Passaic County, New Jersey
Multi-Jurisdictional Hazard Mitigation Plan

prepared by:

Passaic County, New Jersey
Office of Emergency Management

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Section 2
Executive Summary

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2.8 Monitoring and Updating the Plan

2.1 Overview

On October 30, 2000, the President signed into law the Disaster Mitigation Act of 2000, also known as DMA 2000. Among its other features, DMA 2000 established a requirement that in order to remain eligible for federal disaster assistance and grant funds, local and state governments must develop and adopt hazard mitigation plans. On February 26, 2002, the Federal Emergency Management Agency (FEMA) published an Interim Final Rule (IFR) that set forth the guidance and regulations under which such plans are supposed to be developed. The IFR provides detailed descriptions of both the planning process that states and localities are required to observe and the contents of the plan that emerges. This Passaic County, New Jersey Multi-Jurisdictional Hazard Mitigation Plan (the Plan) responds to those requirements.

Hazard mitigation is often defined as actions taken to reduce the effects of natural hazards on a place and its population. Passaic County decided to develop this Plan because of increasing awareness that natural hazards, especially flood and wind, have the potential to affect people, physical assets, and operations in Passaic County.

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The purpose of a mitigation plan is to rationalize the process of determining appropriate hazard mitigation actions. The document includes a detailed characterization of natural hazards in Passaic County; a risk assessment that describes potential losses to physical assets, people, and operations; a set of goals, objectives, strategies, and actions that will guide Passaic County mitigation activities; and a detailed plan for implementing and monitoring the Plan.

This Plan focuses on five countywide hazards with the highest potential for damaging physical assets, people, and operations in Passaic County. These hazards are flood, high wind–straight-line winds, earthquake/geological, dam failure, severe storm–winter weather. Both the risk assessment and mitigation action plan sections reflect this emphasis, which was the result of careful consideration by the Passaic County Hazard Mitigation Planning Committee (HMPC).

2.2 Organization of the Plan

The Plan is organized to parallel the structure provided in the IFR. The Plan has 10 sections.

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There are references to the IFR throughout the Plan. Where possible, these provide specific section and subsection notations to aid the review process. The Plan also includes references to the FEMA crosswalk document, which is used in reviewing mitigation plans.

2.3 Hazards and Risks

2.3.1 Hazards

Sections 6 and 7 of this Plan include detailed descriptions of the process that was used to assess and prioritize Passaic County's risks from natural hazards, quantitative risk assessments for Passaic County as a whole, and more detailed assessments for certain asset classes. Sixteen hazards were initially identified and profiled by the HMPC. These are:

- Dam Failure
- Drought
- Earthquake/Geological
- Erosion–Hurricane/Nor'easter/Tropical Storm
- Extreme Temperature–Cold
- Extreme Temperature–Heat
- Flood
- Hail
- High Wind–Straight-line Winds
- High Wind–Tornado

- Ice Storm
- Landslide (non-seismic)
- Severe Storm–Lightning
- Severe Storm–Winter Weather
- Storm Surge–Hurricane/Nor'easter/Tropical Storm
- Wildfire

For each of these hazards, the profiles in Section 6 include:

- Description
- Geographical Extent
- Severity
- Impact on Life and Property
- Occurrence (probability)

After these initial 16 hazards were profiled, the HMPC used an evaluation system with five criteria to reduce the range of hazards to those with the most potential to impact Passaic County. The criteria are also discussed in detail in Section 6. The criteria included: (1) History, (2) Potential for mitigation, (3) Presence of susceptible areas, (4) Data availability, and (5) Federal Disaster Declarations and local emergency declarations.

As a result of this evaluation, the HMPC determined that five hazards present the greatest risk to Passaic County and its residents; flood, high wind–straight-line winds, earthquake/geological, dam failure, severe storm–winter weather. These hazards were further examined to determine the extent of the risk and to start to identify potential projects.

2.3.2 Risks

A risk calculation is a FEMA requirement. Risk is a numerical indication of potential future damages. Although the range of events from winter weather to hurricanes all have some potential to affect the Passaic County area, flood, high wind–straight-line winds, earthquake/geological, dam failure, and severe storm–winter weather are clearly the most significant countywide hazards.

These five countywide hazards were selected for much more detailed assessments and estimations of future damages. Section 7 includes details about calculation methodologies and results of the countywide risk assessment and the results represented in Table 2.3.2-1.

Table 2.3.2-1:
Summary of Countywide Natural Hazard Risks in Passaic County
By Asset and Hazard Type (100-Year Horizon)
(Sources: 2000 US Census, HAZUS)

Hazard	Asset	Risk (100-Year Horizon)	Risk Per SF (1)	Risk Per Capita (2)
Flood	Repetitive loss properties (residential)	$32,287,476	$16.21	$12,966
Flood	Severe repetitive loss properties	$18,306,811	$45.99	$36,760
Flood	Deaths and Injuries	Not Determined	NA	NA
High Wind–Straight-Line Winds	All assets	$200,053,412	$0.93	$409
High Wind–Straight-Line Winds	Deaths and injuries	Not Determined	NA	NA
Severe Storm–Winter Weather	All assets, direct damages (3)	$4,024,497	NA	$14
Severe Storm–Winter Weather	Deaths (monetized) (4)	$1,027,440	NA	NA
Severe Storm–Winter Weather	Injuries (monetized)	$45,664	NA	NA
Dam Failure	All assets, direct damages	See Section 7.3.4	NA	NA
Earthquake/Geological	All assets	$312,476,989	$1.46	$639
Earthquake/Geological	Deaths (monetized)	$1,272,563	NA	NA
Earthquake/Geological	Injuries (monetized)	$48,878,104	NA	NA

Notes: (1) Risk per square foot (SF) estimate for the flood hazard based on average building size of 2,000 SF. Risk per SF for the high wind–straight-line wind and earthquake/geological hazards based on HAZUS estimate of total square footage for the county (See Table 7.3.2-6). (2) Risk Per Capita column based on Passaic County 2000 population from the United States Census Bureau. Flood risk per capita based on household occupancy of 2.5 people per dwelling. (3) Winter storm risks are assumed to be primarily related to damages to public assets and infrastructure, to interrupted services, or to response requirements. (4) Standard FEMA practice is to express deaths and injuries in terms of dollars (monetized) in order that the risks can be compared to other categories that are not related to life safety. For further information, see FEMA Guidance titled *What is a Benefit*? (included on BCA Toolkit version 3.0).

2.4 Goals, Objectives, and Actions

Section 9 of this Plan describes Passaic County's priorities for mitigation actions. The section identifies priorities, and describes estimated costs, sources of funding, responsible parties, and the potential timing of the action. The section also includes Passaic County hazard mitigation goals and objectives.

2.4.1 Passaic County Hazard Mitigation Goals

Goals are general guidelines that explain what Passaic County wants to achieve. Goals are expressed as broad policy statements representing desired long-term results. Passaic County mitigation planning goals include:

1. Improve education and outreach efforts regarding potential impacts of hazards and the identification of specific measures that can be taken to reduce their impact
2. Improve data collection, use, and sharing to reduce the impacts of hazards
3. Improve capabilities, coordination, and opportunities at municipal and county levels to plan and implement hazard mitigation projects, programs, and activities

4. Pursue opportunities to implement projects including mitigation of repetitive and severe repetitive loss properties and other appropriate programs, and activities

Please refer to section 9.2 for more information on goals for the Passaic County Multi-Jurisdictional Hazard Mitigation Plan.

2.4.2 Objectives

Objectives are well-defined intermediate points in the process of achieving goals. (*Objectives* are generally synonymous with *strategies*.) Passaic County mitigation planning objectives include:

- Increase awareness of risks and understanding of the advantages of mitigation by the general public and by local government officials
- Increase local government official awareness regarding funding opportunities for mitigation
- Improve data available to the county and participating communities for use in future planning efforts
- Provide government officials and local practitioners with educational opportunities and information regarding best practices for hazard mitigation planning, project identification, and implementation
- Acquire and maintain detailed data regarding critical facilities such that these sites can be prioritized and risk-assessed for possible mitigation actions
- Continue support of hazard mitigation planning, project identification, and implementation at the municipal and county level
- Support increased participation in the National Flood Insurance Program Community Rating System
- Support increased integration of municipal/county hazard mitigation planning and floodplain management with effective municipal/county zoning regulation, subdivision regulation, and comprehensive planning
- Provide for user-friendly hazard data accessibility for mitigation and other planning efforts and for private citizens
- Provide direct support, where possible to municipal mitigation programs
- Facilitate development and timely submittal of project applications meeting state and federal guidelines for funding for repetitive and severe repetitive loss properties and hardening/retrofitting infrastructure and critical facilities with highest vulnerability rankings
- Maintain and enhance local regulatory standards including full and effective building code enforcement, floodplain management, and other vulnerability-reducing regulations

Please refer to section 9.2 for more information on objectives for the Passaic County Hazard Mitigation Plan.

2.4.3 Actions

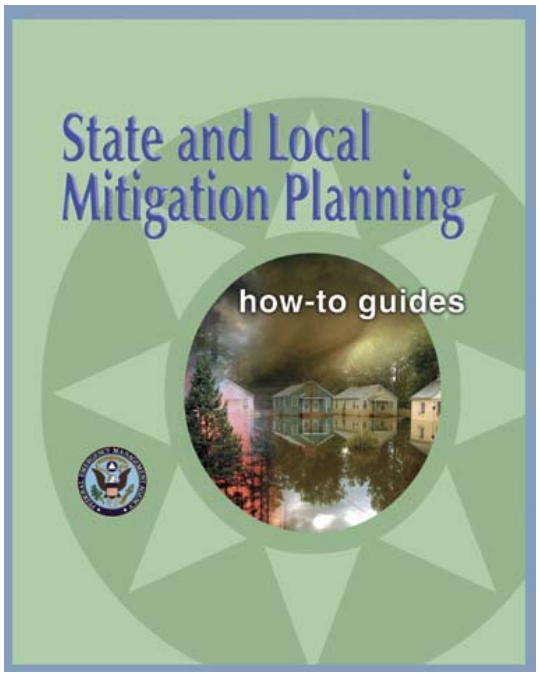
Action Items are the specific steps (projects, policies, and programs) that advance a given objective. They are highly focused, specific, and measurable. Passaic County mitigation actions include, but are not limited to:

- Acquisition of flood prone properties in Hawthorne Borough
- Create a Public Warning/Alert System for Haledon Borough
- Elevation of critical facilities in the City of Passaic
- Assess risk to Yahn's Dam in North Haledon Borough
- Improve storm water conveyance at Goffle Brook in Hawthorne Borough
- Engineering study to assess risk to Passaic Valley Sewage Pumping Station in the City of Clifton
- Install backup power at an emergency shelter in Bloomingdale Borough

The above list is intended to be illustrative of the overall action items, rather than an exhaustive list. Please refer to Section 9.3.3 for more information on municipality specific mitigation actions.

2.5 Planning Process

Section 5 provides details about the process that was used to develop this Plan. The process closely followed the guidance in the FEMA *386* series of planning guidance, which recommend a four-stage process for developing mitigation plans.



- Step 1 Organize resources
- Step 2 Assess risks
- Step 3 Develop a mitigation plan
- Step 4 Implement the plan and monitor progress

Step 1, organizing resources, is described in Section 5 (Planning Process). The section includes details about who was involved, the processes that were used to establish leadership and advisory groups, and public and other outreach and involvement efforts.

Step 2, the risk assessment, was completed by the HMPC. The Risk Assessment is included as Section 7 of the Plan, and is preceded by a separate hazard identification and profiling discussion in Section 6.

Step 3, development of the Mitigation Plan is described in Section 5 (Planning Process) and Section 9 (Mitigation Action Plan). Section 5 includes details about who was involved, the processes that were used, and the products that were developed. Section 9 includes specific details about the identification and development of mitigation goals, objectives, and actions based upon Section 7 (Risk Assessment) and Section 8 (Capability Assessment).

Step 4, implementing the Plan, is described in Section 9 (Mitigation Action Plan), which includes details about who is responsible for implementation of specific strategies and actions; and in Section 10 (Plan Monitoring and Maintenance), which describes long-term implementation through periodic updates and reviews.

2.6 Adoption and Approval

The Passaic County Office of Emergency Management (PCOEM), with the endorsement of the HMPC was responsible for recommending plan approval to the Passaic County Board of Chosen Freeholders. Consistent with that recommendation, the Passaic County Board of Chosen Freeholders approved this Hazard Mitigation Plan on August 12, 2010. Following adoption, the Plan was submitted to FEMA Region II. FEMA reviewed and approved the Plan on July 30, 2010. Subsequently, the participating municipalities also adopted the Plan, submitted their adoption resolutions to FEMA, and received their own approval notifications (see Appendices H and I).

The following 16 municipalities, along with PCOEM and other county departments, actively participated and will adopt the Plan. This includes all the incorporated municipalities in the county.

- Bloomingdale Borough
- Clifton City
- Haledon Borough
- Hawthorne Borough
- Little Falls Township (*)
- North Haledon Borough
- Passaic City
- Passaic County
- Paterson City
- Pompton Lakes Borough
- Prospect Park Borough
- Ringwood Borough
- Totowa Borough
- Wanaque Borough
- Wayne Township (*)
- West Milford Township
- Woodland Park Borough

(*) Little Falls and Wayne Townships have developed local hazard mitigation plans. However, these jurisdictions also will adopt the Plan and participate with Passaic County as part of the multi-jurisdictional plan for future updates. :

It is important to note that this represents 100% participation by municipalities in Passaic County.

2.7 Implementation

The implementation process is described as part of the specific actions in the Mitigation Action Plan in Section 9.

2.8 Monitoring and Updating the Plan

Section 10 (Plan Monitoring and Maintenance) describes the schedule and procedures for ensuring that the Plan stays current. The section identifies when the Plan must be updated, who is responsible for monitoring the Plan, and ensuring that the update procedures are implemented. This section provides a combination of cyclical dates (oriented toward FEMA requirements) and triggering events that will initiate amendments and updates to the Plan. The PCOEM is responsible for monitoring the Plan and initiating the cyclical update process. The point of contact at Passaic County is:

Maryann Trommelen
Passaic County Office of Emergency Management
Public Safety Academy
300 Oldham Road
Wayne, NJ 07470
973-904-3621

Section 3
Context

Contents of this Section

3.1 Introduction
3.2 Geography, Climate, and Population of Passaic County
3.3 The New Jersey State Hazard Mitigation Plan Update
3.4 Federal Planning Requirements
3.5 Key Terms

3.1 Introduction

The recommendations in the Passaic County Multi-Jurisdictional Hazard Mitigation Plan (the Plan) are based in large part on identification of past and potential problems due to natural hazards. As part of the process of identifying potential problems, it is useful to understand the physical characteristics of Passaic County. It is also important to understand any related planning efforts by the New Jersey Office of Emergency Management (NJOEM), as well as requirements of the federal government regarding hazard mitigation plans. In addition, this section provides definitions for key terms used throughout the Plan.

3.2 Geography, Climate, and Population of Passaic County

3.2.1 Geography

Passaic County is located in northern New Jersey and is surrounded by Bergen, Morris, Essex and Sussex counties. The land area of Passaic County is 197 square miles, and it is home to 16 municipalities. The county contains urban, suburban, and rural settings, ranging from the developed urban centers of the cities of Paterson and Passaic to the sparsely developed Highlands region, with its mountains and lakes located in the townships of West Milford and Ringwood.

Passaic County is located in the US Census-defined New York-New Jersey Metropolitan Statistical Area. It is located 11.5 miles from the George Washington Bridge, 13 miles from the Lincoln Tunnel, and 17 miles from the Holland Tunnel. Because of its central location, Passaic County boasts easy accessibility by automobile, bus, freight, passenger train, and air from the Tri-State Region. The county is at the crossroads of a number of New Jersey's major interstate highways (routes 80, 287, 3, 20, 21, 23, 46, the Garden State Parkway and the New Jersey Turnpike), which link the county to New York, Pennsylvania, and Connecticut. The county's location also provides ready accessibility to three international airports (Newark Liberty, LaGuardia, and John F. Kennedy) along with major international shipping ports (Port Newark and the Elizabeth Marine Terminal). Major freight rail service includes Norfolk Southern and New York, Susquehanna & Western.[1]

[1] Passaic County Fast Facts. 12 October 2008. http://www.passaiccountynj.org/Departments/Economic_Development/PDF/Demographics.pdf

