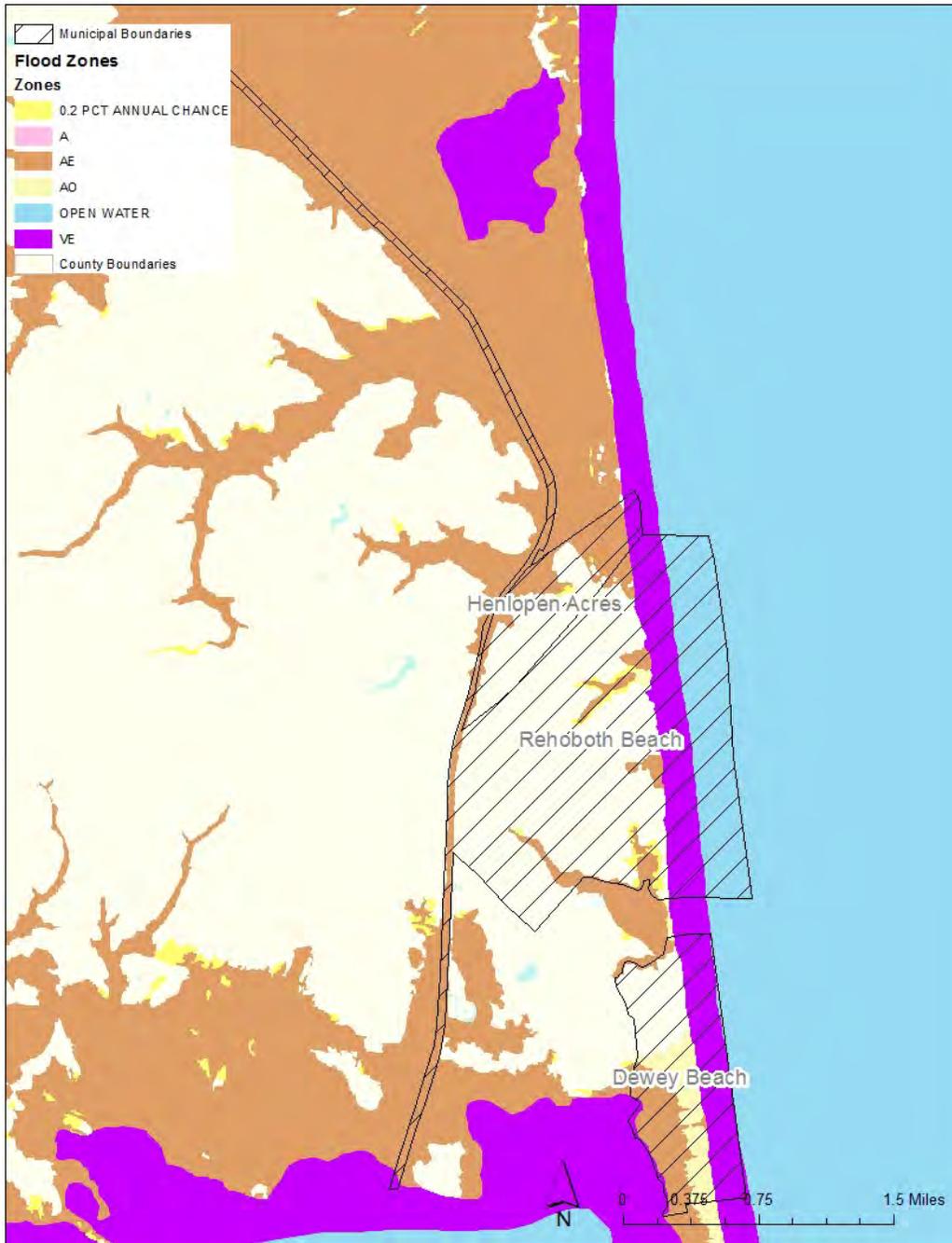
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Under the potential funding sources, the acronyms align with the following programs:

- **CDBG:** Community Development Block Grant Program
- **FMA:** Flood Mitigation Grant Program
- **HMEP:** Hazardous Materials Emergency Preparedness Grant
- **HMGP:** Hazard Mitigation Grant Program
- **HSGP:** Homeland Security Grant Program
- **PDM:** Pre-Disaster Mitigation Grant Program
- **PS:** Private Sector Grants
- **RERP:** Radiological Emergency Response Program

# Appendices

Figure A-18: Rehoboth Beach Flood Map



## Appendices

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### City of Seaford

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#### General Profile

The City of Seaford is the largest city within Sussex County and encompasses 3.5 square miles.

According to the 2010 Census, the population of the City of Seaford is 6,928.

The City of Seaford economy centers on the tourism and vacation industry.