Figure 3.2.1-1: Passaic County Map

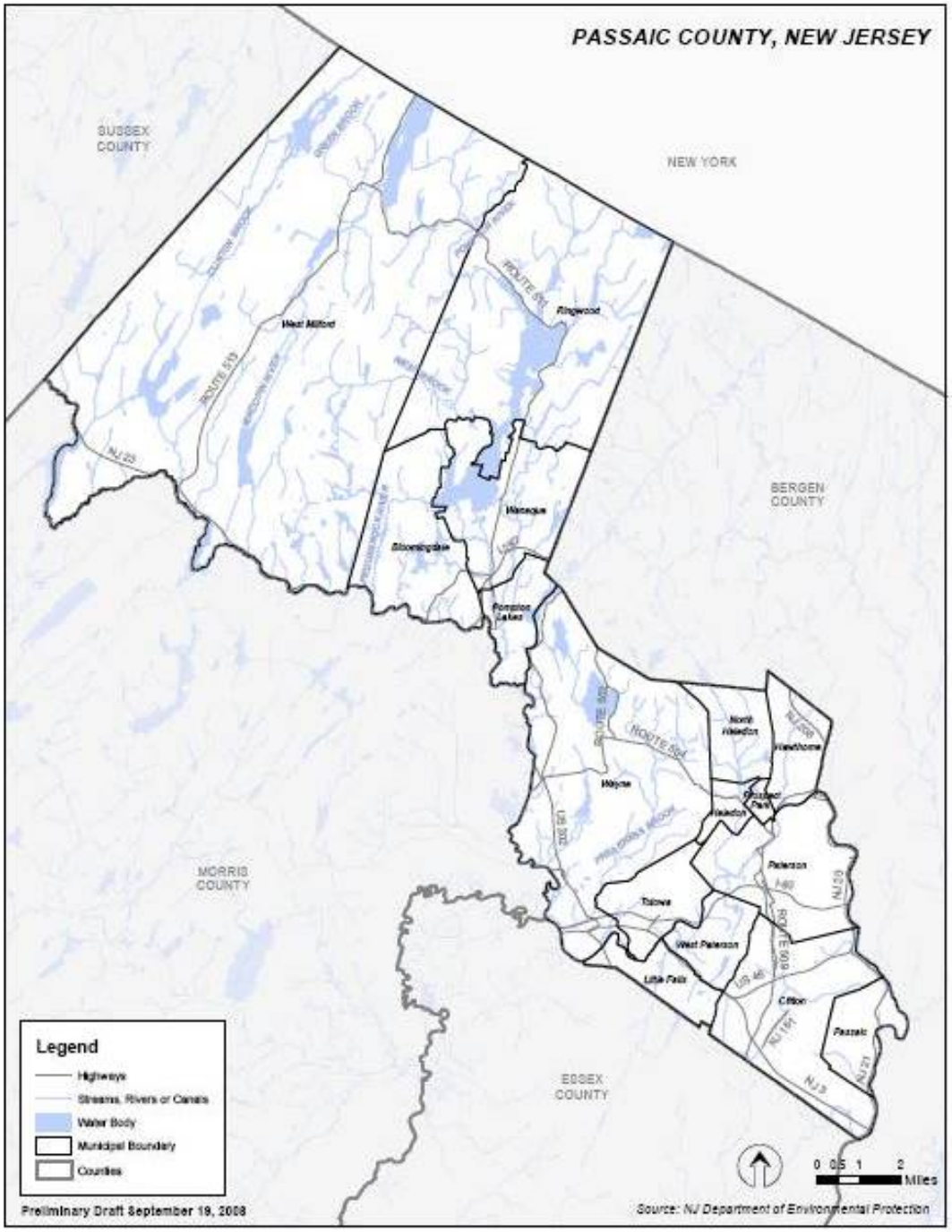
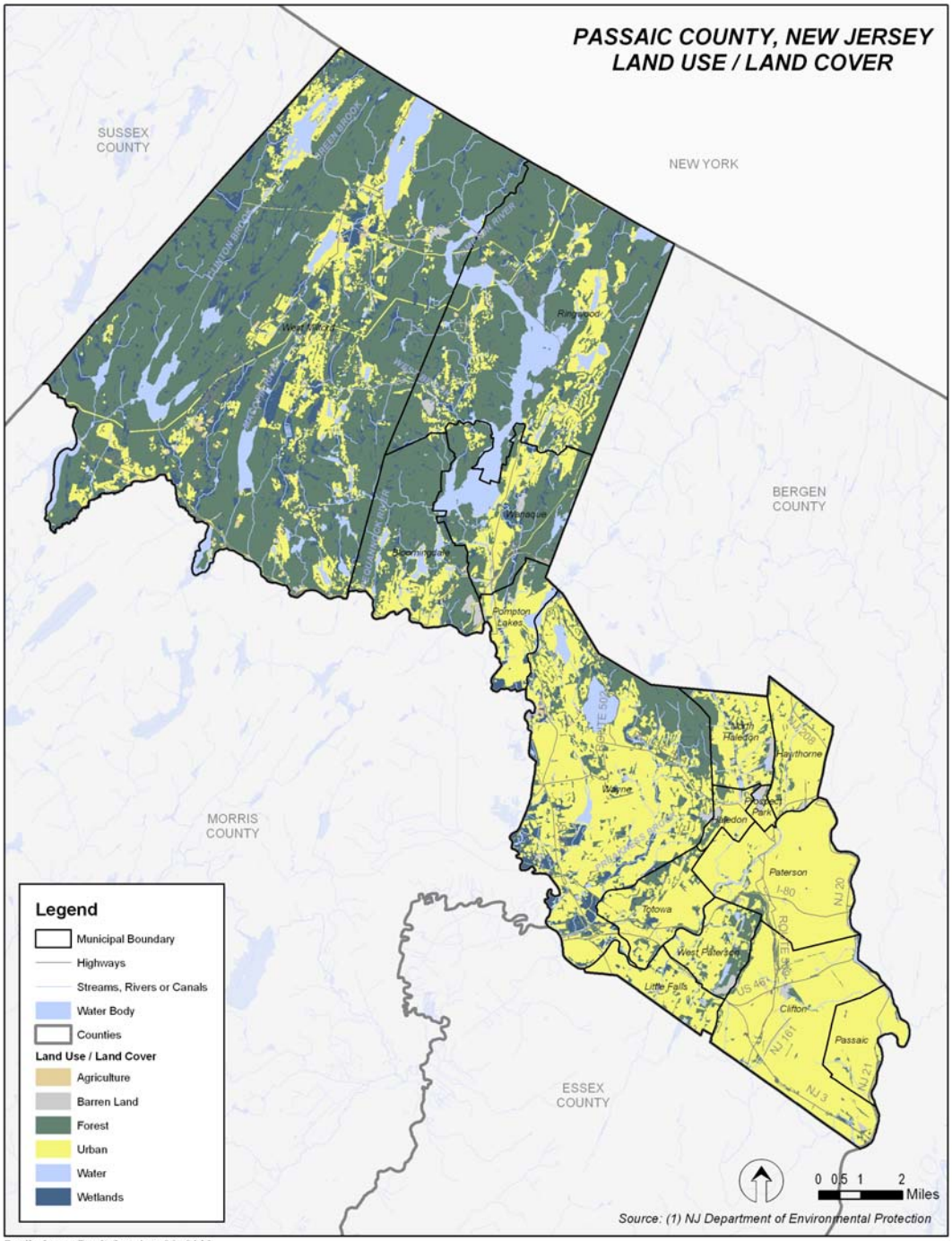


Figure 3.2.1-2: Passaic County Land Use/Land Cover Map



Preliminary Draft October 22, 2008

As shown in Figure 3.2.1-2, land use in the county is primarily forest or urban, (49% and 36%, respectively). Other land use types are wetlands (7%), water (7%), barren (1%), and agriculture (<1%).

3.2.2 Climate

Passaic County's average high temperature arrives in July at 84.1°F, and the average low of 18.4°F takes place in January. The temperature is rarely below 0°F or above 100°F. Precipitation is evenly distributed throughout the year. Passaic County receives on average 48.78" of rain a year.[2] Spring and summer frontal systems can produce high rainfall amounts and spawn tornados. Tropical storm systems can affect the northern Atlantic seaboard from late summer to late fall.

3.2.3 Population

The population of Passaic County has increased in recent years. As shown in Table 3.2.3-1, the population has increased 9.7% between 1990 and 2006.

Table 3.2.3-1: United States Census-Passaic County New Jersey Population
(Sources: 1990, 2000 Census; 2006 American Community Survey)

	1990	2000	2006
Population	**453,060**	**489,049**	**497,093**

Building and development permit activity over the last few years (see Table 3-2) have remained steady. The total permits issued between 2004 and 2006 account for 46% of all permits issued between 2000 and 2006.

Table 3.2.3-2: Passaic County Building Permits and Development Permits, 2004-2006
(Source: New Jersey One Stop Career Center)

Development Review Type	2004	2005	2006
Total	763	647	850
Single	437	230	375
Multi-family	326	417	475

[2] Monthly Station Norms at Wanaque Dam. 12 October, 2008. http://climate.rutgers.edu/stateclim_v1/norms/monthly/index.html

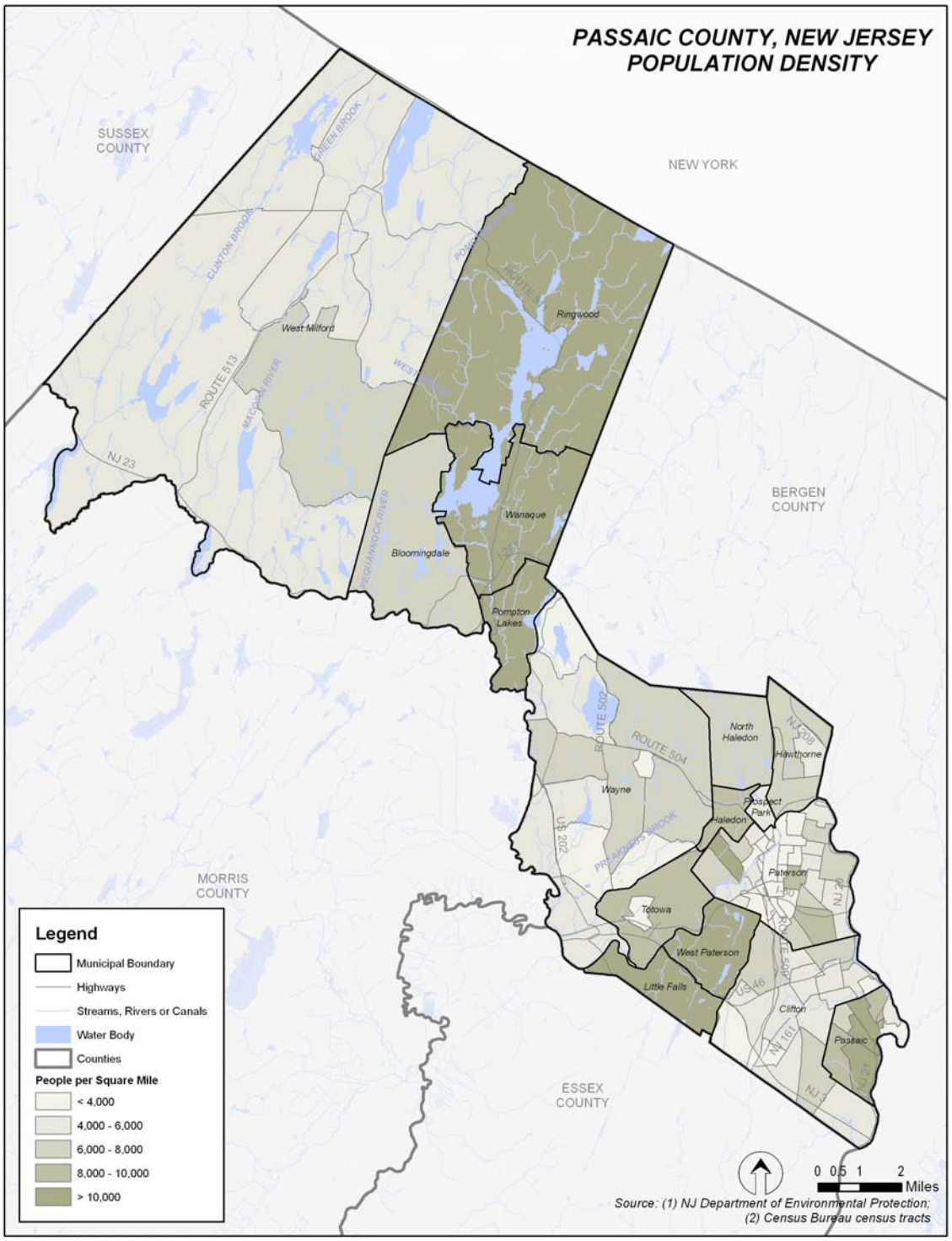
A breakdown of the population of Passaic County as collected by the United States Census is compiled in the Table 3.2.3-3:

Table 3.2.3-3
United States Census Population Characteristics for Passaic County New Jersey, 2006
(Source: 2006 Census: American Factfinder)

General Characteristics	Passaic County	New Jersey	United States
Total population	497,093	5,871,240	299,398,485
Male (%)	48.7%	48.8%	49.2%
Female (%)	51.3%	51.2%	50.8%
Median Age	36.0	38.2	36.4
Under 5 years (%)	7.5%	6.4%	6.8%
18 years and over (%)	73.8%	76.0%	75.4%
65 years and over (%)	11.7%	12.9%	12.4%
Housing Characteristics	**Passaic County**	**New Jersey**	**United States**
Total housing units	171,539	3,472,782	126,311,823
Occupied housing units (%)	92.9%	90.3%	88.4%
Owner-occupied housing units (%)	55.1%	67.3%	67.3%
Renter-occupied housing units (%)	55.1%	32.7%	32.7%
Vacant housing units (%)	7.1%	9.7%	11.6%
Social Characteristics	**Passaic County**	**New Jersey**	**United States**
High school graduate or higher (population 25 years and over)	80.0%	86.1%	84.1%
Bachelor's degree or higher (population 25 years and over)	23.5%	33.4%	27.0%
Disability status (population 5 years and over)	12.6%	12.3%	15.1%
Foreign born	27.9%	20.1%	12.5%
Economic Characteristics	**Passaic County**	**New Jersey**	**United States**
In labor force (population 16 years and older)	64.8%	66.2%	65.0%
Median household (in 2006 inflation-adjusted dollars)	$49,940	$64,470	$48,451

There are a few notable differences between Passaic County, the rest of New Jersey, and the United States as a whole. For instance, although Passaic County has a median household income 3.1% higher than the national average, it is 22.5% below the New Jersey average.

Figure 3.2.3-1
Population Density by Census Tract, Passaic County Map



3.2.4 Special Consideration Communities

It is important to determine if any municipalities within the county would qualify as *Special Consideration Communities.* Special Consideration Communities are often eligible for grants for hazard mitigation and other community improvements on a preferential basis or with less stringent requirements for the non-federal, local share of grants.

The federal government defines a Special Consideration Community as one with 3,000 or fewer individuals that is a rural community, and is not within the corporate boundaries of a larger municipality. To be categorized as a Special Consideration Community, a municipality must be economically disadvantaged, with residents having an average per capita annual income not exceeding 80% of the national per capita income based on best available data. Further, Special Consideration Communities must have a local unemployment rate that exceeds–by one percentage point or more–the most recently reported average national unemployment rate.

Four Passaic County municipalities have lower per capita incomes than the threshold, but all exceed the population threshold and/or would be considered urban areas. Although these municipalities do not qualify for the federal definition of Special Consideration Community, these circumstances are considerations for implementation strategies for these communities. Identification and further statistical information regarding these communities is available from the Passaic County Office of Emergency Management (PCOEM).

3.3 The New Jersey State Hazard Mitigation Plan Update

On April 28, 2008 NJOEM received approval from FEMA for the New Jersey State Hazard Mitigation Plan Update (SHMPU). NJOEM describes the plan and its purpose as follows (http://www.state.nj.us/njoem/mitigation-plan08.html):

"The purpose of the State Hazard Mitigation Plan Update is to rationalize the process of identifying and implementing appropriate hazard mitigation actions. … The present plan update document [2008] constitutes a comprehensive re-write of the original 2005 document. …"

"The development of state and local multi-hazard mitigation plans is key to maintaining eligibility for future Pre-Disaster Mitigation (PDM) funding for:

- Property acquisition or relocation of hazard prone property for conversion to open space in perpetuity;
- Structural and non-structural retrofitting … ;
- Minor structural hazard control or protection projects … ;
- Localized flood control projects, such as certain ring levees and floodwall systems, ..."

"The document includes:

- Characterization of natural hazards statewide, including occurrences, impacts, and probability
- Vulnerability assessment and loss estimation
- Identification of jurisdictions most at risk
- Goals, objectives, strategies and actions that will guide the state's mitigation activities
- A comprehensive evaluation of progress towards achieving the original 2004 goals, strategies, and actions
- A process for implementing and monitoring the Plan"

"The state provides assistance and guidance to local jurisdictions for developing their hazard mitigation Plans. … Information from the state and local Plans is linked and integrated, and … the state prioritizes funding opportunities for local jurisdictions."

Wherever possible, the Plan has incorporated information and recommendations consistent with the New Jersey State Hazard Mitigation Plan Update.

3.4 Federal Planning Requirements

According to the federal rules describing the Disaster Mitigation Act of 2000 (FR 8848, Feb. 26, 2002, as amended at 67 FR 61515, Oct. 1, 2002), "The local mitigation plan is the representation of the jurisdiction's commitment to reduce risks from natural hazards." Local plans serve "as a guide for decision makers as they commit resources to reducing the effects of natural hazards. Local plans will also serve as the basis for the state to provide technical assistance and to prioritize project funding."

Relevant federal planning requirements include establishing minimum standards for grant program eligibility and outlining a planning process.

3.4.1 Grant Program Eligibility

The various federal mitigation grant programs and their eligibility related planning requirements are listed below:

Hazard Mitigation Grant Program (HMGP)
According to 44 CFR §201.3, "For disasters declared after November 1, 2004, a local government must have a mitigation plan approved pursuant to this section in order to receive HMGP project grants."

Pre-Disaster Mitigation (PDM)
According to 44 CFR §203, "By November 1, 2003, local governments must have a mitigation plan approved pursuant to this section in order to receive a project grant through the PDM program, authorized under Section 203 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, 42 U.S.C. 5133. PDM planning grants will continue to be made available to all local governments after this time to enable them to meet the requirements of this section."

Flood Mitigation Assistance (FMA)
According to 44 CFR §78.4, "To be eligible for Project Grants, an eligible applicant will develop, and have approved by the FEMA Regional Director, a Flood Mitigation Plan in accordance with §78.5."

Severe Repetitive Loss (SRL)
According to the 2008 SRL guidance, "all subapplicants must have a FEMA-approved hazard mitigation plan by the application deadline to be eligible to receive project grant funding under the SRL program."

Public Assistance (PA)
State and local governments are eligible to receive assistance in the *emergency* categories of the FEMA Public Assistance Program (Categories A and B). However, an approved state hazard mitigation plan is required for any applicant, state or local, to be eligible to obtain funding assistance for any categories of *permanent work* under PA [Categories C through G].

According to 44 CFR §206.226, "In order to receive assistance under this section, as of November 1, 2004 (subject to 44 CFR 201.4(a)(2)), the state must have in place a FEMA approved State Hazard Mitigation Plan Update in accordance with 44 CFR part 201."

3.4.2 Planning Process Requirements

The following excerpts from the Interim Final Rule (IFR) outline the required planning process. The process used to develop this Plan for Passaic County is consistent with these requirements.

"Multi-jurisdictional plans may be accepted … as long as each jurisdiction has participated in the process and has officially adopted the plan. Statewide plans will not be accepted as multi-jurisdictional plans."

"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, 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 plan shall include the following:

(1) Documentation of the *planning process* [see Section 5 of this Plan, plus appendices] used to develop the plan …
(2) A *risk assessment* [see Sections 6 and 7 of this Plan, plus appendices] that provides the factual basis for activities proposed in the strategy to reduce losses from identified hazards. … The risk assessment shall include:
   (i) A description of the type, location, and extent of all natural hazards that can affect the jurisdiction. …
   (ii) A description of the jurisdiction's vulnerability to the hazards described. …
   (iii) For multi-jurisdictional plans, the risk assessment section must assess each jurisdiction's risks where they vary from the risks facing the entire planning area.
(3) *A mitigation strategy* [see Section 9 of this Plan, plus appendices] that provides the jurisdiction's blueprint for reducing the potential losses identified in the risk assessment. … This section shall include:
   (i) A description of mitigation goals, …
   (ii) A section that identifies and analyzes a comprehensive range of specific mitigation actions and projects, …
   (iii) An action plan describing how the actions … will be prioritized, implemented, and administered by the local jurisdiction. …
   (iv) For multi-jurisdictional plans, there must be identifiable action items specific to the jurisdiction requesting FEMA approval or credit of the plan.
(4) A *plan maintenance process* [see Section 10 of this Plan, plus appendices] that includes:
   (i) A section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle.
   (ii) A process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms …
   (iii) Discussion on how the community will continue public participation in the plan maintenance process.

(5) *Documentation* [see Section 4 of this Plan, plus appendices] that the plan has been formally adopted by the governing body of the jurisdiction requesting approval of the plan … For multi-jurisdictional plans, each jurisdiction requesting approval of the plan must document that it has been formally adopted.

This Plan further details and explicates federal requirements for each section of the Plan by quoting the requirements in their entirety at the start of each section.

The federal requirements continue, "Plans must be submitted to the State Hazard Mitigation Officer for initial review and coordination. The state will then send the plan to [the FEMA Region II office] for formal review and approval. The regional review will be completed within 45 days after receipt from the state, whenever possible.

"Plans must be reviewed, revised if appropriate, and resubmitted for approval within five years in order to continue to be eligible for HMGP funding."

3.5 Key Terms

100-Year Flood: The flood event that has a 1% chance of being equaled or exceeded each year (see also BFE, SFHA). Thus, the 100-year flood could occur more than once in a relatively short period of time. The 100-year flood, which is the standard used by most federal and state agencies, is used by the National Flood Insurance Program (NFIP) as the standard for floodplain management and to determine the need for flood insurance.

500-Year Flood: The flood event that has a .02% chance of being equaled or exceeded each year.

Base Flood Elevation (BFE): The height at which there is a 1% change or greater of flooding in a given year (see also 100-year flood, SFHA). The BFE is used for flood insurance policy rating. An Advisory Base Flood Elevation (ABFE) is issued when new elevations are being established but have yet to be adopted.

Disaster Mitigation Act of 2000 (DMA 2000): This legislation established a requirement that jurisdictions nationwide must develop and implement natural hazard mitigation plans in order to remain eligible for various FEMA grant programs, including those that provide funding for hazard mitigation projects.

Federal Insurance Administration (FIA): A division of FEMA responsible for administering the flood insurance aspects of the NFIP.

Flood Insurance Rate Map (FIRM): The official map of a community for which FEMA has delineated both the special hazard areas (100-yr floodplain) and the risk premium zones applicable to the community.

Flood Insurance Study (FIS): A study that is produced by FEMA and evaluates flood hazard areas, describes its causes, and identifies flood protection measures. Depending on the area studied, the FIS may include water surface elevations. An FIS is developed in conjunction with a Flood Insurance Rate Map (FIRM).

Fujita Scale: The Fujita Scale measures tornado damage severity by assigning numerical values based on wind speeds. Tornadoes are categorizes from 0 to 5 depending on wind speeds. The letter "F" often precedes the numerical value.

Local Coordinators: Individuals that each municipality is required to have identified in order to coordinate and carry out emergency management functions.

Hazard Mitigation Grant Program (HMGP): Provides grants to states and local governments to implement long-term hazard mitigation measures after a major disaster declaration. The purpose of the HMGP is to reduce the loss of life and property due to natural disasters and to enable mitigation measures to be implemented during the immediate recovery from a disaster. The HMGP is authorized under Section 404 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act.

Hazard Mitigation Planning Committee: Committee comprised of a cross section of individuals from emergency management, government, and non-government entities to guide the planning process.

HMGP Expanded Mitigation Strategies Planning Grant Pilot (the Pilot): After hurricanes Katrina, Rita, and Wilma in 2005, FEMA developed a process that expanded the allowable scope of mitigation planning activities that are funded through the HMGP. The Pilot provides funds for eligible HMGP Applicants to identify and plan feasible mitigation projects, and incorporate those projects into their Mitigation Plans. The purpose of the Pilot is to utilize the mitigation planning strategies identified during the Plan Update to implement actual mitigation projects as part of the long-term disaster recovery.

National Flood Insurance Program (NFIP): A federal program enabling property owners in participating communities to purchase insurance protection against losses from flooding. This insurance is designed to provide an insurance alternative to disaster assistance to meet the escalating costs of repairing damage to buildings and their contents caused by floods.

New Jersey Office of Emergency Management (NJOEM): New Jersey state agency responsible for the comprehensive planning for and responding to all manner of disasters, whether man-made or natural. NJOEM may also be requested to provide consequence management for large special events.

Palmer Drought Index: This index was developed by Wayne Palmer in the 1960s and uses temperature and rainfall information in a formula to determine dryness. It has become the semi-official drought index. The Palmer Index is most effective in determining long term drought.

Sea Lake and Overland Surges from Hurricanes (SLOSH) Model: Computer modeling software used to model storm surge heights from historical or hypothetical storms. The model can be used to estimate storm surge heights and winds by considering the pressure, size, forward speed, track, and winds.

Special Flood Hazard Area (SFHA): A high risk area defined as any land that would be inundated by a flood having a 1% chance of occurring in any given year (see also BFE, 100-year flood). The SFHA is commonly identified on NFIP Flood Insurance Rate Maps (FIRMs). A structure located within a SFHA shown on a FIRM has a 26% chance of suffering flood damage during the term of a 30-year mortgage.

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Section 4
Adoption and Approval

Contents of this Section

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4.2 Authority
4.3 Adoption and Approval Procedure
4.4 Adoption Resolutions
4.5 Approval Letters

4.1 Interim Final Rule Requirement for Adoption and Approval

Requirement §201.6(c)(5): *[The local hazard mitigation plan shall include] documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval of the plan (e.g., City Council, County Commissioner, Tribal Council). For multi-jurisdictional plans, each jurisdiction requesting approval of the plan* ***must*** *document that it has been formally adopted.*

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.*

4.2 Authority

In the State of New Jersey, counties are empowered to manage their own affairs via a governing body known as the Board of Chosen Freeholders. The following is an excerpt from the relevant portion of the New Jersey Statutes Annotated (NJSA 40:20 et seq.)[1]:

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

The board of chosen freeholders of any county which has created the office of county administrator, pursuant to the provisions of NJS 40A:9-42, may, by resolution, delegate to that office such executive and administrative powers, duties, functions, and responsibilities as the board may deem appropriate.

[1] New Jersey Office of the Attorney General.

4.3 Adoption and Approval Procedure

On July 30, 2010, the Federal Emergency Management Agency (FEMA) Region II determined that the Plan was "approvable pending adoption." On August 3, 2010, the Passaic County Hazard Mitigation Planning Committee met and recommended that Passaic County and the participating municipalities should adopt the Plan. The Plan was submitted to the Passaic County Board of Chosen Freeholders as well as the appropriate entity for each participating municipality for review and adoption. The resulting Adoption Resolutions were then submitted to FEMA Region II for approval. FEMA subsequently issued formal approval letters to New Jersey Office of Emergency Management (NJOEM) for Passaic County and each participating municipality that adopted the Plan. NJOEM, in turn issued approval letters to the approved jurisdictions.

4.4 Adoption Resolutions

Appendix H contains the signed Adoption Resolutions for Passaic County and the participating municipalities.

4.5 Approval Letters

Appendix I contains the formal Approval Letters for Passaic County and the participating municipalities.

Section 5
Planning Process

Contents of this Section

5.1 Interim Final Rule Requirement for the Planning Process
5.2 Description of the Planning Process
5.3 Involvement by the Public and Other Interested Parties
5.4 Review and Incorporation of Plans, Studies, Reports, and Other Information

5.1 Interim Final Rule Requirements for the Planning Process

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

Requirement §201.6(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.

5.2 Description of the Planning Process

5.2.1 How the Plan was Prepared (Overview)

The Passaic County Multi-Jurisdictional Hazard Mitigation Plan was prepared in accordance with the process established in the *State and Local Mitigation Planning How-to Guides* (FEMA Publication Series 386) produced by the Federal Emergency Management Agency (FEMA), and the requirements of the February 26, 2002 Interim Final Rule (IFR). The process established in the FEMA 386 guides includes four basic steps.

- Step 1: Organize resources
- Step 2: Assess risks
- Step 3: Develop a mitigation plan
- Step 4: Implement the plan and monitor progress

5.2.2 Step 1: Organize Resources

The Passaic County Office of Emergency Management (PCOEM) was the lead agency for the development of the Plan. In addition, several individuals and organizations worked together to develop the Plan. These participants were organized into the Passaic County Hazard Mitigation Planning Committee (HMPC). At the beginning of the process, a consultant firm, James Lee Witt Associates (JLWA), was hired to provide technical support to Passaic County.

The HMPC was comprised of the county OEM coordinator and all municipal Office of Emergency Management (OEM) coordinators in Passaic County. The HMPC is a function of the municipal emergency coordinators group, which has regular interaction with the PCOEM. In addition to each participating municipality's OEM, the HMPC included representatives from related agencies within the county, and public entities that wished to participate in the planning effort. The duties and responsibilities of the HMPC included: representing their communities' interests, serving as the point of contact for their communities, and completing necessary planning tasks, including data collection, identification of local mitigation actions, and reviewing the Plan products. Table 5.2.2-1 lists the membership of the Passaic County HMPC.

Table 5.2.2-1
Passaic County Hazard Mitigation Planning Committee (HMPC) Members

Name	Organization
Pete Croop	Bloomingdale, New Jersey
Capt. William Henn	Clifton, New Jersey
Scott Wilson	Haledon, New Jersey
Lt. Richard McAuliffe	Hawthorne, New Jersey
Det. Alfred Batelli	Little Falls, New Jersey
Lt. Todd Darby	North Haledon, New Jersey
Lt. Edwin Ramirez	Passaic, New Jersey
Rhonda E. Thompson	Paterson, New Jersey
Al Evangelista	Pompton Lakes, New Jersey
Ed VanderPloeg	Prospect Park, New Jersey
Chief Bernard Lombardo	Ringwood, New Jersey
Allen Del Vecchio	Totowa, New Jersey
Capt. Thomas Norton	Wanaque, New Jersey
Sandy Galacio	Wayne, New Jersey
Ron Svrchek	West Milford, New Jersey
George Galbraith	Woodland Park, New Jersey
Steve Edmond	Passaic County Engineer
Michael LaPlace	Passaic County Planning Director
Michael Lysicatos	Passaic County Senior Planner
Robert A Lyons	Passaic County OEM Director
Maryann Trommelen	Passaic County OEM Deputy Coordinator
Maria Dombayci	Passaic County OEM Specialist
Edward J Murphy	Passaic County DPP
Carl Padula	Passaic County Community College
Anthony DeNova	Passaic County Administrator
Timothy Cunningham	Passaic County Deputy Administrator

Meeting Schedule

There were several meetings conducted during the development of the Plan, shown in Table 5.2.2-2. The meetings focused primarily on the review of work-in-progress for the development of the Plan. However, in some cases, the meetings were essentially working sessions for identification of potential mitigation projects.

Table 5.2.2-2
Committee Meeting Schedule

Date	Meeting	Attendees
September 3, 2008	HM Plan Setup Meeting	Passaic Co OEM, JLWA
September 19, 2008	HMPC Kickoff Meeting	HMPC, JLWA
October 9, 2008	HMPC Meeting	HMPC, JLWA
November 13, 2008	HMPC Meeting	HMPC, JLWA
November 14, 2008	HMPC Meeting	HMPC, JLWA, Members of the Public
December 11, 2008	HMPC Meeting	HMPC, JLWA
January 8, 2009	HMPC Meeting and Public Meeting	HMPC, JLWA, Members of the Public
February 19, 2009	HMPC Meeting	HMPC, JLWA
March 12, 2009	HMPC Meeting	HMPC, JLWA
April 9, 2009	HMPC Meeting and Public Meeting	HMPC, JLWA, Members of the Public
June 18, 2009	HMPC Meeting	HMPC, JLWA
July 16, 2009	HMPC Meeting and Public Meeting	HMPC, JLWA, Members of the Public
August 13, 2009	HMPC Meeting	HMPC, JLWA

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

5.2.3 Step 2: Assess Risks

In accordance with general mitigation planning practice, as well as the process FEMA established in its *How-to Guides*, the risk assessment forms the basis for this Plan by quantifying and rationalizing information about how natural and manmade hazards affect Passaic 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 6 and 7 and Appendices D and E of this Plan. The assessment determined several aspects of the risks of hazards faced by the county and the participating municipalities:

- The natural hazards that are most likely to affect Passaic County
- How often hazards are expected to impact Passaic County
- The expected severity of the hazards
- Which areas of Passaic County are likely to be affected by hazards
- How Passaic County's assets, operations, people, and infrastructure may be impacted by hazards
- How private and commercial assets, operations, infrastructure may be impacted by hazards
- The expected future losses if the risk is not mitigated

The HMPC first identified all hazards with the potential to impact the county. Next, using a rating system (explained in detail in Section 6), the HMPC reduced the initial list of hazards down to the five that were considered the most relevant for this type of planning process at the countywide scale. These hazards are described in the Hazard Identification, Profiling, and Ranking portion of the Plan (Section 6).

As a result of in-depth examination of the characteristics of the reduced list of hazards, the HMPC was able to make qualitative determinations that allowed further refinement of the focus of this Plan to the five most relevant countywide hazards: Flood; High Wind–Straight-Line Winds; Earthquake/Geological; Dam Failure; and Severe Storm–Winter Weather.

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 the public presentations (see Section 5.3). The full process and results of this work is presented in the Risk Assessment portion of this Plan (Section 7).

5.2.4 Step 3: Develop the Mitigation Plan

The HMPC developed a series of goals and objectives in response to the results of the risk assessment. A capability assessment was also conducted to help determine the capacity of Passaic County and the participating municipalities to implement hazard mitigation projects. In addition, the HMPC 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 Action Plan. The Mitigation Action Plan was discussed and validated by the HMPC. The results of these efforts are detailed in Sections 8 and 9.

5.2.5 Step 4: Implement the Plan and Monitor Progress

Finally, the HMPC identified a process for on-going monitoring and revisions to the Plan over the next five years. Section 10 details the resulting monitoring, evaluation, and plan update procedures.

5.3 Involvement by the Public and Other Interested Parties

During the development of this Plan, the public was involved through requesting their participation in four public presentations/meetings, providing drafts of the Plan for their review, and inviting their comments on the contents of the Plan. The public presentations and meetings are detailed in Table 5.3-1. In addition, attendance lists, presentation materials and meeting notes are compiled in Appendix C.2.

Future outreach by Passaic County and municipal coordinators, including proposed public education and work with stakeholders and other interested parties over the next 5 years will improve public involvement for the next Plan update.

Table 5.3-1
Public Involvement

Date	Type of Involvement	Meeting Location
November 1, 2008	Press release regarding hazard mitigation and Plan development issued	N/A
November 3, 2008	Citizen Survey posted on website[1]	N/A
November 3, 2008	Local Capability Survey posted on website	N/A
November 14, 2008	Public meeting with presentation and open discussion	Passaic County Office of Emergency Management
January 7, 2009	Press release regarding hazard mitigation and Plan development issued	N/A
January 8, 2009	Public meeting with presentation and open discussion	Passaic County Office of Emergency Management
TBD	Public meeting with presentation and open discussion	Passaic County Office of Emergency Management

As part of the development of the Plan, Floodplain Administrators were engaged in Plan development and review in many municipalities. In some cases, the Municipal Coordinator who led work on this Plan was also the Floodplain Administrator for the community. Involvement of Floodplain Administrators in the development of the Plan is shown in Table 5.3-2. Proposed efforts to increase outreach to Floodplain Administrators will result in enhanced participation in the next Plan update.

Table 5.3-2
Passaic County Floodplain Administrator Involvement

Municipality	Floodplain Administrator Name	Method of Involvement in Plan
Bloomingdale Borough	Peter Croop	Municipal Point of Contact
Clifton City	James Yellen	Not involved in development of the Plan
Haledon Borough	Phil Cheff	Primary contact
Hawthorne Borough	Eric Maurer	Not involved in development of the Plan
Little Falls Township	Joseph Marcones	Not involved in development of the Plan
North Haledon Borough	Phillip Chef	Reviews draft materials for the Plan and works closely with the municipal point-of-contact for the Plan
Passaic City	Jorge Torres	Reviews draft materials for the Plan and works closely with the municipal point-of-contact for the Plan
Paterson City	Fred Margon	Not involved in development of the Plan
Pompton Lakes Borough	Ronald Vandyne	Reviews draft materials for the Plan and works closely with the municipal point-of-contact for the Plan

[1] The Citizen Survey and a summary of responses are included in Appendix F.

Municipality	Floodplain Administrator Name	Method of Involvement in Plan
Prospect Park Borough	Kenney Valt	Not involved in development of the Plan
Ringwood Borough	Jeffrey Yuhas	Not involved in development of the Plan
Totowa Borough	Allen Delveccchio	Municipal Point of Contact
Wanaque Borough	Michael Cristaldi	Not involved in the development of the Plan
Wayne Township	John Szabo	Reviews draft materials for the Plan and works closely with the municipal point-of-contact for the Plan
West Milford Township	Jim Lupo	Not involved in the development of the Plan
Woodland Park Borough	Felix Exposito	Reviews draft materials for the Plan and works closely with the municipal point-of-contact for the Plan

Notes:

1) Passaic County does not include any unincorporated land not governed by municipalities and as a result does not have a floodplain management program per se.

In addition, notice was sent to adjacent jurisdictions and other interested parties that the Draft and Final Plans were available for review prior to adoption by Passaic County and the participating municipalities. Meeting materials and copies of relevant correspondence are included in Appendix C.2 and C.3.

5.4 Review and Incorporation of Plans, Studies, Reports, and Other Information

5.4.1 Federal Government

Selected key federal sources of information and pre-existing planning work are presented in Table 5.4.1-1. Additional sources and detail can be found in Appendix B.

Table 5.4.1-1
Federal Documents and Data Utilized

Existing Program/Policy/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 an history of loss data for multiple hazards
FEMA/National Flood Insurance Program Flood Maps (Flood Insurance Rate Maps, Digital Flood Insurance Rate Maps (DFIRM), “Q3”data)	Used in developing HIRA, strategies, and mitigation actions

Existing Program/Policy/Technical Documents	Method of incorporation into the Plan
FEMA Hazards US (HAZUS) v.1.1	Used in developing various risk assessments and critical facilities inventories
FEMA Benefit Cost Analysis modules	Used in developing various risk assessments
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
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 Hurricane Center-Hurricane Preparedness, Storm Surge	Used in developing HIRA, strategies and mitigation actions
United States Army Corp of Engineers (Philadelphia Office)-New Jersey Hurricane Evacuation Study Transportation Analysis, including storm surge mapping	Used in developing HIRA, strategies and mitigation actions
United States Census Bureau data	Used in developing various risk assessments and establishing planning context
United States Department of Agriculture-New Jersey Eligible Communities	Used in identifying Special Circumstance Communities
Unite States Geological Survey (USGS) National Hazard Seismic Mapping Project	Used in developing HIRA and history of loss data
United States Environmental Protection Agency Toxic Release Inventory	Used in developing hazard identification, strategies, and mitigation actions
United States Department of Transportation Hazardous Materials Incident Data	Used in developing hazard identification, strategies, and mitigation actions

5.4.2 State of New Jersey

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

New Jersey State Hazard Mitigation Plan Update

New Jersey completed the current 2008 State Hazard Mitigation Plan Update (SHMPU) to meet the requirements of IFR Section 201.4(d), which mandates that states update their mitigation plans every three years, “to reflect changes in development, progress in state wide mitigation efforts, and changes in priorities.”

The SHMPU is the demonstration of New Jersey’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 New Jersey, and to aid state and local emergency management officials in developing hazard reduction programs.

It is NJOEM's intent to use the SHMPU as a way to provide data to local and regional governments to support their mitigation planning processes, and to provide guidance on best practices. For each on-going plan development effort, NJOEM attends at least one mitigation core team meeting, one stakeholder meeting, and one public meeting to be a resource to the municipality or county, to answer any questions and to direct planners to state resources or tools. NJOEM staff also is available during the draft plan development to answer any questions or provide guidance and assistance.

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 SHMPU and were utilized in the development of the Passaic County Multi-Jurisdictional Hazard Mitigation Plan.

Other State of New Jersey Information

In addition to the SHMPU, selected state sources of information and pre-existing planning work are presented in Table 5.4.2-1. Additional sources and detail can be found in Appendix B.