#### Risk Assessment

The City of Seaford considers their top hazards to be flooding, wind related events and winter storms, and extreme heat / cold.

#### Capabilities

**Plans and Programs in Place**

Jurisdiction	HMP	DRP	CLUP	FMP	SMP	EOP	COOP	REP	SARA	TRANS	CIP	REG-PL	HPP	ZO	SO	FDPO	NFIP	CRS	BC
Seaford		X	X	X		X	X		X	X		X	X	X	X	X	X	X	X

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| <ul style="list-style-type: none"> <li>▪ <b>HMP</b> – Hazard Mitigation Plan</li> <li>▪ <b>DRP</b> – Disaster Recovery Plan</li> <li>▪ <b>CLUP</b> – Comprehensive Land Use Plan</li> <li>▪ <b>FMP</b> – Floodplain Management Plan / Flood Mitigation Plan</li> <li>▪ <b>SMP</b> – Stormwater Management Plan</li> <li>▪ <b>EOP</b> – Emergency Operations Plan</li> <li>▪ <b>COOP</b> – Continuity of Operations Plan</li> <li>▪ <b>REP</b> – Radiological Emergency Plan</li> <li>▪ <b>SARA</b> – SARA Title III Emergency Response Plan</li> </ul> | <ul style="list-style-type: none"> <li>▪ <b>TRANS</b> – Transportation Plan</li> <li>▪ <b>CIP</b> – Capital Improvements Plan (that regulates infrastructure in hazard areas)</li> <li>▪ <b>REG-PL</b> – Regional Planning</li> <li>▪ <b>HPP</b> – Historic Preservation Plan</li> <li>▪ <b>ZO</b> – Zoning Ordinance</li> <li>▪ <b>SO</b> – Subdivision Ordinance</li> <li>▪ <b>FDPO</b> – Flood Damage Prevention Ordinance</li> <li>▪ <b>NFIP</b> – National Flood Insurance Program</li> <li>▪ <b>CRS</b> – Community Rating System</li> <li>▪ <b>BC</b> – Building Codes</li> </ul> |
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## Appendices

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- B-1 - Local Comprehensive Plan Update
- B-2 - Building Code Effectiveness Grading Schedule (BCEGS)
- B-3 - National Flood Insurance Program participation
- B-4 - Community Rating System Participation
- B-5 - Self-assessment of Local Capability

### B-1: Local Comprehensive Plan Updates

Jurisdiction	Plan Status
Seaford	Updated 2015

### B-2: BCEGS Grades for Sussex County Jurisdictions

Jurisdiction	BCEGS Grade
Seaford	6

### B-3: NFIP Participation in Sussex County

Jurisdiction	NFIP Entry Date
Seaford	2/01/79

### B-4: CRS Communities in Sussex County

Jurisdiction	CRS Entry Date	Current CRS Class
Seaford	10/01/96	9

### B-5: Self-Assessment of Local Capability

Jurisdiction	Technical Capability	Fiscal Capability	Administrative
Seaford	M	M	H

*L=Low capability, M=Moderate capability, H=High capability*

### NFIP Registered Repetitive Loss Properties

Jurisdiction	Number of Properties	Number of Losses	Total Cost
<b>Repetitive Loss Properties</b>			
N/A	N/A	N/A	N/A
<b>Severe Repetitive Loss Properties</b>			
N/A	N/A	N/A	N/A

## Appendices

### Mitigation Actions Review

Project Description	Adopted	Priority	Timeline	Status	Estimated Cost	Potential Funding Source
<b>Previous Plan Mitigation Actions Review</b>						
Conduct computer modeling of key drainage in and around the City to identify restrictions and/or potential problems. Also identify necessary modification or repairs to improve functionality.	Yes	High	Short term	In process	Zero cost	N/A
Address street flooding in the Washington and State Street area- identify necessary modification or repairs to improve functionality.	Yes	High	Short term	Completed	1.99 million	N/A
Ensure security of water production sites and storage facilities.	Yes	High	Short term	Pending funding source		HMGP, CDBG, HSGP
Construct storm drain improvements on Washington Street to increase the drainage capacity of the area and prevent future flooding.	No	Moderate	Short term	Completed	Same project as 2	N/A
Construct stormwater drains on Porter Street to increase the drainage capacity of the area and prevent future flooding.	No	Moderate	Short term	Completed	750.000	N/A
<b>Mitigation Actions Started / Completed since 2010 Plan Update</b>						
Stormwater management system Virginia Ave (regional system project to protect rep loss properties due to improper construction.	Yes	High	Short term	Completed	200K	N/A
<b>Potential / New Mitigation Actions For Consideration</b>						