Table 5.4.2-1
Other State Documents and Data Utilized

Existing Program/Policy/Technical Documents	Method of incorporation into the Plan
New Jersey Administrative Code-Dam Safety Standards (NJAC: 7-20), Dam Classifications	Used in developing HIRA
New Jersey Geological Survey (NJGS) Map of Landslides in New Jersey	Used in hazard profiling and loss estimation
New Jersey Division of Community Affairs (NJDCA), Division of Codes and Standards-Bulletin No. 3-4 Wind Speed Map	Used in developing HIRA, strategies, and mitigation actions
NJDCA-State Development and Redevelopment Plan	Used in future development analysis
NJDCA, Office of Smart Growth-GIS data.	Used in future development analysis, development of HIRA and strategies
NJDEP, Department of Dam Safety and Flood Control data	Used in developing loss history and HIRA
NJDEP-Landslides in New Jersey report, Landslide Susceptibility/Incidence maps and geodata	Used in developing loss history and HIRA
NJDEP-County Land Use Land Cover data	Used in developing hazard profiling and loss estimation
New Jersey Forest Fire Service-wildfire mapping and data	Used in developing hazard profiling and loss estimation
NJOEM Summary of Presidentially Declared Disasters 1992-2000	Used in developing hazard profiling and loss estimation
NJOEM-Hazard Analysis New Jersey	Used in developing hazard profiling
New Jersey Office of the State Climatologist (at Rutgers University)	Used in developing hazard profiling
NJGS-Earthquake Loss Estimation Study for Passaic County	Used in developing hazard profiling and loss estimation
Workforce New Jersey Public information Network–Residential Building Permits Authorized 2000-2006	Used in establishing planning context and to validate future development analysis

5.4.3 Passaic County

New Jersey 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 the county governmental entities. Counties throughout New Jersey are expected to act in the best interest of, and for the protection of, the citizens residing within the confines of the county. State statutes do give limited authorities to the counties, but the more significant authorities rest with the individual municipalities.

Selected key county sources of information and pre-existing planning work are presented in Table 5.4.3-1. Additional sources and detail can be found in Appendix B.

Table 5.4.3-1
County Documents and Data Utilized

Existing Program/Policy/Technical Documents	Method of incorporation into the Plan
Comprehensive Farmland Preservation Plan (2005)	Used in development of hazard identification
Construction Permits Data	Used in establishing planning context, development of mitigation actions
County GIS database map, soils, storm surge, infrastructure, parcels, land use	Used to validate data used in risk assessment, future development analysis
Critical Facilities Inventory and Data	Used in development of HIRA and mitigation actions
Cross-Acceptance Report (2005)	Used to validate data used in future development analysis
Dams inventory and data	Used in development of HIRA and mitigation actions
Development Review Annual Report (2007)	Used in establishing planning context
Emergency Operations Plan	Used in hazard identification
Photographs of critical facilities	Used in development of risk assessments and mitigation actions
Repetitive Loss /Severe Repetitive Loss (RL/SRL) inventory and data	Used in development of risk assessments and mitigation actions
Website materials (various)	Used in establishing planning context

5.4.4 Municipalities

Upon initiating the plan development process, the PCOEM point of contact made initial contacts to form the HMPC. Concurrent with that effort, all of the local OEM coordinators were made aware of the significance this planning effort. A comprehensive *wish list* of documents, data sources, maps, studies, Emergency Operations Plans, land use data, laws, and ordinances was provided with the task of collecting as much of the items as possible. The HMPC and PCOEM regularly provided guidance and support in this gathering effort through the use of e-mail inquiries, phone contact, and agenda items at the local coordinator meetings.

Selected key municipal sources of information and pre-existing planning work are presented in Table 5.4.4-1. Additional sources and detail can be found in Appendix B.

In some cases, as noted in Table 5.4.4-2, information that may exist at the municipal level was not uniformly provided or available for this initial Plan. During the next 5 years, PCOEM and the municipal coordinators will be taking steps to locate, review and incorporate all the indicated documents in the next Plan update.

Table 5.4.4-1
Municipal Documents and Data Utilized

Existing Program/Policy/Technical Documents	Method of incorporation into the Plan
Critical Facilities inventory and data	Used in development of HIRA and mitigation actions
Dams inventory and data	Used in development of HIRA and mitigation actions
Mitigation 20/20 reports	Used in development of planning context, hazard identification, risk assessment, and critical facilities identification/mitigation actions
RL/SRL inventory and data	Used in development of risk assessments and mitigation actions

Table 5.4.4-2
Complete Inventory (per FEMA Region II "Tool Kit") of Potential Municipal Documents and Data, and Status of Inclusion in Plan

Document or Data (for all Municipalities in Passaic Co.)	Available for Plan	Status of Incorporation in Plan
Comprehensive plans	Y	Reviewed. See Table 5.4.3-1 (reviewed in summary form in Cross Acceptance Report)
Growth Management plans	Y	Reviewed. See Table 5.4.3-1 (reviewed in summary form in Cross Acceptance Report)
Capital Improvement plans	N	To be reviewed (if available) and included in plan update
Flood Damage Prevention Ordinances	N	To be reviewed (if available) and included in plan update
Floodplain Management plans	N	To be reviewed (if available) and included in plan update
Open Space program plans	N	To be reviewed (if available) and included in plan update
Flood Insurance Studies, DFIRMs or engineering studies for streams	N	To be reviewed (if available) and included in plan update
Hazard Vulnerability Analyses (by the local Emergency Management Agency)	Y	Reviewed. See Table 5.4.4-1
Emergency Management Plans/ Emergency Operations Plans	Y	Reviewed. See Table 5.4.3-1
Zoning Ordinances	N	To be reviewed (if available) and included in plan update

Document or Data (for all Municipalities in Passaic Co.)	Available for Plan	Status of Incorporation in Plan
Building Codes	Y	Reviewed. Standard UCC for all of NJ
Drainage Ordinances	N	To be reviewed (if available) and included in plan update
Critical Facilities maps	Y	Reviewed. See Table 5.4.4-1
Existing Land Use maps	Y	Reviewed. See Table 5.4.3-1 (reviewed in summary form in Cross Acceptance Report)
Elevation Certificates	N	To be reviewed (if available) and included in plan update
State plan	Y	Reviewed. See Table 5.4.2.1
HAZUS studies	Y	Reviewed. See Table 5.4.1-1
SLOSH Studies	Y	Reviewed. See Table 5.4.1-1 (USACE Evacuation Study)
Hurricane Evacuation Plans	Y	Reviewed. See Table 5.4.1-1 (USACE Evacuation Study)

5.4.5 Other Resources

Selected other key sources of information and pre-existing planning work, including regional and academic resources, are presented in Table 5.4.5-1. Additional sources and detail can be found in Appendix B.

Table 5.4.5-1
Other Documents and Data Utilized

Existing Program/Policy/Technical Documents	Method of incorporation into the Plan
New Jersey Association of County Tax Boards-parcel data	Used to validate data used in risk assessment
Public Entity Risk Institute-Presidential Disaster Declarations	Used in developing hazard profiling and loss estimation
Right-to-Know Network-biennial reporting, emergency response notification database	Used in developing hazard profiling

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Section 6
Hazard Identification, Profiling and Ranking

Contents of this Section

6.1 Interim Final Rule Requirement for Hazard Identification and Profiling
6.2 Hazard Identification
6.3 Overview of Type and Location of Hazards that can affect Passaic County

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6.3.3 Earthquake / Geological
6.3.4 Erosion – Hurricane / Nor'easter / Tropical Storm
6.3.5 Extreme Temperature – Cold
6.3.6 Extreme Temperature – Heat
6.3.7 Flood
6.3.8 Hail
6.3.9 Hazardous Materials Release – Fixed Site
6.3.10 Hazardous Materials Release – Transportation
6.3.11 High Wind – Straight-line Winds
6.3.12 High Wind – Tornado
6.3.13 Ice Storm
6.3.14 Landslide (non-seismic)
6.3.15 Severe Storm - Lightning
6.3.16 Severe Storm – Winter Weather
6.3.17 Storm Surge– Hurricane / Nor'easter / Tropical Storm
6.3.18 Wildfire

6.4 Methodology for Identifying Hazards of Concern

6.1 Interim Final Rule Requirement for Hazard Identification and Profiling

Requirement §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.*

Note that Appendix D includes general descriptions of all selected hazards that can affect Passaic County. The present section addresses the specific requirements of the IFR with regard to hazards in the planning area.

6.2 Hazard Identification

In accordance with IFR requirements, and as part of its efforts to support and encourage hazard mitigation initiatives, Passaic County's Hazard Mitigation Planning Committee (HMPC) prepared this general assessment of the hazards that have potential to impact the county. The following subsections provide an overview of past hazard events in the county and brief descriptions of the potential for future losses. Section 7 (Risk Assessment) includes much more detailed information about past and potential losses (risk) from a subset of the most significant hazards in Passaic County.

The term "planning area" is used frequently in this section. This term refers to the geographic limits of Passaic County. The Risk Assessment (Section 7) addresses the potential future damages of hazards on Passaic County and its citizens.

Overview of Passaic County's History of Hazards

Numerous federal agencies maintain a variety of records regarding losses associated with natural hazards. Unfortunately, no single source offers a definitive accounting of all losses. The Federal Emergency Management Agency (FEMA) maintains records on federal expenditures associated with declared major disasters. The U.S. Army Corps of Engineers and the Natural Resources Conservation Service collect data on losses during the course of some of their ongoing projects and studies. Additionally, the National Oceanic Atmospheric Administration's (NOAA) National Climatic Data Center (NCDC) database collects and maintains data about natural hazards in summary format. The data includes occurrences, dates, injuries, deaths, and costs.

According to the NCDC database, between 1950 and 2007, Passaic County has experienced the following hazard events.

- 403 wildfires (average of 34 acres burned per year)
- 103 thunderstorm and high wind events (6 exceeding 69 mph)
- 59 floods/flash floods
- 46 winter storms (4 major blizzards/ severe winter storms)
- 20 hail storms (7 of which had hailstones with 1" diameter or greater)
- 11 hurricanes or tropical storms
- 5 extreme heat events
- 4 extreme cold temperature events
- 3 tornadoes (1 F0s and 2 F1s)
- 3 significant lightning events
- 2 ice storms (8 snow/ice events and 1 wintry mix event)
- 2 droughts
- 0 storm surge events (1 coastal flooding event)

In addition to the events recorded in the NCDC database other sources identified three earthquakes, and five partial dam failures. A number of these events caused property damage, injuries, and loss of life.[1] These figures are discussed in more detail in the hazard-specific subsections that follow.

[1] NOAA/NCDCD database

In the absence of definitive data on some of the hazards that may occur in Passaic County, illustrative examples are useful. Table 6.2-1 provides brief descriptions of particularly significant hazard events occurring in the county's recent history. This list is not meant to capture every event that has affected the area, rather lists some of the more significant events that have occurred here in the past.

Passaic County has received nine major Presidential Disaster Declarations and eight Emergency Declarations since 1950. Five of the nine major disaster declarations were the result of significant flooding.[2] The more recent major and emergency declarations, and one non-declared event, are included as part of the summary in Table 6.2-1 below.

Table 6.2-1
Recent Hazards and Declared Emergency and Major Disasters in Passaic County, New Jersey (1992 to 2007)
Sources: NOAA/NCDC; FEMA; and the NJ Office of Emergency Management (NJOEM)

Date & Disaster (DR)	Nature of Event
12/18/1992 (DR-973)	SEVERE STORMS AND INLAND AND COASTAL FLOODING - A major winter storm (Nor'easter) that caused considerable coastal flooding and beach erosion. A total of 12 counties in NJ included as part of the Presidentially Declared Disaster.
3/13/1993 (EM-3106)	SEVERE STORMS AND FLOODING (Emergency Declaration) - Event known as the "Storm of the Century" affected as many as 26 States from Florida to Maine, the Gulf Coast, and the Ohio Valley. One of the most intense nor'easters to ever affect the United States. The "storm of the Century" label was given to the event due to the record low pressure, wind speeds, temperature and snowfall. All 21 counties in New Jersey were included in the Presidentially Declared Disaster.
1/7/1996 (DR-1088)	BLIZZARD - A State of Emergency was declared for the blizzard that hit the State. Road conditions were dangerous due to the high winds and drifts. Both government and contract snow plowing operations were running at a maximum. Local roads were impassable. This blizzard also brought on coastal flooding with the high tides of Sunday evening and Monday morning, and there were reports of damage to dunes and beaches from the heavy wave activity. More than 400 National Guard personnel were activated for transport assistance, primarily for medic missions. In Passaic County snowfall totals ranged from 17-27 inches.
9/16/1999 (DR-1295)	HURRICANE FLOYD (Emergency Declaration) - This downgraded fall hurricane put the entire Eastern Seaboard on flood watch, including every county in New Jersey. Although downgraded from a hurricane by the time it hit New Jersey, the storm lasted approximately 18 hours and resulted in rainfall totals of up to 14.45 inches at Pompton Lakes in Passaic County. The Passaic River at Little Falls was above flood stage of seven feet from the 16th through the 20th, with the crest stage of ten feet occurring on the 17th. The Ramapo River at Pompton Lakes was also above its flood stage of 11.8 ft. from the 16th the 18th. The crest stage of 13.02 ft. occurred early on the 17th. In Passaic County the storm killed an 82 year old man when he drowned in his house from floodwaters.
2/16/2003 (EM-3181)	HEAVY SNOW (Emergency Declaration) - The most powerful storm to affect New Jersey since the Blizzard of 1996. The combination of the very cold temperatures and the approach of a strong storm system caused widespread snow to break out, starting before sunrise on Sunday, February 16th. Snow continued during the day Sunday, heavy at times, and continued into Sunday night. Precipitation continued on Monday, before finally coming to an end on Tuesday. Total snowfall in Passaic County ranged from 18.1 to 28.0 inches. New Jersey requested and was granted a Snow Emergency Declaration for all 21 counties. The President's Day snowstorm tied or set records in all 21 New Jersey counties including Passaic County. Statewide, the event resulted in damages estimated at approximately $30.2 million.

[2] Public Entity Risk Institute – disaster database

Date & Disaster (DR)	Nature of Event
4/2/2005 (DR 1588)	SEVERE STORMS AND FLOODING - On April 2nd and 3rd heavy rains from an intense low pressure system caused widespread flooding throughout northern New Jersey. The NJ Office of Emergency Management (OEM) estimated that the flooding forced 6,000 residents from their homes and caused a total of $60 million in damages. In Passaic County, major flooding occurred along portions of Route 202. Glen Gray Road was completely flooded and Bear Swamp Road was partially flooded. A Presidential Disaster Declaration was issued in 9 New Jersey Counties, including Passaic. The damages in Passaic County were estimated at $12 million.
4/15/2007 (DR 1694)	SEVERE STORMS AND INLAND AND COASTAL FLOODING - A 7-day Nor'easter deluged New Jersey with over nine inches of rain, causing millions of dollars of damage and killing three residents. Statewide damage was estimated at $180 million dollars. Passaic County rainfall ranged from 4.04 inches at Wayne to 8.08 inches at Garrett Mountain. The Passaic River at Little Falls did not fall below flood stage until late on April 23rd.

Weather-Related Deaths and Injuries

According to the NCDC, Passaic County has experienced 19 deaths and 30 injuries from natural hazards in the period from 1950 to 2007.[3]

6.3 Overview of the Type and Location of Hazards that can affect Passaic County

In the initial phase of the planning process, Passaic County's HMPC considered 26 natural and technological hazards and the risks they create for the county and its material assets, operations, and staff. The hazards initially considered are shown in Table 6.3-1.

[3] NOAA/NCDCD database

Table 6.3-1
Preliminary Hazard List - Passaic County

Hazard	Type (1)	Passaic County EOP	NJSHMPU (Draft) (2)	Include in PC HMP?
Civil Disturbance	I			No
Crime	I			No
Dam Failure	**T**	✓		**Yes**
Drought	**N**		✓	**Yes**
Earthquake / Geological (3)	**N**		✓	**Yes**
Economic Crisis	T			No
Enemy Attack / Terrorism	I			No
Erosion – Hurricane / Nor'easter / Coastal Storm	**N**		✓	**Yes**
Extreme Temperature – Cold	**N**		✓	**Yes**
Extreme Temperature – Heat	**N**		✓	**Yes**
Flood (4)	**N**	✓	✓	**Yes**
Hail	**N**		✓	**Yes**
Hazardous Materials Release – Fixed Site	**T**	✓		**Yes**
Hazardous Materials Release – Transportation	**T**	✓		**Yes**
High Wind – Straight-Line Winds (5)	**N**		✓	**Yes**
High Wind – Tornado	**N**		✓	**Yes**
Ice Storm	**N**			**Yes**
Landslide (non-seismic)	**N**			**Yes**
Pandemic Disease / Infestation	B			No
Radiological Incident	T			No
Severe Storm – Lightning	**N**			**Yes**
Severe Storm – Winter Weather	**N**		✓	**Yes**
Storm Surge – Hurricane / Nor'easter / Tropical Storm	**N**		✓	**Yes**
Utility Failure (gas, power, sewer, telecom, water)	T			No
Urban Fire	I			No
Wildfire	**N**		✓	**Yes**

Notes:
1. Type Legend: B = Biological; I = Intentional Acts; N = Natural; T = Technological / Manmade
2. NJSHMPU (Draft) = Draft State of New Jersey Hazard Mitigation Plan Update (approved by FEMA in April 2008).
3. Earthquake / Geological includes effects of surface faulting, ground shaking, earthquake induced landslides and liquefaction
4. Flood includes tidal, flash, sheet, and riverine flooding
5. High Wind – Straight-Line Winds includes winds due to Nor'easters, coastal storms, hurricanes, and severe storms, but not tornadoes

In the initial identification process, the Passaic County HMPC catalogued potential hazards to identify those with the most chance to significantly affect the county. The hazards include those that have occurred in the past and may occur in the future. A variety of sources were used in the investigation. These included national, regional, and local sources such as emergency operations plans, the State Hazard Mitigation Plan, websites, published documents, databases, and maps, as well as discussion with the HMPC.

The Passaic County HMPC reviewed the 26 hazards and determined that 8 of these hazards were the result of intentional acts or were due to biological or technological hazards that were not consistent with traditional hazard mitigation planning and implementation processes. These 8 hazards were referred to the Passaic County Office of Emergency Management for further action as part of appropriate preparedness activities (e.g., emergency operations planning). The remaining 18 hazards, listed below, were selected for inclusion in the Plan by the HMPC.

1. Dam Failure
2. Drought
3. Earthquake / Geological
4. Erosion – Hurricane / Nor'easter / Coastal Storm
5. Extreme Temperature – Cold
6. Extreme Temperature – Heat
7. Flood
8. Hail
9. Hazardous Materials Release – Fixed Site
10. Hazardous Materials Release – Transportation
11. High Wind – Straight-line Winds
12. High Wind – Tornado
13. Ice Storm
14. Landslide (non-seismic)
15. Severe Storm - Lightning
16. Severe Storm – Winter Weather
17. Storm Surge – Hurricane / Nor'easter / Tropical Storm
18. Wildfire

The following section profiles each of the 18 hazards listed above and includes a description of the hazard, location of the hazard, severity of the hazard, impact on life and property, and past occurrences of the hazard.

6.3.1 Dam Failure

Description of the Dam Failure Hazard

A dam is defined by the New Jersey Department of Environmental Protection (NJDEP) as any artificial dike, levee or other barrier that is constructed for the purpose of impounding water on a permanent or temporary basis, that raises the water level five feet or more above the usual, mean, low water height when measured from the downstream toe-of-dam to the emergency spillway crest or, in the absence of an emergency spillway, the top-of-dam[4].

Dam failures can result from a variety of causes including lack of maintenance, seismic activity, improper design or construction, or the effects of large storms. Significant rainfall can quickly inundate an area and cause floodwaters to overwhelm a reservoir. If the spillway of the dam cannot safely pass the resulting flows, water will begin flowing in areas not designed for such flows and failure may occur[5]. See Appendix D for a more detailed description and definition of the dam failure hazard.

[4] New Jersey Department of Environmental Protection (NJDEP)
[5] NJDEP

To prevent, or reduce the probability of a failure, existing dams are periodically inspected by professional engineers. Table 6.3.1-1 summarizes the dam inspection schedule for New Jersey, including Passaic County.

Table 6.3.1-1
New Jersey Dam Inspection Schedule
(Source: NJDEP – Dam Safety and Flood Control)

Dam Class	Regular Inspection	Formal Inspection
Class I Large Dam	annually	once every 3 years
Class I Dam	once every 2 years	once every 6 years
Class II Dam	once every 2 years	once every 10 years
Class III Dam	once every 4 years	only as required
Class IV Dam	once every 4 years	only as required

Location of the Dam Failure Hazard

According to the NJDEP there are a total of 142 dams in Passaic County. The following table lists the dams, including the municipality name, hazard classification, the river or stream the dam is located along, the last inspection date and the name of the dam. The table is ordered by hazard classification which ranks the potential for loss of life and infrastructure and property damages downstream if a dam failure were to occur. The three hazard classifications include high hazard (H), significant (S), and low (L); these are defined at the bottom of the table.

In Passaic County 49 dams are classified as high hazard by the NJDEP - Bureau of Dam Safety and Flood Control. These dams are identified with an “H” under the Hazard Class column in the following table. The New Jersey Department of Environmental Protection database does not include the data points listed as “na” in the table.

Table 6.3.1-2
Inventory of Passaic County Dams, ordered by Hazard Classification
(Source: NJDEP – Bureau of Dam Safety and Flood Control)

Municipality Name	Dam Name	Hazard Class	River/Stream	Height (ft)	Length (feet)	Last Date Inspected
West Milford Township	Upper Mount Glen Lake Dam	H	West Brook	8.2	247	10/19/2007
West Milford Township	Lower Mount Glen Lake Dam	H	West Brook	15	465	10/19/2007
West Milford Township	High Crest Lake Dam	H	Pequannock River-TR	21.5	520	5/4/2007
Bloomingdale Borough	Kampfe Lake Dam	H	Pequannock River-TR	12.5	180	7/20/2007
West Milford Township	New Jersey No Name # 40 Dam	H	Post Brook-TR	15	190	4/20/2004
West Milford Township	River Wall Dam	H	Pequannock River	26	2020	12/21/2006
West Milford Township	Greenwood Lake Dam	H	Wanaque River	17	270	12/5/2006
West Milford Township	Echo Lake Spillway Dam	H	Macopin River	22	260	12/12/2006
West Milford Township	Clinton Reservoir Dam	H	Clinton Brook	55.5	1530	12/12/2006
West Milford Township	Pinecliff Lake Dam	H	Belcher's Creek	15	820	1/18/2007
Bloomingdale Borough	Star Lake Upper Dam	H	Pequannock River-TR	10.5	200	2/11/2008
West Milford Township	Lindy's Lake Dam	H	West Brook-TR	24	649	7/9/2007
West Milford Township	Echo Lake Intake Dam	H	Macopin River	32	370	12/12/2006
West Milford Township	Macopin Reservoir Dam	H	Pequannock River	34	434	12/21/2006
West Milford Township	Charlotteburg Dam	H	Pequannock River	102	675	12/21/2006
West Milford Township	Gordon Lakes Dam	H	Post Brook-TR	12	450	12/11/2006
West Milford Township	Lookover Lake Dam	H	Longhouse Brook	12	150	9/29/2007
West Milford Township	West Milford Lake Dam	H	Long House Creek	16	665	3/12/2007
West Milford Township	Upper Greenwood Lake Dam	H	Long House Brook	20	460	8/5/2006
Ringwood Borough	Monksville Dam	H	Pompton River-TR	150	2170	11/1/2006
North Haledon Borough	Oldham Pond Dam	H	Molly Ann Brook	18	850	8/1/2006
Ringwood Borough	Sallys Pond Dam	H	Ringwood Creek	15	250	10/17/2007
Bloomingdale Borough	Irish Brook Dam	H	Irish Brook	16.5	259	6/6/2007
Bloomingdale Borough	Post Brook Dam	H	Post Brook	14.5	316	6/6/2007
Wanaque Borough	Overflow Weir Dam	H	Wanaque River	30	552	11/1/2006
Wanaque Borough	Wolf Den Dam	H	Wanaque River	55	2160	11/1/2006
Wanaque Borough	Green Swamp #4 Dam	H	Wanaque River	65	300	11/1/2006
Wanaque Borough	Green Swamp #3 Dam	H	Wanaque River	12	135	11/1/2006
Wanaque Borough	Green Swamp #2 Dam	H	Wanaque River	62	1140	11/1/2006
Bloomingdale Borough	Green Swamp #1 Dam	H	Post Brook	30	640	11/1/2006

Municipality Name	Dam Name	Hazard Class	River/Stream	Height (ft)	Length (feet)	Last Date Inspected
Ringwood Borough	Furnace Road Dam	H	Wanaque River	18	730	11/1/2006
Ringwood Borough	Midvale Dam	H	Wanaque River	42	290	11/1/2006
Wayne Township	Pines Lake Dam	H	Haycock Brook	42	127	11/24/2006
North Haledon Borough	Haledon Reservoir Dam	H	Molly Ann Brook	25	625	5/13/2004
Ringwood Borough	Erskine Upper Lake Dam	H	Wanaque River-TR	20	800	1/30/2008
Ringwood Borough	Cupsaw Lake Dam	H	Cupsaw Brook	35	430	8/18/2006
Pompton Lakes Borough	Pompton Lakes Dam	H	Ramapo River	30	290	11/1/2006
Wayne Township	Lionshead Lake Dam	H	Haycock Brook	27	200	1/27/2007
Wanaque Borough	Raymond Dam	H	Wanaque River	188	1603	11/1/2006
Ringwood Borough	Skyline Lake #1 (Lower) Dam	H	Shepard Brook	16	210	8/28/2007
Ringwood Borough	Skyline Lake #2 (Upper) Dam	H	Shepard Brook	24	230	8/28/2007
West Milford Township	Green Turtle Pond Dam	H	Wanaque River-TR	35	305	7/13/2005
Wayne Township	Point View Dam	H	Haycock Brook	55	1100	1/31/2008
Wayne Township	Packanack Lake Dam	H	Packanack Brook	15	2300	9/26/2006
Woodland Park Borough	Highland Lake Dam	H	Slippery Rock Brook	40	104	12/3/2007
Woodland Park Borough	New Street Reservoir Dam	H	Slippery Rock Brook	26	449	6/5/2006
Woodland Park Borough	Great Notch Reservoir Dam	H	Yantecaw Brook	74	460	11/3/2006
Little Falls Township	Cedar Grove North Res Dam	H	Offstream	51	587	11/29/2006
Little Falls Township	Cedar Grove South Res Dam	H	Offstream	51	587	11/29/2006
West Milford Township	Apshawa Main Dam	S	Apshawa Brook	22	500	7/2/2007
West Milford Township	Carpi Lake Dam	S	Morsetown Brook	12.1	300	7/2/2007
West Milford Township	Kitchell Lake Dam	S	West Brook-TR	14.3	475	12/3/2004
West Milford Township	Henion Pond Dam	S	Pequannock River-TR	10	675	11/11/2004
Bloomingdale Borough	Cold Spring Lake Dam	S	Peaquannock RIver	15.5	300	4/20/2007
West Milford Township	Cedar Pond Dam	S	Clinton Brook-TR	8	225	12/27/2006
West Milford Township	Nosenzo Pond Dam	S	West Brook-TR	9	265	9/24/2007
West Milford Township	Hanks Pond Dam	S	Mossmans Brook	14	203	11/21/2006
West Milford Township	Pettet Pond Dam	S	Belcher Creek	10	490	4/24/2007
West Milford Township	Butler Intake Reservoir Dam	S	Apshawa Brook	25	60	9/4/2007
West Milford Township	Apshawa Auxiliary Dam	S	Apshawa Brook	16	132	7/2/2007
West Milford Township	Lake Arcadia Dam #1 Dam	S	Bear Swamp Brook	22	315	10/12/2007
West Milford Township	Lake Arcadia Dam #2 Dam	S	Bear Swamp Brook	17.5	68	10/12/2007
West Milford Township	Forest Hill Park Dam	S	Pequannock River-TR	22	300	12/13/2007

Municipality Name	Dam Name	Hazard Class	River/Stream	Height (ft)	Length (feet)	Last Date Inspected
West Milford Township	Zeliff Pond Dam	S	Posts Brook	16	200	7/19/2004
Wayne Township	Barbour Mill Dam	S	Preakness Brook	13	460	2/2/2006
Wanaque Borough	Stephens Lake Dam	S	High Mountain Brook	12	100	8/2/2004
Wayne Township	Preakness Hills C.C. Dam No. 1	S	na	15	100	8/13/2007
Bloomingdale Borough	Glen Wild Lake Dam	S	Mud Brook	21	700	8/30/2005
Wanaque Borough	Upper Twin Lakes Dam	S	Irish Brook	7	270	1/4/2002
Pompton Lakes Borough	Lower Twin Lakes Dam	S	Post Brook	10	210	11/2/2007
Ringwood Borough	Lake Erskine Dam	S	Wanaque River-TR	10	200	7/18/2006
Wayne Township	Pompton Dam	S	Ramapo River	22.2	1940	5/23/2003
Wayne Township	Beatties Mill Dam	S	Passaic River	19.3	287	4/16/2007
Woodland Park Borough	Barbours Pond Dam	S	Slippery Rock Brook	20	142	1/19/2005
Bloomingdale Borough	Delario Lake Dam	L	Pequannock River	7	95	na
West Milford Township	Clifford Dam	L	Branch of Belcher Creek	12	200	na
West Milford Township	Schaeffer Dam	L	Small Branch Pequannock R	7	170	na
West Milford Township	Carpignano Dam	L	Branch of Belcher Creek	9	150	na
West Milford Township	Pinecrest Lake Dam	L	Branch of Belcher Creek	18	260	na
West Milford Township	Happy Hollow Dam	L	Small Branch Post Brook	na	217	na
West Milford Township	Iona Grove Dam	L	Small Branch Pequannock River	10	72	na
Bloomingdale Borough	Pequannock Rubber Co. Dam	L	Pequannock River	6	160	na
West Milford Township	Lake Sonoma Dam	L	Wanaque River	24	215	12/15/2000
West Milford Township	Boy Scout Lake Dam	L	Wanaque River-TR	8	130	8/30/2007
West Milford Township	Morse Lake Dam	L	na	na	180	na
West Milford Township	Greenwood Pond Dam	L	Pequannock River-TR	na	400	na
West Milford Township	Matthews Pond Dam	L	Posts Brook	8	250	1/6/2002
West Milford Township	Pfeifer Dam	L	Pequannock River-TR	14	300	5/14/2007
West Milford Township	Kay Len Lake Upper Dam	L	Pequannock River	15	120	3/13/2002
West Milford Township	Kay Len Lake Lower Dam	L	Pequannock River	8	80	3/13/2002
West Milford Township	Daniel Dam	L	Pequannock Rier-TR	10	230	5/1/2002
West Milford Township	Cliffwood Lake Dike	L	Pequannock River-TR	20	100	6/9/2004
West Milford Township	Eagle Ridge Basin #3 Dam	L	na	16	452	1/28/2004
West Milford Township	Eagle Ridge Basin #6 Dam	L	na	14	512	1/28/2004
West Milford Township	Bubbling Springs Lower Pond Dam	L	Belcher Creek-TR	8.2	350	9/24/2004
West Milford Township	West Brook Park Dam	L	West Brook	9.8	90	8/6/2004

Municipality Name	Dam Name	Hazard Class	River/Stream	Height (ft)	Length (feet)	Last Date Inspected
West Milford Township	Unnamed Dam	L	Pinecliff Creek-TR	6.5	40	na
West Milford Township	Cotter's Brook Diversion Dam	L	Pequannock River	20	120	12/11/2001
Bloomingdale Borough	Star Lake Lower Dam	L	Small Branch Pequannock River	15	140	1/29/2002
West Milford Township	Gordon Lakes Upper Dam	L	Posts Brook	6	200	na
West Milford Township	Bearfort Waters Dam	L	Mosemanns Brook	8	200	5/10/2005
West Milford Township	Hansen Pond #2 Dam	L	Long House Creek	7	75	na
Wanaque Borough	Matthew's Lake Dam	L	North Branch Post Brook	8	255	na
West Milford Township	Mount Laurel Lake Dam	L	Longhouse Brook	15	345	3/29/2002
West Milford Township	Pine Cliff Lake Dam	L	Belchar Creek	12	200	na
Wayne Township	Oak Ridge #2 Dam	L	Pompton River-TR	na	430	na
Wayne Township	Stone Bridge Detention Dam	L	na	33.5	100	11/1/2000
Wayne Township	High Mountain Detention Dam #1	L	Singac Brook-TR	23	240	3/25/1992
Wayne Township	High Mountain Detention Dam #2	L	Singac Brook-TR	11.5	140	3/25/1992
North Haledon Borough	Lotz Pond Dam	L	Passaic River	8	460	na
Bloomingdale Borough	Meer-Bloomingdale Estates Dam	L	Pequanock River-TR	15	69	5/6/2004
Wayne Township	Preakness Hills C.C. Dam No. 2	L	na	5.5	50	3/29/2007
Wayne Township	Preakness Hills C.C. Dam No. 3	L	na	9	100	3/29/2007
North Haledon Borough	Bridge Pond Dam	L	Passaic River	13	375	na
North Haledon Borough	Haledon Reservoir Lower Basin Dam	L	Molly Ann Brook	10	na	9/20/2007
Ringwood Borough	Forge Pond Dam	L	Wanaque River	na	270	na
Ringwood Borough	Ringwood Mill Dam	L	Ringwood River	11	250	4/12/2005
Bloomingdale Borough	Diversion Dam	L	Post Brook	10	130	11/1/2006
Pompton Lakes Borough	Morse Lake Dam	L	Irish Brook	14	260	2/10/2000
Wanaque Borough	Lake Washington Dam	L	Wanaque River	11	475	9/22/2007
Wanaque Borough	Ajello Dam	L	West Brook Wanaque River	6	80	na
Hawthorne Borough	DeGrays Pond Dam	L	Goffle Brook Passaic Rive	12	350	na
Hawthorne Borough	Arnold Pond Dam	L	Goffle Brook Passaic Rive	6.5	155	9/23/2004
North Haledon Borough	Yahn's Pond Dam	L	Squaw Brook	9	285	9/9/2000
Prospect Park Borough	Prospect Park Pool Dam	L	Passaic River	13	375	na
Wayne Township	Pine View Dam	L	Haycock Brook Ramapo River	7	200	na
Ringwood Borough	Lake Rickonda Dam	L	Small Branch Wanaque River	14	600	12/12/2000
Wayne Township	Brower Dam	L	Pompton River	6	150	na

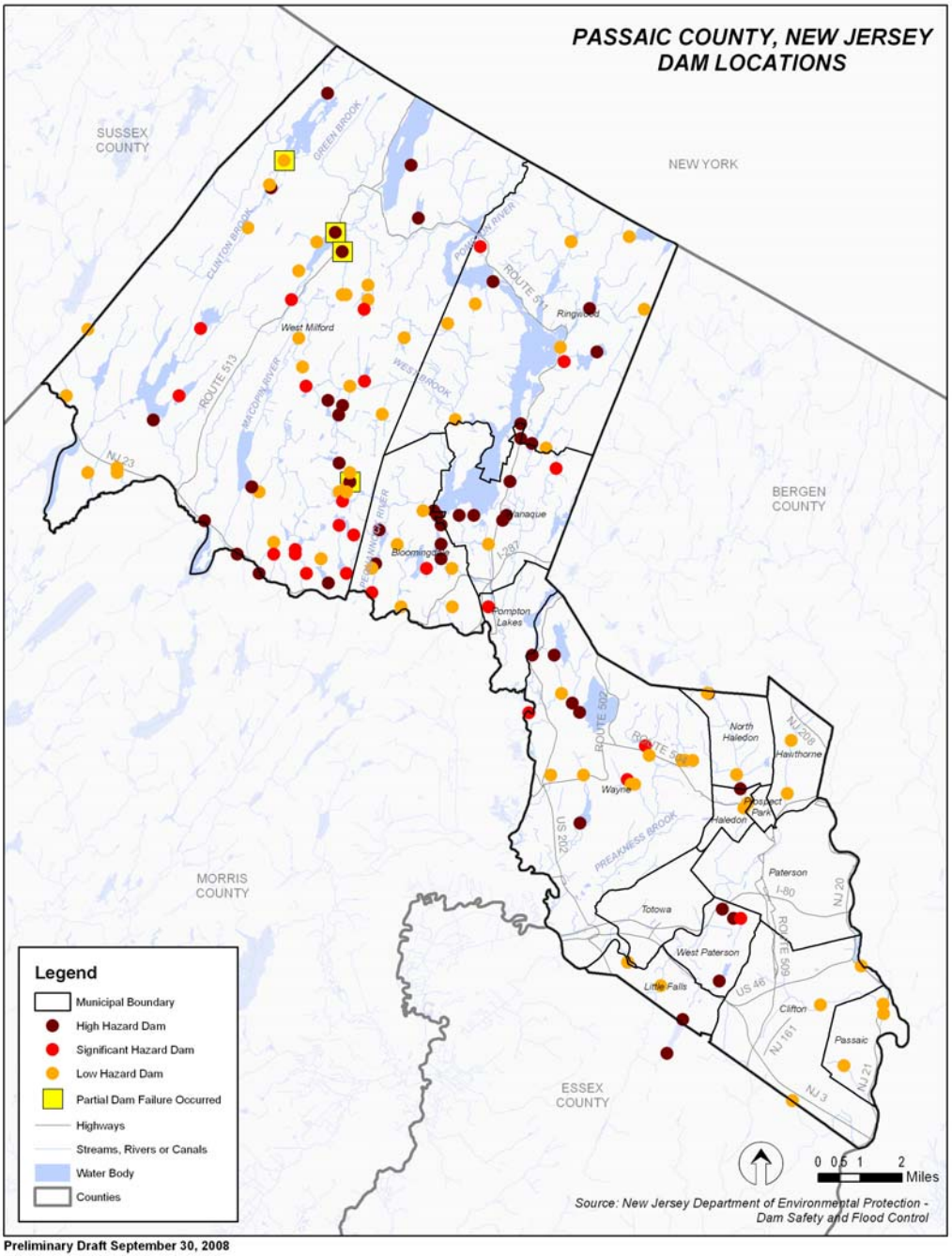
Municipality Name	Dam Name	Hazard Class	River/Stream	Height (ft)	Length (feet)	Last Date Inspected
Wayne Township	Hinchman Pond Dam	L	Singac Brook Passaic River	11	280	na
Wanaque Borough	Durand Dam	L	Wanaque River	na	720	na
Ringwood Borough	Shepherd Lake Dam	L	Cupsaw Brook	18	170	1/21/2003
Ringwood Borough	Harrison Mountain Lake Dam	L	Branch Brunt Meadow Brook	15	470	11/2/2001
Ringwood Borough	Weyble Pond Dam	L	Wanaque River	20	225	12/15/2000
Clifton City	Dietrich Dam	L	Third River	6.3	100	na
Passaic City	Botany Mills Pond Dam	L	Weasel Brook	9.5	80	na
Passaic City	Botany Mills Weir Dam	L	Weasel Brook	4	18	na
Clifton City	Weasel Brook Park Dam	L	Passaic River	6.4	76	9/16/2003
Clifton City	Bloodgood Dam	L	Passaic River	na	na	na
Passaic City	Hughes Lake Dam	L	MacDonalds Brook	7.7	90	na
Little Falls Township	Little Falls Laundry Dam	L	Peckman Brook	5	138	na
Clifton City	Dundee Lake Dam	L	Passaic River	21	545	3/6/2008
Paterson City	Great Falls Dam	L	Passaic River	12	325	7/31/2007

Hazard Classes (Source: New Jersey Administrative Code - Dam Safety Standards (NJAC: 7-20): Dam Classifications)

H = High Hazard: Loss of life likely (if failure were to occur)
S = Significant Hazard: Loss of life not likely but the potential for significant property damage
L = Low Hazard: Loss of life not likely and minimal infrastructure or property damage other than the structure itself

The following map identifies the location for 141 of the 142 dams in Passaic County. The inventory of dams was provided by the NJDEP - Bureau of Dam Safety and Flood Control. The NJDEP data did not include latitude and longitude coordinates for the Haledon Reservoir Lower Basin Dam, and therefore it is not displayed on this map.