## Appendices

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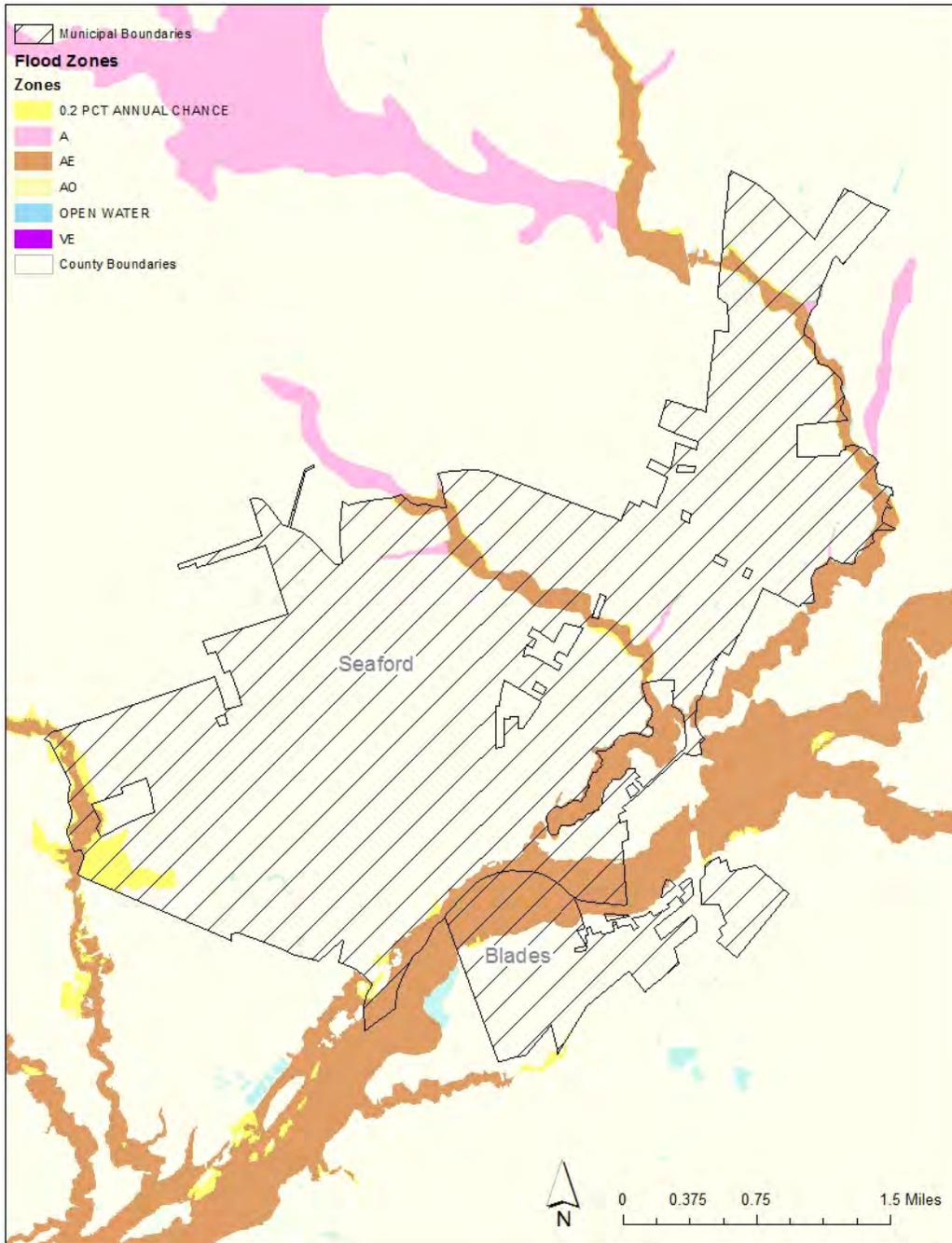
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- **HMGP:** Hazard Mitigation Grant Program
- **HSGP:** Homeland Security Grant Program
- **PDM:** Pre-Disaster Mitigation Grant Program
- **PS:** Private Sector Grants
- **RERP:** Radiological Emergency Response Program

# Appendices

Figure A-19 Seaford Flood Map



## Appendices

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### Town of Selbyville

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#### General Profile

The Town of Selbyville encompasses 1.4 square miles.

According to the 2010 Census, the population of the Town of Selbyville is 2,167.

The Town of Selbyville's economy centers on the poultry industry.

#### Risk Assessment

The Town of Selbyville considers their top hazards to be flooding, wind related events and winter storms, and extreme heat / cold.

#### Capabilities

**Plans and Programs in Place**

Jurisdiction	HMP	DRP	CLUP	FMP	SMP	EOP	COOP	REP	SARA	TRANS	CIP	REG-PL	HPP	ZO	SO	FDPO	NFIP	CRS	BC
Selbyville			X	X	X	X			X		X	X	X	X	X	X	X		X

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## Appendices

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- B-1 - Local Comprehensive Plan Update
- B-2 - Building Code Effectiveness Grading Schedule (BCEGS)
- B-3 - National Flood Insurance Program participation
- B-4 - Community Rating System Participation
- B-5 - Self-assessment of Local Capability

### B-1: Local Comprehensive Plan Updates

Jurisdiction	Plan Status
Selbyville	Certified 2007

### B-2: BCEGS Grades for Sussex County Jurisdictions

Jurisdiction	BCEGS Grade
Selbyville	8

### B-3: NFIP Participation in Sussex County

Jurisdiction	NFIP Entry Date
Selbyville	7/16/91

### B-4: CRS Communities in Sussex County

Jurisdiction	CRS Entry Date	Current CRS Class
Selbyville	N/A	N/A

### B-5: Self-Assessment of Local Capability

Jurisdiction	Technical Capability	Fiscal Capability	Administrative
Selbyville	M	M	M

*L=Low capability, M=Moderate capability, H=High capability*

### NFIP Registered Repetitive Loss Properties

Jurisdiction	Number of Properties	Number of Losses	Total Cost
<b>Repetitive Loss Properties</b>			
N/A	N/A	N/A	N/A
<b>Severe Repetitive Loss Properties</b>			
N/A	N/A	N/A	N/A

## Appendices

### Mitigation Actions Review

Project Description	Adopted	Priority	Timeline	Status	Estimated Cost	Potential Funding Source
<b>Previous Plan Mitigation Actions Review</b>						
Replace deteriorating bridge and culverts on Railroad Avenue over major storm water management ditch.	No	High	6 months	Pending funding source.	1.2 million	HMGP, CDBG, PS
Educate residents and improve public awareness on being better prepared to face hazards.	No	High	Ongoing	<del>Ongoing</del>	4000 start up 2500 annual	HMGP, FMA, PDM, CDBG
<b>Mitigation Actions Started / Completed since 2010 Plan Update</b>						
Storm Preparedness Plan: plan calls for community alerts, storm vulnerable materials removal by public works	Yes	High	N/A	Ongoing	Minimal built in	N/A
<b>Potential / New Mitigation Actions For Consideration</b>						

## Appendices

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Under timeline for completion, the County has identified the following parameters:

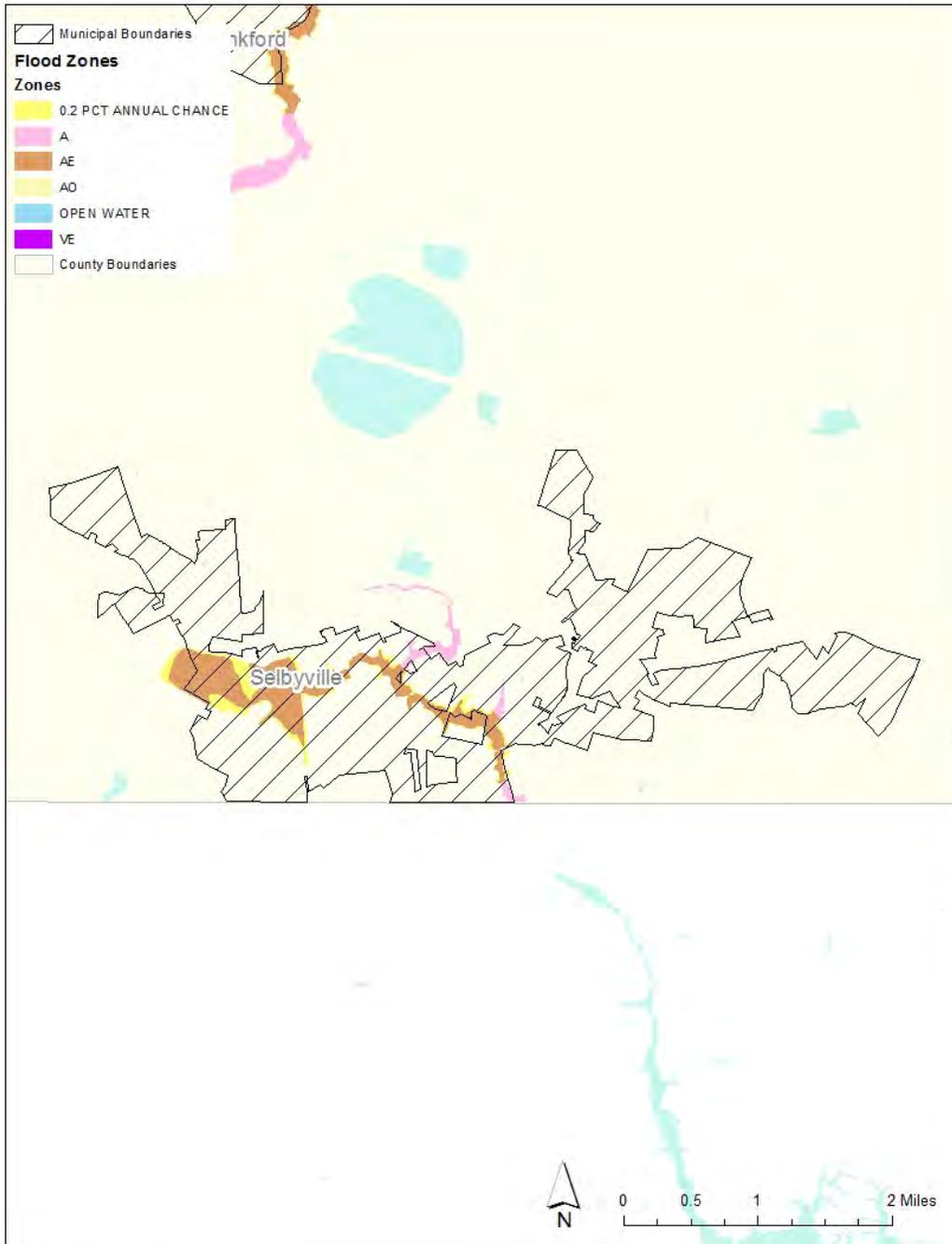
- **Ongoing:** Initiative is currently being implemented under existing programs and budgets.
- **Short-term:** Initiative can be completed within 1 to 5 years once funding has been secured.
- **Long-term:** Initiative will take 5 or more years to complete once funding has been secured.