Figure 6.3.1-1
Passaic County Dams
(Source: NJDEP – Bureau of Dam Safety and Flood Control)



Preliminary Draft September 30, 2008

Severity of Dam Failure Hazard

In 1921, the New Jersey Legislature created the Bureau of Dam Safety and Flood Control, which instituted laws relating to the construction, repair, and inspection of existing and proposed dam structures. The law was amended in 1981, and became known as the Safe Dam Act. New Jersey's Dam Safety program is administered by NJDEP's Division of Engineering & Construction, Dam Safety Section.[6]

The severity of a dam failure event can depend on various aspects related to the size of the dam, the extent of the failure, the velocity of the floodwaters released, and the density of downstream development.

Impact on Life and Property

According to the National Inventory of Dams as of 2005 there were 79,500 dams in the United States. Approximately one third of these pose a "high" or "significant" hazard to life and property if failure occurs. Dam failure has the potential for catastrophic impact on life and property. This risk can be reduced by proper design, construction and routine maintenance and inspection.

Occurrences of the Dam Failure Hazard

The NJDEP indicates there have been no previous catastrophic dam failures in New Jersey, but the number of small failures has risen over the past few years. This has been primarily due to a combination of lack of inspection and the number of dams nearing the end of their design life.[7]

The NJDEP – Bureau of Dam Safety and Flood Control lists dam failures in New Jersey from several major flooding events including Hurricane Floyd in September of 1999 and the Sparta storm in 2000. Review of these floods indentified five partial dam failures in Passaic County. The Mount Laurel Lake Dam, West Milford Lake Dam, Stowaway Lake Dam, Pinecliff Lake Dam, and Gordon Lake Dam all partially failed after Hurricane Floyd.[8] Repairs were never completed to the Stowaway Lake Dam after the flood. This dam is no longer functioning, and therefore is not included in the county-wide list of dams identified by the NJDEP in Table 6.3.1-2.

All five dams are located within West Milford Township, in northwestern Passaic County. The partial dam failures are described below for two of the five dams.

- Gordon Lake Dam. Strong floodwaters damaged a portion of masonry wall downstream of the dam.
- West Milford Lake Dam. Floodwaters downed numerous trees after overtopping the dam.

No failures were identified from other events. Based on the five previous partial dam failure events in Passaic County, the likelihood of a major failure occurring in the future is considered low to moderate. The Passaic County HMPC determined that six high-hazard dams should be addressed in the risk assessment (Section 7) of this Plan. See Section 7.3.4, Dam Failure Risk in Passaic County, for a more detailed analysis of the six high hazard dams selected for the risk assessment. These dams include: Clinton Reservoir, Charlotteburg, Monksville, Pompton Lakes, .Raymond, and New Street Reservoir.

[6] NJDEP - Bureau of Dam Safety and Flood Control
[7] NJDEP - Bureau of Dam Safety and Flood Control
[8] NJDEP - Bureau of Dam Safety and Flood Control – Historical Events

6.3.2 Drought

Description of the Drought Hazard

A drought is an extended dry climate condition when there is not enough water to support urban, agricultural, human, or environmental water needs. It usually refers to a period of below-normal rainfall, but can also be caused by drying bores or lakes, or anything that reduces the amount of liquid water available. Drought is a recurring feature of nearly all the world's climatic regions. See Appendix D for a more detailed description and definition of the drought hazard.

Location of the Drought Hazard

Droughts may occur anywhere in the United States. Effects seen in different regions vary depending on normal meteorological conditions such as precipitation and temperature, as well as geological conditions such as soil type and subsurface water levels.

Drought is possible throughout the planning area, but the data has revealed no significant drought history since 1950.

Severity of the Drought Hazard

A drought's severity depends on numerous factors, including duration, intensity, and geographic extent as well as regional water supply demands by humans and vegetation. The severity of drought can be aggravated by other climatic factors, such as prolonged high winds and low relative humidity (FEMA, 1997). Due to its multi-dimensional nature, drought is difficult to define in exact terms and also poses difficulties in terms of comprehensive risk assessments.

Impact on Life and Property

There are no known deaths, injuries or property damage from droughts in the planning area.

Occurrences of the Drought Hazard

According to the NCDC database, Passaic County has experienced 11 drought events in the period from 1950 to 2007. All 11 events are between 2001 and 2002. The database provides no indication as to why there are no events prior to 2001, although presumably occurrences follow the same pattern and frequency as shown in the NCDC list. The events are listed by month. For example, if a drought lasts several continuous months, it is listed in the database as separate events. If the continuous months are combined into single events, the number of events is reduced from 11 to two.

Table 6.3.2-1
Reported Droughts, Passaic County, 1950 – 2007
(Source: NOAA/NCDC)

Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
1 NJZ002>006 - 011	10/01/2001	12:00 AM	Drought	N/A	0	0	0	0
2 NJZ002>006 - 011	11/01/2001	12:00 AM	Drought	N/A	0	0	0	0
3 NJZ002>006 - 011	12/01/2001	12:00 AM	Drought	N/A	0	0	0	0
4 NJZ002>006 - 011	01/01/2002	12:00 AM	Drought	N/A	0	0	0	0
5 NJZ002>006 - 011	04/01/2002	12:00 AM	Drought	N/A	0	0	0	0
6 NJZ002>006 - 011	05/01/2002	12:00 AM	Drought	N/A	0	0	0	0
7 NJZ002>006 - 011	06/01/2002	12:00 AM	Drought	N/A	0	0	0	0
8 NJZ002>006 - 011	07/01/2002	12:00 AM	Drought	N/A	0	0	0	0
9 NJZ002>006 - 011	08/01/2002	12:00 AM	Drought	N/A	0	0	0	0
10 NJZ002>006 - 011	09/01/2002	12:00 AM	Drought	N/A	0	0	0	0
11 NJZ002>006 - 011	10/01/2002	12:00 AM	Drought	N/A	0	0	0	0
				TOTALS:	0	0	0	0

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

6.3.3 Earthquake / Geological

(Includes surface faulting, ground shaking, earthquake induced landslide, and liquefaction)

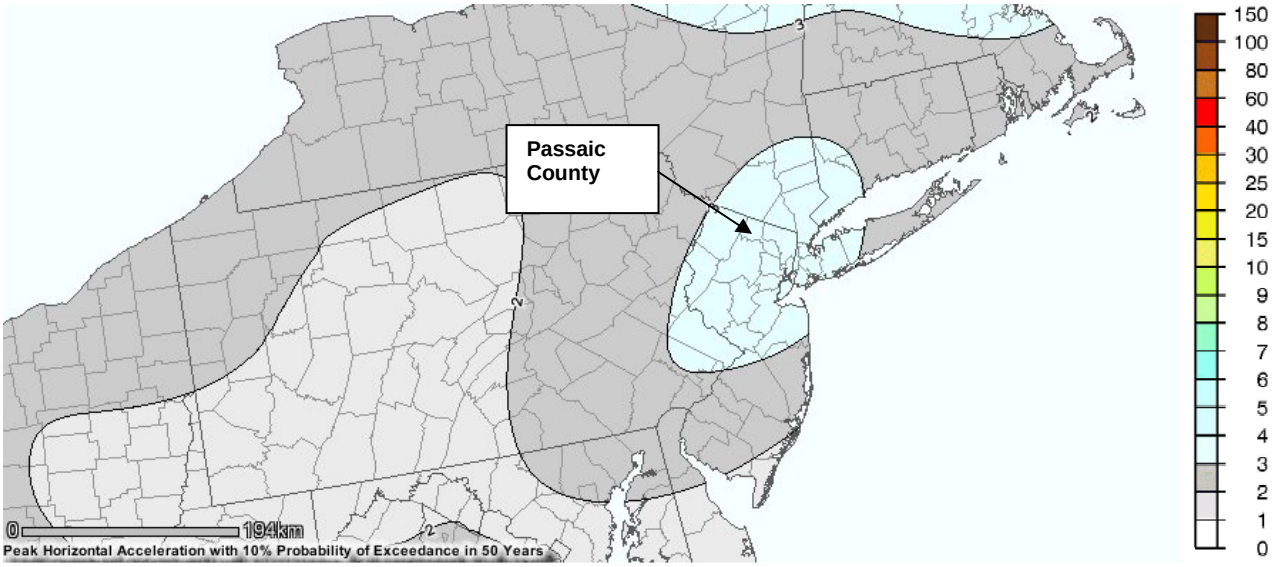
Description of the Earthquake Hazard

An earthquake is a sudden release of energy from the earth's crust that creates seismic waves. Tectonic plates become stuck, putting a strain on the ground. When the strain becomes so great that rocks give way, fault lines occur. At the Earth's surface, earthquakes may manifest themselves by a shaking or displacement of the ground, which may lead to loss of life and destruction of property. Size of an earthquake is expressed quantitatively as magnitude and local strength of shaking as intensity. The inherent size of an earthquake is commonly expressed using a magnitude. See Appendix D for a more detailed description of the earthquake hazard.

Location of the Earthquake Hazard

The entire planning area is susceptible to the effects of earthquakes. Figure 6.3.3-1 displays the northeast portion of a United States Geological Survey (USGS) earthquake hazard map produced in 2008. The map shows peak ground acceleration (pga) with a 10% chance of being exceeded over 50 years is highest in northeastern NJ (6%g) and decreasing to the south (2%g). The *FEMA How-To Guidance, Understanding Your Risks*, FEMA 386-2, pages 1-7, suggests the earthquake hazard should be profiled if the pga is greater than 3%g. The map shows Passaic County is in the 3%g range, a slightly higher level of risk than in the central and southern parts of the state.

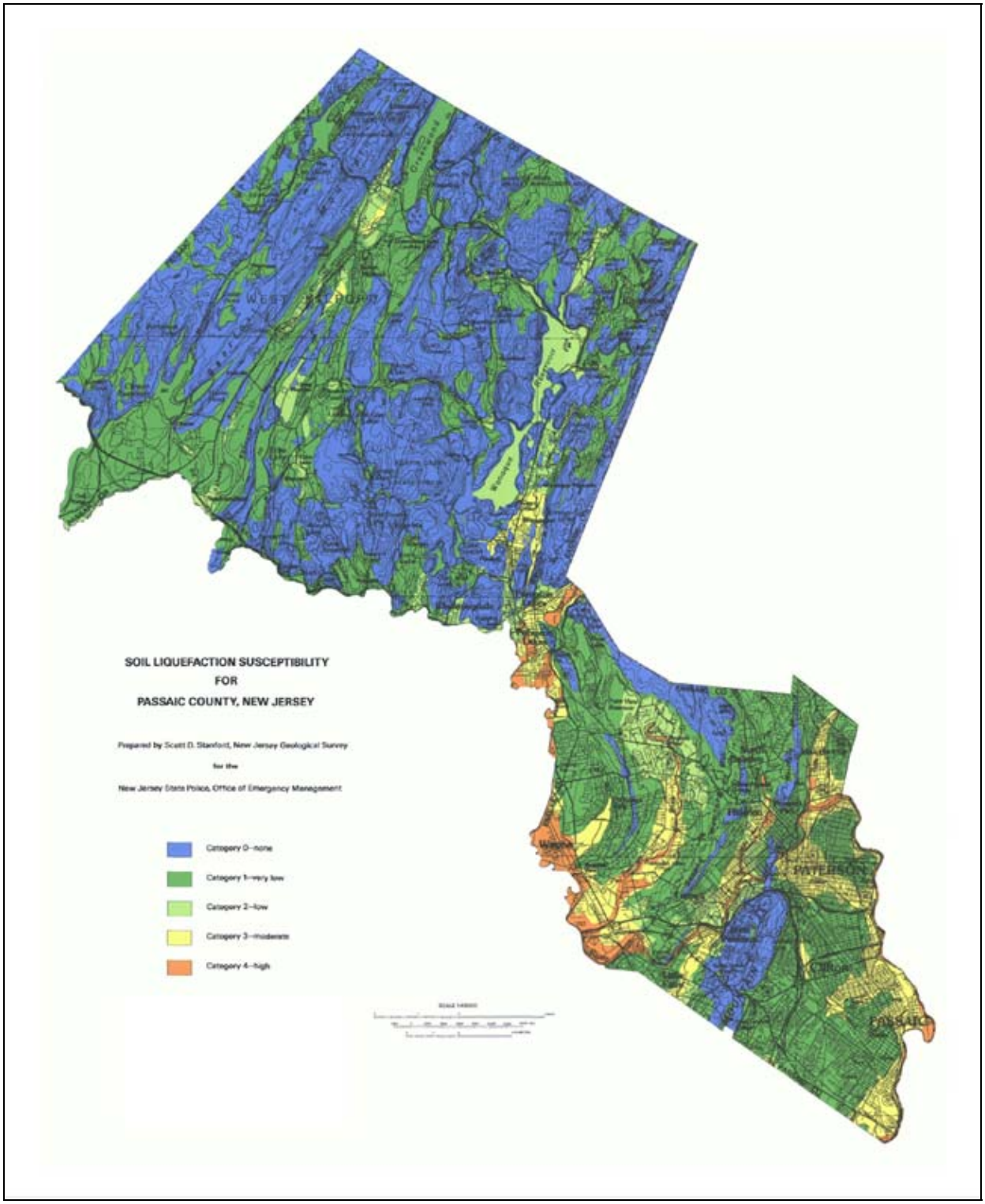
Figure 6.3.3-1
New Jersey Seismic Hazard Map, showing Peak Ground Acceleration in Percent of *g*, with 10 % exceedence in 50 years.
(Source: USGS, 2008)



In September, 2004 the New Jersey Geologic Survey (NJGS) completed an *Earthquake Loss Estimation Study for Passaic County.* The NJGS acquired and analyzed geologic, topographic and test-boring data in order to map seismic soil class, liquefaction susceptibility, and landslide susceptibility for Passaic County. The soil class, liquefaction, and landslide susceptibility were then entered into the FEMA HAZUS (Hazards U.S.) model for each census track in the county.

The Study completed by the NJGS identified and mapped the distribution and thickness of 12 surface materials for Passaic County. Mapping the soil type for each census track identifies areas that are susceptible to soil liquefaction. Figure 6.3.3-2 below is a soil liquefaction map for Passaic County. The map identifies the southeastern region of Passaic County as the main area of higher susceptibility for soil liquefaction.

Figure 6.3.3-2
Passaic County, New Jersey Soil Liquefaction Susceptibility
(Source: Earthquake Loss Estimation Study for Passaic County, New Jersey: Geologic Component
(New Jersey Geologic Survey, 2004)



Additional information about the results of the *Earthquake Loss Estimation Study for Passaic County* can be found in Section 7.3 (Risk Assessment) of this Plan.

Severity of the Earthquake Hazard

Relatively low on magnitude and intensity scales for past events, Passaic County has experienced few and minor earthquakes, on average, over the past 75-plus years.[9] As shown in Figure 6.3.3-1, the probability of any severe earthquake in the area is moderate. As discussed in Appendix D, the severity of earthquakes is influenced by several factors, including the depth of the quake, the geology in the area, and the soils. The severity of soil liquefaction is dependent on the soils grain size, thickness, compaction, and degree of saturation[10].

Impact on Life and Property

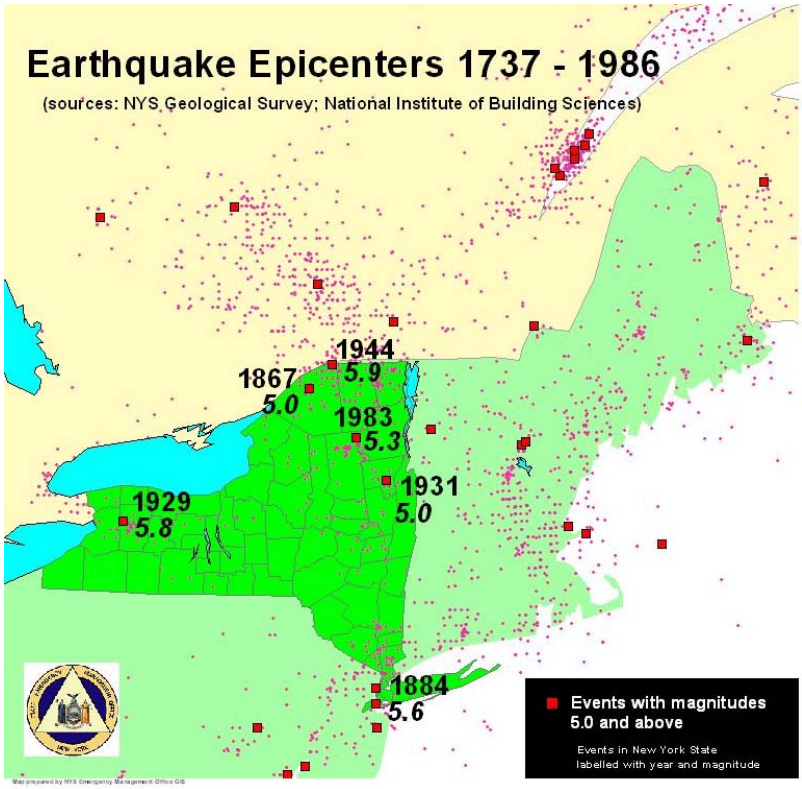
There are no known deaths or injuries from earthquakes in Passaic County. Some of the past earthquake events were severe enough to cause minor property damage such as broken windows or contents falling from shelves. Although the probability of a significant earthquake occurring in this region is relatively small, the effects on life and property in the area could be significant, so this hazard is included in the risk assessments in Section 7. The Mitigation Strategies in Section 9 also includes specific actions related to earthquake risk.

Occurrences of the Earthquake Hazard

To identify past earthquake occurrences that have potentially impacted Passaic County, the map titled *Earthquake Epicenters 1737-1986* displaying historical earthquakes was reviewed. Figure 6.3.3-3 displays historical earthquake epicenters across the Northeast U.S. from 1737 to 1986. Although the map highlights historical earthquakes in New York State, it also shows earthquake occurrences for surrounding states, including New Jersey. The map indicates there have been six historical earthquakes of 5.0 magnitude or greater within New Jersey during the period of record. This map was prepared by the Geographical Information System (GIS) division of the New York State Emergency Management Office (SEMO) using New York State Geological Survey/ National Institute of Building Sciences data.