Under the potential funding sources, the acronyms align with the following programs:

- **CDBG:** Community Development Block Grant Program
- **FMA:** Flood Mitigation Grant Program
- **HMEP:** Hazardous Materials Emergency Preparedness Grant
- **HMGP:** Hazard Mitigation Grant Program
- **HSGP:** Homeland Security Grant Program
- **PDM:** Pre-Disaster Mitigation Grant Program
- **PS:** Private Sector Grants
- **RERP:** Radiological Emergency Response Program

# Appendices

Figure A-20: Selbyville Flood Map



## Appendices

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### Town of Slaughter Beach

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#### General Profile

The Town of Slaughter Beach encompasses 1.3 square miles.

According to the 2010 Census, the population of the Town of Slaughter Beach is 207.

The Town of Slaughter Beach economy centers on the tourism and vacation industry.

#### Risk Assessment

The Town of Slaughter Beach considers their top hazards to be flooding, wind related events and winter storms, and extreme heat / cold.

#### Capabilities

**Plans and Programs in Place**

Jurisdiction	HMP	DRP	CLUP	FMP	SMP	EOP	COOP	REP	SARA	TRANS	CIP	REG-PL	HPP	ZO	SO	FDPO	NFIP	CRS	BC
Slaughter Beach			X			X	X		X			X		X	X	X	X		X

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- B-5 - Self-assessment of Local Capability

### B-1: Local Comprehensive Plan Updates

Jurisdiction	Plan Status
Slaughter Beach	2010, update 2016

### B-2: BCEGS Grades for Sussex County Jurisdictions

Jurisdiction	BCEGS Grade
Slaughter Beach	8*

### B-3: NFIP Participation in Sussex County

Jurisdiction	NFIP Entry Date
Slaughter Beach	7/02/80

### B-4: CRS Communities in Sussex County

Jurisdiction	CRS Entry Date	Current CRS Class
Slaughter Beach	N/A	N/A

### B-5: Self-Assessment of Local Capability

Jurisdiction	Technical Capability	Fiscal Capability	Administrative
Slaughter Beach	L	L	L

*L=Low capability, M=Moderate capability, H=High capability*

### NFIP Registered Repetitive Loss Properties

Jurisdiction	Number of Properties	Number of Losses	Total Cost
<b>Repetitive Loss Properties</b>			
N/A	N/A	N/A	N/A
<b>Severe Repetitive Loss Properties</b>			
N/A	N/A	N/A	N/A

## Appendices

### Mitigation Actions Review

Project Description	Adopted	Priority	Timeline	Status	Estimated Cost	Potential Funding Source
<b>Previous Plan Mitigation Actions Review</b>						
Improve stormwater drainage throughout the Town.	Yes	High	Short term	Ongoing	\$180,000	HMGP, FMA, PDM
Flood-proof water pumping stations.	Yes	High	Short term	Ongoing	Unknown	HMGP, FMA, PDM
Elevate access and evacuation roads that flood (Route 224 - Slaughter Beach Road approximately 1' - 4' from intersection of Bay Avenue to west boundary of Prime Hook National Wildlife Refuge (± 1 mile).	Yes	High	Short term	Pending Vulnerability Assessment	\$10 million	HMGP, FMA, PDM, CDBG, PS, USACE
Elevate flood-prone homes.	Yes	High	Short term	Ongoing	\$205,000	DEMA
Initiate stormwater management system improvements along ± 1 mile of North Bay	Yes	Low	Short term	Ongoing	180,000	HMGP, FMA, PDM
Beach Restoration & Contouring with Grass Planting.	Yes	High	Long term	Ongoing	\$15,000	DENRC
<b>Mitigation Actions Started / Completed since 2010 Plan Update</b>						
Develop automated telephone warning system.	Yes	High	Short term	Completed via email system	\$1,000	Self
Develop a strategy to improve NFIP enforcement processes to include local permitting processes.	Yes	High	Ongoing	Completed	Administrative costs	Self
Provide building/zoning/flood zone ordinances to public via Web site or other electronic means.	Yes	Moderate	Short term	Completed	Administrative costs	Self
Community Vulnerability Assessment	Yes	Moderate	Ongoing	Ongoing		Delaware Coastal Program
<b>Potential / New Mitigation Actions For Consideration</b>						
Wastewater Management Lines Reconfiguration Feasibility Study	Yes	Moderate	Short term	Ongoing	\$60,000	CDBG, HMGP, HSGP, FMA, PDM, PS
Severe Weather Sheltering Facility	No	Low	Ongoing	Ongoing	Administrative Costs	Fire Department, HMGP, PDM, PS
Wildfire Management Fragmentizes Control Project	Yes	Moderate	Short term	Ongoing	\$10,000	Delaware Forest Fire Service
Marsh Water to Back Bay Inundation Study	Yes	Low	Short term	Ongoing	Unknown	University of Delaware
North Jetty Repair	No	Low	Short term	Long term	\$30,000,000	USACE
Propane tank tie down ordinance	No	Low	Short term	Long term	\$1,500	Community

## Appendices

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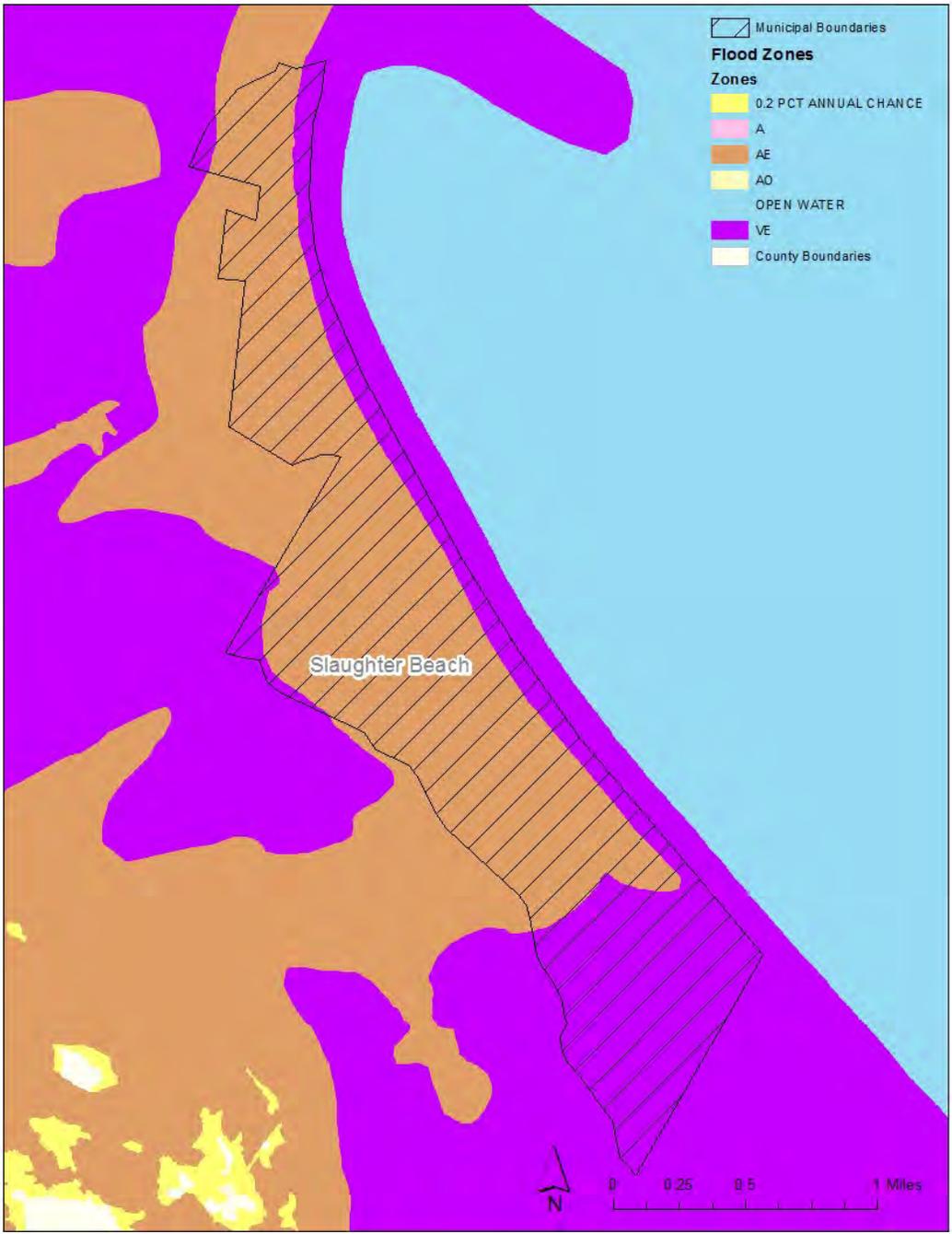
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- **HMGP:** Hazard Mitigation Grant Program
- **HSGP:** Homeland Security Grant Program
- **PDM:** Pre-Disaster Mitigation Grant Program
- **PS:** Private Sector Grants
- **RERP:** Radiological Emergency Response Program