[9] USGS and NJGS – New Jersey earthquake history
[10] NJGS

Figure 6.3.3-3
Earthquake Epicenters for the Northeast U.S., 1737-1986
(Sources: NYS Geological Survey, National Institute of Building Sciences)



In addition to the *Earthquake Epicenters* map prepared by the New York SEMO, the USGS also offers earthquake history for each state. The USGS earthquake history for New Jersey indicates there have been more than 150 recorded earthquakes since 1783. Additionally, many unrecorded events probably occurred in the period between the earliest recorded event and the 1960s, when the record becomes much more robust because of improved detection and recording methods. Most events in the state are relatively minor, with Richter magnitudes at or below 2.0, although there have been a few with higher magnitudes. Table 6.3.3-1 summarizes the past earthquake events that have impacted the planning area. This list is based on a review of data found at http://www.state.nj.us/dep/njgs/geodata/dgsdown/njearthquakes.pdf, and includes those events that appear from the map to have epicenters in Passaic County. There are numerous earthquakes with epicenters in nearby Morris County that also may have impacted the planning area.

Table 6.3.3-1
Passaic County Earthquake History
(Source: USGS)

Event Date	Approximate Epicenter	Magnitude
4/1947	Pompton Lakes	2.7
10/1962	Pompton Lakes	0.0
5/1978	Bloomingdale	1.5
9/1983	Ringwood	1.5
5/1987	Paterson	1.5
12/1988	Wanaque	1.0
12/1988	Wanaque	1.1
8/1990	Wanaque	0.7

Event Date	Approximate Epicenter	Magnitude
10/1992	West Milford	1.0
2/1996	Ringwood	0.8
1/1999	Clifton	1.4
5/2006	Fairlawn	2.0
6/2007	Fairfield	2.1

Based on the historical record, the probability of earthquakes of all magnitudes occurring in the future is moderate in the planning area, although such events are generally low magnitude. Section 7 of this Plan includes a more detailed discussion of the earthquake risk in Passaic County, including HAZUS simulation results from the NJGS, and probability-based risk estimates that were performed using the FEMA Full-Data Earthquake Benefit-Cost Analysis Module.

6.3.4 Erosion

(Including Hurricane / Nor'easter / Tropical Storm)

Description of the Erosion Hazard

Coastal erosion is a dynamic process that is constantly occurring at varying rates along the coasts and shorelines of the U.S. Numerous factors can influence the severity and rate of coastal erosion including human activities, tides, the possibility of rising sea levels, and the frequency and intensity of hurricanes. Strong storms and hurricanes can erode large sections of coastline with a single event. The process of coastal erosion results in permanent changes to the shape and structure of the coastline. Human activities such as poor land use practices and boating activities can also accelerate the process of coastal erosion. See Appendix D for a more detailed description and definition of the erosion hazard.

Location of the Erosion Hazard

The State of New Jersey has over 130 miles of coastline, most of which is within close proximity to major metropolitan centers of the mid-Atlantic. Passaic County is located in the far northern part of New Jersey, bordered to the northwest by Sussex County, to the east by Bergen County, to the south by Morris and Essex Counties, and to the northeast by Orange and Rockland Counties in New York. The center part of the county (Borough of Pompton Lakes) is located approximately 50 miles from the Atlantic coastline and not impacted by the coastal erosion effects of hurricanes, nor'easters, and coastal storms.

Severity of the Erosion Hazard

Episodic storm erosion generates the most significant erosion along the New Jersey coast. Typically these storms can impact the coast over periods of hours (tropical cyclones) to several days (nor'easters). Although the storm events are short-lived, the resulting erosion can be equivalent to decades of long-term coastal change. The actual quantity of sediment eroded from the coast is a function of storm tide elevation relative to land elevation, the duration of the storm and the characteristics of the storm waves. During severe coastal storms, it is not uncommon for the entire berm and part of the dune to be removed from the beach. The amount of erosion is also dependent on the pre-storm width and elevation of the beach. If the beach has been left vulnerable to erosion due to the effects of recent storms, increased erosion is likely. The time necessary for the beach to naturally recover from significant erosion can often be on the order of years to decades. As mentioned above, Passaic County is landlocked by four surrounding counties and New York to the north. The planning area is not affected by the coastal erosion hazard.

Impact on Life and Property

Erosion from coastal storms has the potential to cause significant property damage particularly to the more densely populated beach communities that are on the Atlantic coast. Potentially billions of dollars of coastal development may be damaged or destroyed by the effects of erosion. Additionally, the loss of beach shoreline can also have a negative impact on a community due to the potential loss of tourism.

The coastal erosion problem has been studied by various federal, state and local agencies and organizations. The New Jersey Beach Profile Network (NJBPN) has been monitoring and surveying beach erosion along the New Jersey coastline since 1986. The survey data produced by the NJBPN includes cross-sectional profiles and quantitative measurements of volumetric changes along the profiles over time. There is no coastline in Passaic County, so the coastal erosion hazard has no impact on life and property in the planning area.

Occurrences of the Erosion Hazard

Passaic County has experienced no coastal erosion events in the past. However, the one coastal flooding event identified in Section 6.3.17 most likely included minor erosion along parts of the Passaic River shoreline. Based on past history, future storm events such as nor'easters, hurricanes, and coastal storms may result in minor erosion along the Passaic River. The impact to life and property in the planning area will most likely be minimal.

6.3.5 Extreme Temperature - Cold

Description of the Extreme Temperature (Cold) Hazard

Temperatures that are significantly below normal are considered extreme cold temperatures. What constitutes extreme cold and its effect varies across different areas of the United States. In areas unaccustomed to winter weather, near freezing temperatures are considered "extreme cold." Freezing temperatures can cause severe damage to citrus fruit crops and other vegetation. Pipes may freeze and burst in homes that are poorly insulated or without heat. In the northeast, below zero temperatures may be considered as "extreme cold".[11] The consequences of extreme cold on humans are intensified by high winds which increase the rate of heat loss and has the effect of making it feel colder than the actual air temperature. Extreme cold temperatures combined with high winds can lead to frostbite, permanent damage to the body, or even death. See Appendix D for a more detailed description and definition of the extreme cold hazard.

Location of the Extreme Temperature (Cold) Hazard

The entire planning area is subject to the hazards associated with extreme cold temperatures.

Severity of Extreme Temperature (Cold)

The severity of extreme cold temperature events are measured by temperature, duration and humidity. Most events are of less than a week in duration but can occasionally last for longer periods up to several weeks.

[11] NOAA – Winter Storms…The Deceptive Killers

Impact on Life and Property

The structure of the NCDC database combines the extreme cold and extreme heat into a single category called temperature extremes. The database indicates there have been no deaths and no injuries from four extreme cold events. Damages from extreme cold temperatures are generally confined to effects on humans (described above), although occasionally there may be relatively minor effects on infrastructure such as freezing pipes or electric grids.

Occurrences of Extreme Temperature (Cold)

The NCDC database indicates there have been four recorded extreme cold temperature events in Passaic County during the period 1950 – 2007. Although the query results begin in 1950, the first reported event was in 2000. Three of the four events listed in the database occurred within a 10 day period in January of 2000. These three events were most likely from one cold air mass lingering over the area for an extended period of time, and can be combined into a single event. If the January 2000 cold spell is considered one event, the number of events identified in the NCDC database is reduced to two. There are most likely additional extreme cold events prior to 2000 that are not captured in the database. No indication is given in the database as to why there are no events identified prior to 2000, although the pattern is most likely similar with a couple of extreme cold temperature events occurring about every five years. Table 6.3.5-1 lists the extreme temperature events from the NCDC for Passaic County. Periodically throughout Section 6.3, the output from the NCDC database queries has been included to summarize past events for specific hazards.

Table 6.3.5-1
Reported Extreme Temperature Events, Passaic County, 1950 – 2007
(Source: NOAA/NCDC)

Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
1 NJZ002>006 - 011	07/04/1999	02:30 PM	Excessive Heat	N/A	10	0	0	0
2 NJZ002>006 - 011	01/17/2000	12:00 AM	Extreme Windchill	N/A	0	0	0	0
3 NJZ002>006 - 011	01/21/2000	02:00 PM	Extreme Windchill	N/A	0	0	0	0
4 NJZ002>006 - 011	01/27/2000	06:00 PM	Extreme Windchill	N/A	0	0	0	0
5 NJZ002>006 - 011	08/07/2001	04:00 PM	Excessive Heat	N/A	0	0	0	0
6 NJZ002>006 - 011	07/02/2002	12:00 PM	Excessive Heat	N/A	0	0	0	0
7 NJZ002>006 - 011	07/29/2002	12:00 PM	Excessive Heat	N/A	0	0	0	0
8 NJZ002>006 - 011	01/15/2004	06:00 PM	Extreme Cold/wind Chill	N/A	0	0	0	0
9 NJZ002>006 - 011	08/01/2006	12:00 PM	Excessive Heat	N/A	2	0	0	0
			TOTALS:		12	0	0	0

Note: Coded letters and numbers under Location or County column are a result of output from the NCDC query.

Several of the column headings (the five farthest to the right) within the NCDC table above have been abbreviated and are defined as follows:

- Mag = Magnitude of the event for applicable hazards (Hailstorms, Tornadoes, etc.)
- Dth = Number of deaths
- Inj = Number of Injuries
- PrD = The dollar amount of reported property damage
- CrD = The dollar amount of reported crop damage

Based on the two events between 2000 and 2006, an extreme cold temperature event occurs on average approximately once every three years. Taking into account the historical data from the NCDC database, the probability of future extreme cold temperature events is considered moderate to high. However, the impact on life and property in the planning area will most likely be minimal.

6.3.6 Extreme Temperature - Heat

Description of the Extreme Temperature (Heat) Hazard

Temperatures that are significantly above normal are considered extreme temperatures. There is no specific point when air temperatures are defined as significantly above normal. However, the National Weather Service will initiate alert procedures such as special weather statements when the heat index is expected to exceed 105 - 110 degrees Fahrenheit (depending on local climate), for at least two consecutive days.[12] Heat stress can be indexed by combining the effects of temperature and humidity. See Appendix D for a more detailed description and definition of the extreme heat hazard.

Location of the Extreme Temperature (Heat) Hazard

The entire planning area is subject to the hazards associated with extreme temperatures from high heat.

Severity of Extreme Temperature (Heat)

The severity of extreme temperature events is measured by temperature, duration and humidity. Most events are less than a week in duration. In the northeastern U.S. periods of warmer than normal temperatures typically occur several times a summer. Extreme heat waves may occur about once every five years or so where maximum daily temperatures exceed 100 degrees Fahrenheit for an extended period of time. The passing of a cold front usually moderates temperatures after a few days to a week.

Impact on Life and Property

The structure of the NCDC database combines the extreme cold and extreme heat into temperature extremes. The database indicates there have been 12 deaths and no injuries in Passaic County from excessive heat-related events. Ten of the 12 reported deaths were from one event that occurred from July 4 – 6, 1999. From the description provided in the NCDC database, the 12 deaths appear to cover all parts of New Jersey impacted by the event, not just Passaic County. During the July 4 – 6th heat wave, the NCDC database indicates one death occurred in Passaic

[12] NOAA - Heat Wave Description

County. The combination of the temperature and humidity during this event produced heat indices of around 110 degrees during the afternoon of each day. Damages from the extreme high temperature hazard are generally confined to effects on humans, although occasionally there may be relatively minor effects on infrastructure such as electric grids.

Occurrences of Extreme Temperature (Heat)

The NCDC database indicates there have been five recorded extreme temperature events related to high heat in Passaic County during the period 1950 – 2007. Although the query results begin in 1950 the first reported event was in 1999. There are most likely additional extreme cold events prior to 1999 that are not captured in the NCDC database. The database provides no indication as to why there are no events prior to 1999, although presumably occurrences follow the same pattern and frequency as shown in the NCDC list. Similar to droughts and other hazards, the events are listed by month. If the continuous months are combined into single events, the number of events is reduced from five to four. Table 6.3.6-1 lists the extreme temperature events from the NCDC for Passaic County.

Table 6.3.6-1
Reported Extreme Temperature Events, Passaic County, 1950 – 2007
(Source: NOAA/NCDC)

Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
1 NJZ002>006 - 011	07/04/1999	02:30 PM	Excessive Heat	N/A	10	0	0	0
2 NJZ002>006 - 011	01/17/2000	12:00 AM	Extreme Windchill	N/A	0	0	0	0
3 NJZ002>006 - 011	01/21/2000	02:00 PM	Extreme Windchill	N/A	0	0	0	0
4 NJZ002>006 - 011	01/27/2000	06:00 PM	Extreme Windchill	N/A	0	0	0	0
5 NJZ002>006 - 011	08/07/2001	04:00 PM	Excessive Heat	N/A	0	0	0	0
6 NJZ002>006 - 011	07/02/2002	12:00 PM	Excessive Heat	N/A	0	0	0	0
7 NJZ002>006 - 011	07/29/2002	12:00 PM	Excessive Heat	N/A	0	0	0	0
8 NJZ002>006 - 011	01/15/2004	06:00 PM	Extreme Cold/wind Chill	N/A	0	0	0	0
9 NJZ002>006 - 011	08/01/2006	12:00 PM	Excessive Heat	N/A	2	0	0	0
				TOTALS:	12	0	0	0

Notes: Coded letters and numbers under Location or County column is a result of output from the NCDC query. See bullets following Table 6.3.5-1 for column heading definitions.

As mentioned above, one of the worst extreme heat-related events occurred in July, 1999. A very strong and oppressive high pressure system that extended from the surface to aloft gave New Jersey a brutal heat wave that included the entire Independence Day weekend. High temperatures reached the 90s for the first time on the 3rd, but sweltering humidity and record breaking maximum temperatures of around 100 degrees occurred from Independence Day through the 6th of the month.[13]

Based on the four events between 1999 and 2007, on average, an extreme heat event occurs approximately once every 2 years. Based on the historical data from the NCDC database, extreme heat events will continue to occur in the county at least annually, but with relatively minor impacts on life and property.

[13] NOAA/NCDC database

6.3.7 Flood

(Includes Tidal, Flash, and Riverine Flooding)

Description of the Flood Hazard

Flooding is defined as a condition of partial or complete inundation of normally dry land, typically in a floodplain, due to a variety of conditions. The floodplain is the land adjoining the channel of a river, stream, ocean, lake, or other watercourse or water body that is susceptible to flooding.

Hundreds of floods occur each year in the United States, including overbank flooding of rivers and streams and shoreline inundation along lakes and coasts. Flooding typically results from large-scale weather systems generating prolonged rainfall. Flooding in Passaic County can be the result of the following weather events: hurricanes, thunderstorms (convectional and frontal), flash flood, storm surge or severe winter storms. See Appendix D for more detailed descriptions and definitions of the flood hazard.

Location of the Flood Hazard

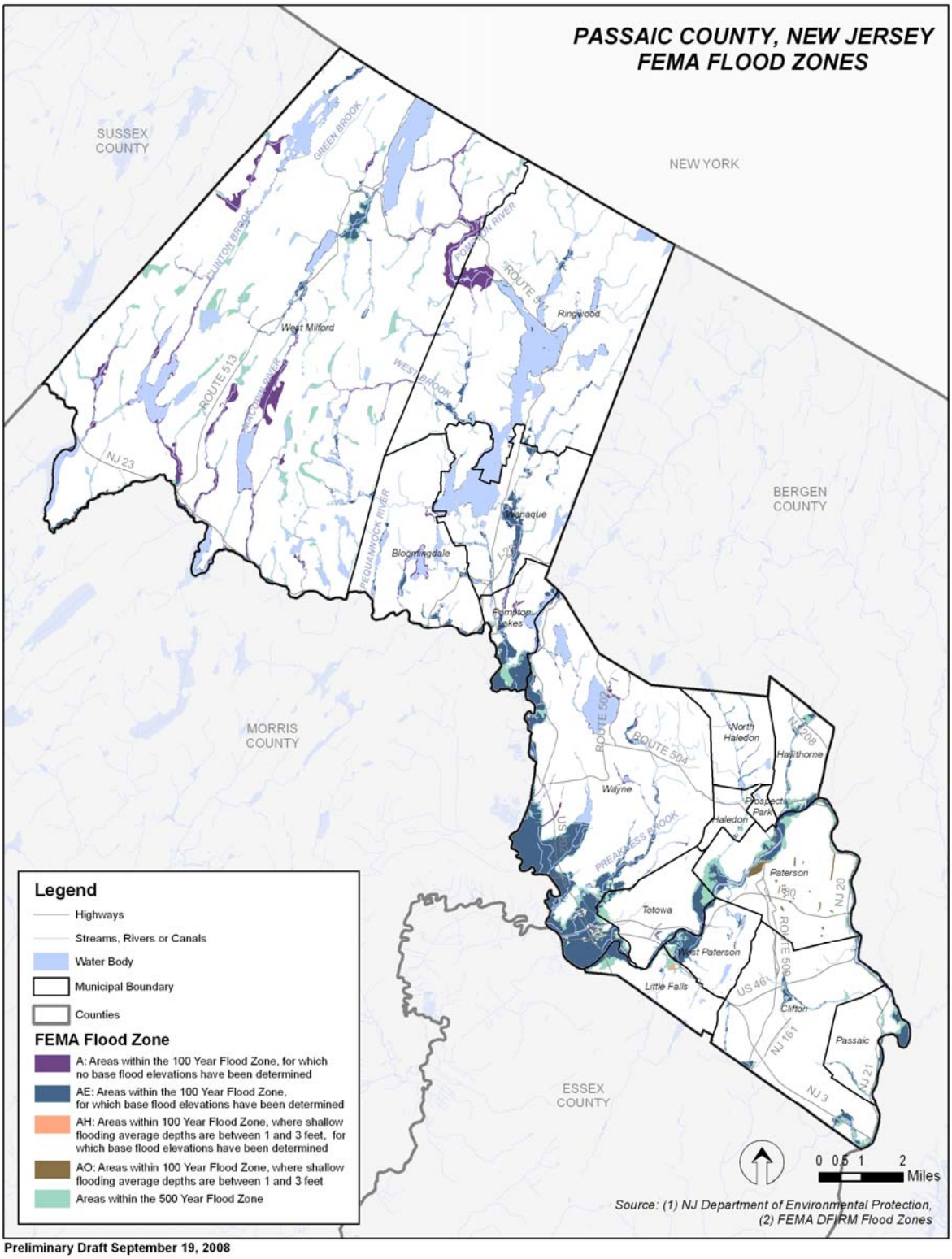
Passaic County is located in the upper northeast portion of New Jersey. It is bordered to the northwest by Sussex County, to the east by Bergen County, and to the northeast by Orange and Rockland Counties in New York. The county is bordered to the south by the Pompton and Pequannock Rivers, which creates the border between Passaic and Morris Counties. In the southeastern portion of the county the Passaic River forms the border between Bergen and Passaic counties. The topography of the county is greatly varied. In the southern half of the county the terrain is quite flat, with several cities and highly developed areas. The terrain in the northern half of the county is less populated and very mountainous.[14]

Numerous areas within Passaic County are susceptible to localized flooding from excess rain events, stormwater runoff, urban flooding, local drainage problems, overbank flooding, and other sources. All of the municipalities within the county experience some degree of flooding. The urban areas of Passaic County are vulnerable to severe flooding and flood-related damage. Low-lying areas throughout the county are subject to periodic flooding caused by the overflow of streams.[15] This section highlights several of the significant flood areas throughout Passaic County.