# Appendices

Figure A-21: Slaughter Beach Flood Map



## Appendices

### Town of South Bethany

#### General Profile

The Town of South Bethany encompasses 0.5 square miles. The town is bordered to the north by Bethany Beach, Fenwick Island to the south, the Atlantic Ocean to the east, and unincorporated sections of Sussex County to the west.

According to the 2010 Census, the population of the Town of South Bethany is 449 but will swell to over 1400 during the summer vacation season.

The Town of South Bethany economy centers on the tourism and vacation industry.

#### Risk Assessment

The Town of South Bethany considers their top hazards to be flooding, wind related events and winter storms, and extreme heat / cold.

#### Capabilities

**Plans and Programs in Place**

Jurisdiction	HMP	DRP	CLUP	FMP	SMP	EOP	COOP	REP	SARA	TRANS	CIP	REG-PL	HPP	ZO	SO	FDPO	NFIP	CRS	BC
South Bethany		X	X	X		X	X		X		X	X		X	X	X	X	X	X

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|--|--|
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- B-5 - Self-assessment of Local Capability

### B-1: Local Comprehensive Plan Updates

Jurisdiction	Plan Status
South Bethany	Complete 10-year re-cert (2016) Pending

### B-2: BCEGS Grades for Sussex County Jurisdictions

Jurisdiction	BCEGS Grade
South Bethany	<i>Declined Participation</i>

### B-3: NFIP Participation in Sussex County

Jurisdiction	NFIP Entry Date
South Bethany	10/06/76

### B-4: CRS Communities in Sussex County

Jurisdiction	CRS Entry Date	Current CRS Class
South Bethany	10/01/07	8

### B-5: Self-Assessment of Local Capability

Jurisdiction	Technical Capability	Fiscal Capability	Administrative
South Bethany	M	L	H

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### NFIP Registered Repetitive Loss Properties

Jurisdiction	Number of Properties	Number of Losses	Total Cost
<b>Repetitive Loss Properties</b>			
N/A	N/A	N/A	N/A
<b>Severe Repetitive Loss Properties</b>			
Town of South Bethany	1	5	\$100,038

## Appendices

### Mitigation Actions Review

Project Description	Adopted	Priority	Timeline	Status	Estimated Cost	Potential Funding Source
<b>Previous Plan Mitigation Actions Review</b>						
Improve stormwater drainage throughout the Town.	Yes	High	Ongoing	In Progress		HMGP, FMA, PDM
Continue to identify and promote flood-proofing/elevation solutions to at-risk homes throughout the Town in accordance with current FEMA regulations.	Yes	Moderate	Ongoing	In Progress		HMGP, FMA, PDM
Upgrade the Town's Building and Zoning Ordinances to reflect NFIP and ISO requirements.	Yes	Moderate	Short term	Complete	\$1000	Self-funding
<b>Mitigation Actions Started / Completed since 2010 Plan Update</b>						
Flood elevation one house: Back bay (204 Carlisle Road/Drive	Yes	High	Short term	Complete	59,000	N/A
<b>Potential / New Mitigation Actions for Consideration</b>						
Sea level Rise Committee formed: Elevation mapping of entire town	Yes	High	Ongoing	Ongoing	10,000	
Public Outreach by Sea Level Committee	Yes	High	Ongoing	Ongoing	1,000	Self-funding

## Appendices

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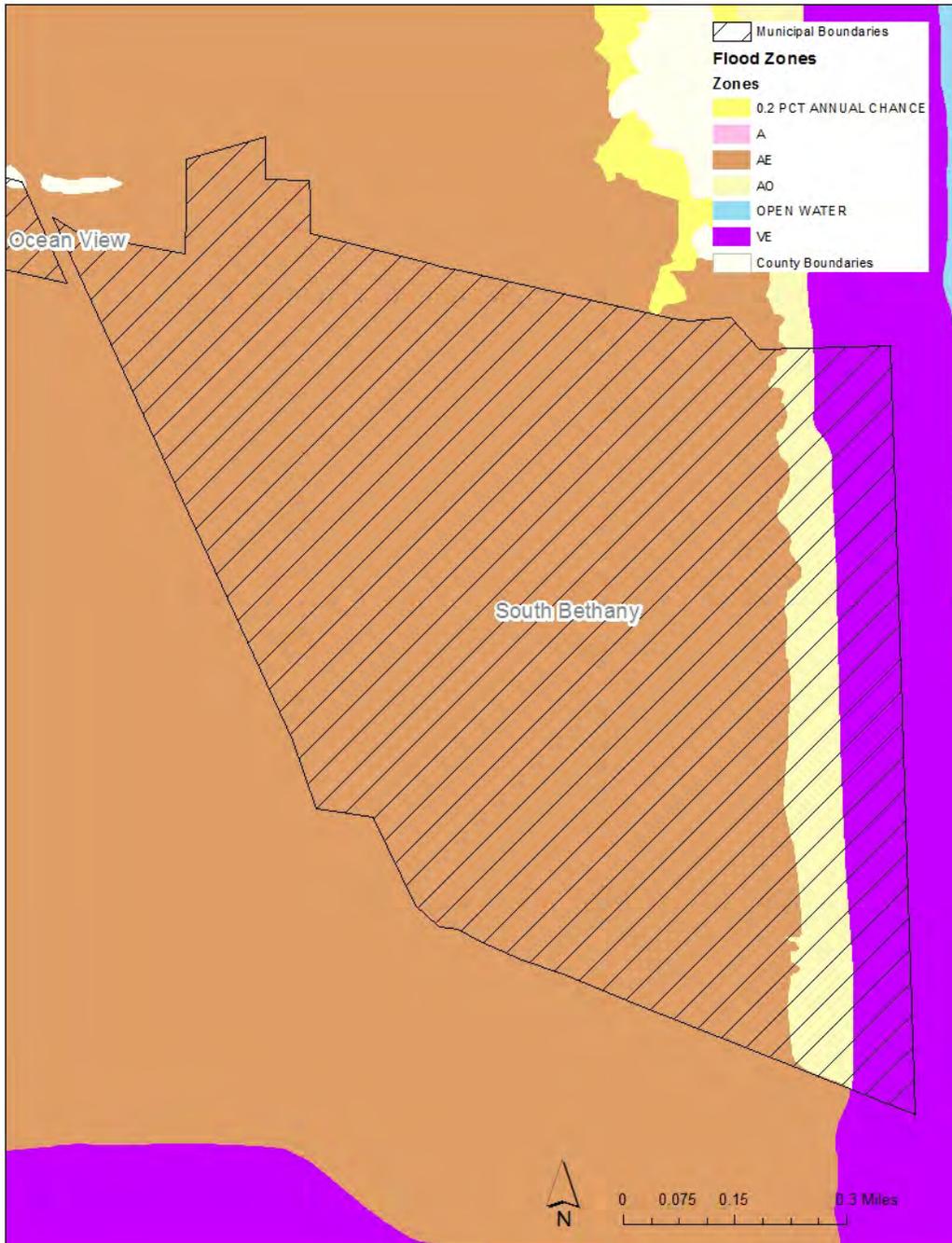
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- **PS:** Private Sector Grants
- **RERP:** Radiological Emergency Response Program

Figure A-22: South Bethany Beach Flood Map



**APPENDIX B: SUPPORTING DOCUMENTATION**

To be inserted with submission to DEMA/FEMA

**APPENDIX C: DESIRED PLAN DATA**

To be inserted with submission to DEMA/FEMA

**APPENDIX D: ADOPTION RESOLUTIONS FOR SUSSEX COUNTY  
AND THE PARTICIPATING MUNICIPALITIES**

To be inserted after approval pending adoption

**APPENDIX E: FORMAL APPROVAL LETTERS FOR SUSSEX COUNTY  
AND THE PARTICIPATING MUNICIPALITIES.**

To be inserted with DEMA/FEMA submission