Figure 6.3.7-1 shows various flood zones in Passaic County (see flood zone descriptions following the map). The 100-year floodplain includes areas with a 1% annual chance of flooding, indicated by zones A, AE, AH and AO. In Figure 6.3.7-1 the A zone is shaded purple, the AE zone is shaded dark blue, AH is shaded orange, and AO is shaded brown. The majority of 100-year floodplain areas follow the major rivers in Passaic County; these include the Passaic, Pompton, Ramapo, and Pequannock Rivers. The 500-year floodplain includes areas with a 0.2% annual chance of flooding. The flood zone X500 is shown on the map below in green and represents the areas between the limits of the 100 and 500-year floodplains. The unshaded area (zone X), is considered outside of the 500-year floodplain.

[14] FEMA - Passaic County Flood Insurance Study (FIS), September 28, 2007
[15] FEMA - Passaic County FIS, September 28, 2007

Figure 6.3.7-1
Floodplain Map of Passaic County
(Sources: FEMA and NJDEP)



Preliminary Draft September 19, 2008

The flood zone designations are defined as follows:

- Zone A (1% annual chance flooding). Shaded purple. Areas with a 1% annual chance of flooding and a 26% chance of flooding over the life of a 30-year mortgage. Because detailed analyses are not performed for such areas; no depths or base flood elevations are shown within these zones.
- Zone AE (1% annual chance flooding). Shaded dark blue. Areas with a 1% annual chance of flooding and a 26% chance of flooding over the life of a 30-year mortgage. In most instances, base flood elevations derived from detailed analyses are shown at selected intervals within these zones.
- Zone AH (1% annual chance flooding). Shaded orange. Areas with a 1% annual chance flooding where shallow flooding (usually areas of ponding) can occur with average depths between one and three feet.
- Zone AO (1% annual chance flooding). Shaded brown. Areas with a 1% annual chance flooding, where shallow flooding average depths are between one and three feet.
- X500 (0.2% annual chance of flooding). Shaded green. Represents areas between the limits of the 1% annual chance flooding and 0.2% chance flooding.
- Zone X. Shaded gray. Areas outside the 1% annual chance floodplain and 0.2% chance floodplain, areas of 1% annual chance sheet flow flooding where average depths are less than one (1) foot, areas of 1% annual chance stream flooding where the contributing drainage area is less than one (1) square mile, or areas protected from the 1% annual chance flood by levees. No Base Flood Elevations or depths are shown within this zone.[16]

The following subsections highlight several of the major flood areas throughout Passaic County. These include the Passaic, Ramapo and Pequannock Rivers.

Passaic River Flooding

The source of the Passaic River begins near Mendham, New Jersey where small streams come together to form a brook where the river then continues through open farm land and eventually winding through seven counties, 45 municipalities and into the Newark Bay. At its source it is about 600 feet above sea level and in its southeasterly flow goes south of Jockey Hollow National Park and becomes the boundary between Somerset and Morris Counties, east of Bernardsville and Basking Ridge and southwest of the Great Swamp National Wildlife Refuge. It flows along for about 90 miles; where some areas the movement is slow and at other points overflows its banks during heavy rains.[17]

When the river reaches Passaic County, it passes through Two Bridges, New Jersey where it takes a slow easterly course to Little Falls. The Passaic then continues northeast to the Great Falls in Paterson. At Great Falls the river passes over a 70 foot rocky ledge, eventually leading to the city of Paterson. It continues north, reversing itself at Hawthorne where it flows about 25 miles to Newark Bay. At Hawthorne it becomes the boundary between Passaic and Bergen Counties. Flowing downstream from Hawthorne, the river has been dammed, creating Dundee Lake. Below the dam at Garfield, the Saddle River joins the Passaic and flows through heavily industrialized and residential areas of Bergen, Hudson and Essex Counties. At Harrison it makes an S-curve northeast and then turns southeast and unites with the Hackensack River as it empties into the Newark Bay.[18]

Flooding has long been a problem in the Passaic River Basin. The growth of residential and industrial development in recent years has multiplied the threat of serious damages and loss of life from flooding. The United States Army Corp. of Engineers (USACE) - New York District indicates more than 2.5 million people live in the basin, and about 20,000 homes and businesses are within the Passaic River floodplain. Since 1900, at least 26 lives have been lost in

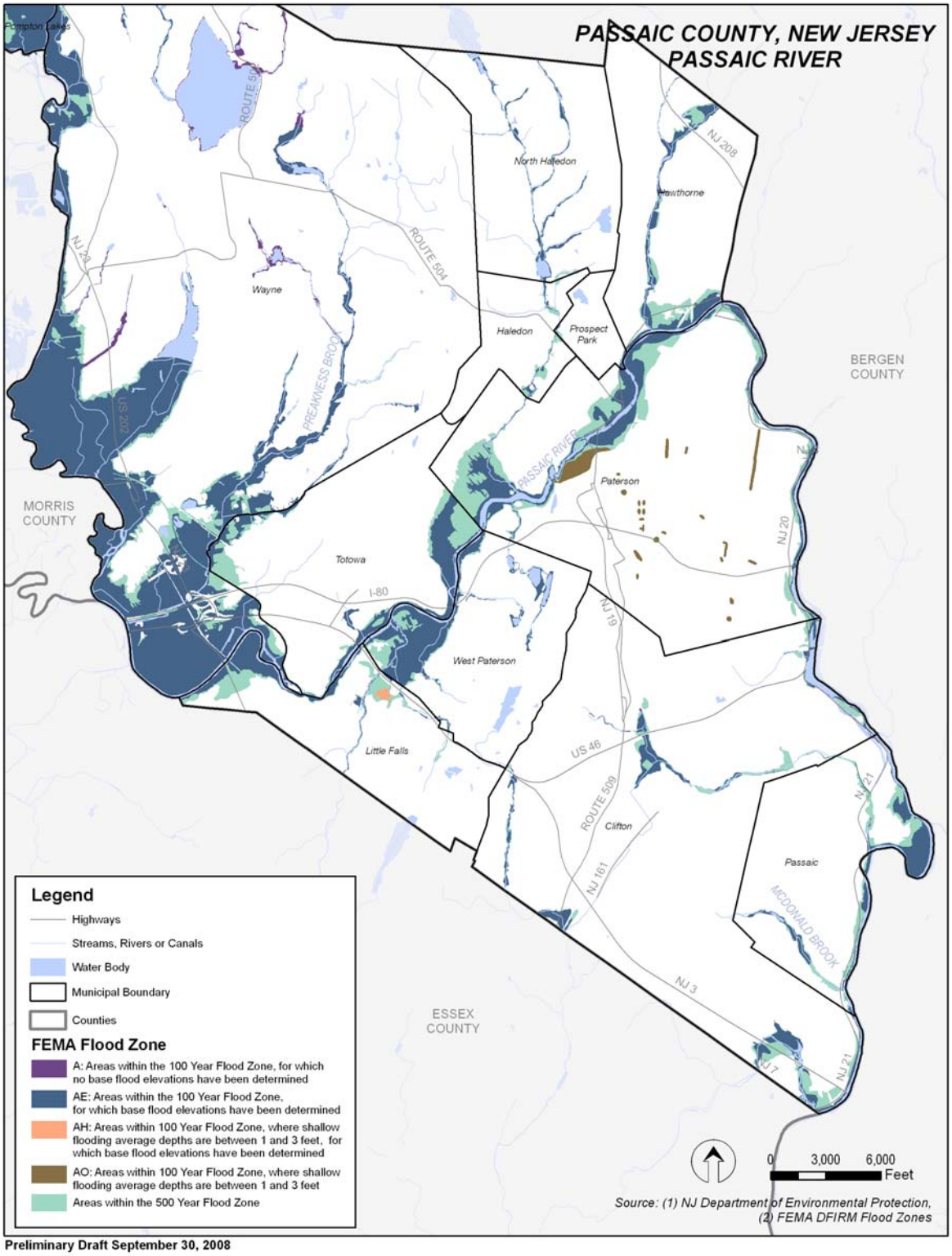
[16] FEMA – Flood Zone Designations
[17] PassaicRiver.com
[18] PassaicRiver.com

floods and the total loses are over $4.5 billion. Significant interruption to businesses and transportation has also resulted in hardship in the basin and region after each flood event.[19]

In Passaic County, flooding from the Passaic River affects the Boroughs of Bloomingdale, Prospect Park, Totowa, Woodland Park, and Hawthorne, the Townships of Little Falls and Wayne and the Cities of Clifton, Passaic and Paterson. This is due to the establishment of highly developed areas adjacent to the Passaic River.[20] The most recent FEMA Flood Insurance Study (FIS) for Passaic County indicates that these municipalities also experience minor to moderate flooding from numerous other smaller streams and tributaries, but the main source of flooding is the Passaic River. Figure 6.3.7-2 is a map highlighting the Passaic County portion of the Passaic River.

[19] USACE – New York District. Passaic River Mainstem and Tributaries, New Jersey. Flood Damage Reduction and Restoration Projects
[20] FEMA - Passaic County FIS, September 28, 2007

Figure 6.3.7-2
Floodplain Map of the Passaic County portion of the Passaic River
(Sources: FEMA, NJDEP)



Preliminary Draft September 30, 2008

The largest flood on record in Passaic County occurred in 1903. The Department of Interior estimated the flood reoccurrence interval to be 100-years, producing an estimated peak discharge of 39,800 cubic feet per second at the mouth of the Passaic River. More recent floods in 1968, 1971, 1972, 1973, two in 1975, 1984, 1992, 1999, 2005, and 2007 were sufficiently devastating to warrant Presidential-Disaster Declarations. Table 6.3.7-1 identifies the flood damages estimated by the USACE–New York District, within the Passaic River basin for past flood events in 1984, 1999, 2005 and 2007. For comparison purposes, the figures have been adjusted by the USACE to October 2006 dollar values, and shows that the April 2007 flood was the most costly of the four most recent flood events. The USACE provided no indication as to why the year 2006 was selected for the adjusted dollar values.

Table 6.3.7-1
Estimated Damages (In Millions of Dollars) within the Passaic River Basin for Flood Events in 1984, 1999, 2005, and 2007
(Source: USACE – New York District)

Date of Flood Event	Estimated Damages (In Millions)
April 7, 1984	$642
September 16, 1999	$261
April 2, 2005	$100
April 15, 2007	$686

Note: Estimated damages adjusted to October 2006 dollars.

In September 1999 Tropical Storm Floyd (DR-1295) caused significant flooding in parts of Passaic County. FEMA Public Assistance (PA) Project Worksheets (PWs) indicate that infrastructure damages in Passaic County totaled just over $3.7 million. Of this amount, slightly less than $1.7 million in damages occurred within municipalities bordering the Passaic River. The downgraded hurricane resulted in over a foot of rain in parts of southeastern Passaic County, flooding the low-lying areas adjacent to the River.

Table 6.3.7-2 identifies the FEMA Public Assistance funds provided to municipalities located along the Passaic River after Tropical Storm Floyd. The damage descriptions from the PWs indicate that the majority of the damages are from flooding from the Passaic River, but some damages were also attributable to flooding from other sources, such as water intrusion into buildings resulting from high winds and rain. The table shows that the highest amount of FEMA PA funds along the Passaic River after Tropical Storm Floyd were provided to Wayne Township. The PA funds for this applicant were predominately for emergency protective measures (Categories A and B) after the storm, but also included $310,372 for permanent repairs to parks and recreation facilities.[21] See Section 7 of this Plan for a more detailed summary of the FEMA PWs for Passaic County.

[21] FEMA Region II, Public Assistance Program

Table 6.3.7-2
Project Worksheet (PW) Summary for Hurricane Floyd (DR-1295) Applicants in Passaic County along the Passaic River, ordered by PW Total
(Source: FEMA Region II – Public Assistance Program)

Applicant Name	Cat. A	Cat. B	Cat. C	Cat. D	Cat. E	Cat. F	Cat. G	TOTAL
Wayne, Township of	$290,782	$153,090	$1,555	$0	$0	$0	$310,372	$755,799
Little Falls, Township of	$157,805	$26,599	$0	$4,227	$1,112	$0	$37,288	$227,031
Woodland Park (note 1)	$96,897	$33,965	$3,701	$0	$12,302	$0	$74,687	$221,552
Hawthorne, Borough of	$58,721	$51,629	$3,124	$0	$0	$0	$42,547	$156,021
Paterson, City of	$33,678	$43,367	$55,563	$0	$0	$0	$0	$132,608
Clifton, City of	$97,185	$14,093	$0	$0	$0	$0	$1,071	$112,349
Totowa, Borough of	$52,569	$21,777	$2,600	$0	$0	$15,760	$0	$92,706
Passaic, City of	$28,180	$16,557	$27,500	$0	$0	$0	$0	$72,237
Clifton Board of Education	$16,234	$0	$0	$0	$39,700	$0	$0	$55,934
Wayne Board of Education	$0	$33,397	$0	$0	$2,830	$0	$0	$36,227
Hawthorne Board of Education	$3,960	$0	$0	$0	$0	$0	$19,721	$23,681
Bloomingdale, Borough of	$3,996	$8,079	$0	$0	$0	$0	$0	$12,075
Little Falls Board of Education	$0	$0	$0	$0	$0	$0	$5,986	$5,986
Prospect park, Borough of	$0	$4,392	$0	$0	$0	$0	$0	$4,392
Grand Total	**$743,110**	**$372,981**	**$90,342**	**$4,227**	**$43,642**	**$15,760**	**$416,985**	**$1,687,046**

Note 1: Woodland Park was known as West Paterson at the time of Hurricane Floyd. The data in this row includes both the City of West Paterson (Woodland Park) and the West Paterson Board of Education.

The FEMA Public Assistance categories are generally defined as follows

- Category A: Emergency work, primarily debris clearance.
- Category B: Emergency protective measures.
- Category C: Permanent repair work, roads and bridges.
- Category D: Permanent repair work, water control facilities.
- Category E: Permanent repair work, public buildings.
- Category F: Permanent repair work, utilities.
- Category G: Permanent repair work, parks and recreation facilities.

The USACE–New York District has studied the Passaic River basin extensively and developed plans to reduce flooding in the area as far back as 1936. As part of their analysis, the USACE has evaluated more than 150 plans in cooperation with the State of New Jersey, municipalities, and local groups, including a full range of non-structural alternatives such as buying out flood prone homes to provide protection on the main stem of the Passaic River and its major basin tributaries. In 1987, the State selected a dual inlet water diversion tunnel system as the centerpiece of an environmentally sound and a comprehensive flood damage reduction program for the basin.[22]

The major elements of the Passaic River "Main Stem" flood damage reduction project consist of two underground tunnels, a 20.4 mile-long main tunnel 42-foot diameter and a 1.3 mile-long 23-foot diameter spur tunnel. The main tunnel would carry floodwaters from an inlet on the upper Pompton River in Wayne, New Jersey down to an outlet in

[22] USACE – New York District. Passaic River Mainstem and Tributaries, New Jersey. Flood Damage Reduction and Restoration Projects

Newark Bay. The spur tunnel would convey central basin floodwaters from an inlet just downstream of Two Bridges in Wayne, New Jersey to an underground connection with the main tunnel. The USACE indicates that the tunnels would cause minimal disruption to development and the environment along the Pompton River and Passaic River. Channel modifications would also be required to direct the flows into the tunnel inlets and levees and floodwalls would reduce flood damage in urban pockets not protected by the tunnel. The diversion tunnels and associated surface works are generally designed to protect against floods, ranging up to the 100-year event and reduce the impact of even larger floods.[23]

The project also includes the acquisition of 5,350 acres of natural flood storage areas, 5,200 acres of which are wetlands and could conceivably be developed, worsening existing flood problems. The State will also continue to protect 6,300 floodway acres, thus avoiding any secondary development. About 9,500 acres of the central basin are already protected as designated parkland, bringing the total of natural flood storage areas that would be permanently protected to 21,000 acres. Since 1996, the State has requested that the USACE proceed with three elements of the Main Stem project. They are the Preservation of Natural Flood Storage Areas, the Joseph G. Minish Waterfront Park, and the Harrison Levee/Floodwall Project. A variety of other basin projects are currently underway or recently completed as reconnaissance studies, planning or feasibility studies, or design efforts.[24]

Ramapo River and Pequannock Rivers

The Ramapo River is about 30 miles long and is a tributary to the Pompton River. The Ramapo originates in the mountainous areas of central Orange County, New York. In Passaic County the River flows south-southwest, along the east side of the Ramapo Mountains. It then flows into Potash Lake in Oakland and empties into the Pequannock River shortly after Pompton Lake. The intersection of these two rivers forms the Pompton River which flows into the main stem of the Passaic River.[25]

The principal flood problem along the Ramapo River is flooding caused by the backwater effect produced by the Pompton Lake Dam, the hydraulic constrictions produced by bridges crossing the river, and insufficient channel capacity. Flooding has occurred frequently, with the most recent events in 1968, 1970, 1971, 1973, 1977, 1978, 1979, 1980, 1983, 1984, 1987, 1993, January 1996, September 1999, April 2005, October 2005, and April 2007. The April 1984 flood was the most severe causing $9.5 million in damages (October 1995 dollars). The USACE–New York District estimated the flood had a 50-year recurrence frequency. The USACE also estimated that if a storm with a 100-year reoccurrence interval were to occur, approximately 350 structures would sustain damages, resulting in approximately $11,600,000 in damages (October 1995 dollars).[26]

Severity of the Flood Hazard

Flood severity is measured in various ways, including frequency, depth, velocity, duration and contamination, among others. In Passaic County, the metrics used to characterize the severity of the flood hazard depends on what part of the county is being considered, but generally the most important factor is how often floods occur.

Floods have been and continue to be the most frequent, destructive, and costly natural hazard facing Passaic County. Most recently, the county has been impacted by four significant flood events, in 1996, 1999, 2005, and

[23] USACE – New York District. Passaic River Mainstem and Tributaries, New Jersey. Flood Damage Reduction and Restoration Projects
[24] USACE – New York District. Passaic River Mainstem and Tributaries, New Jersey. Flood Damage Reduction and Restoration Projects
[25] Wikipedia – Ramapo River description.
[26] USACE – New York District. Ramapo River at Oakland, NJ. Flood Damage Reduction Project – Fact Sheet

2007. With the exception of the 1903 event, Tropical Storm Floyd in September 1999 was the most severe on record along the Passaic River. More recently, the April 2007 flood resulted in peak discharges of 9,930 cubic feet per second (CFS) along the Ramapo River at Pompton Lakes, and 15,800 along the Passaic River at Little Falls. In comparison, the historic peak discharge of record along the Passaic at Little Falls was 31,700 CFS during the November, 1903 flood.[27] Table 6.3.7-3 summarizes the flood peaks for select USGS gage stations along the Ramapo and Passaic Rivers in Passaic County during the April 15 – 18, 2007 flood event.

Table 6.3.7-3
Summary of Flood Peaks for Select USGS Gage Stations in Passaic County
During the April 16-18, 2007 Flood
(Source: USGS)

Gage Station #	Station Name	Drainage Area (sq. miles)	Peak Discharge (CFS)	Peak Gage Height (Feet)	Date of Peak Discharge	Recurrence Interval (Years)
01382500	Pequannock River at Macopin Intake Dam	63.7	2,010	6.38	4/16/07	Not Calculated
01388000	Ramapo River at Pompton Lakes	160	9,930	16.99	4/16/07	20
01388500	Pompton River at Pompton Plains	355	18,000	21.72	4/16/07	30
01389500	Passaic River at Little Falls	762	15,800	11.88	4/18/07	30

Impact on Life and Property

Figures maintained by NCDC indicate that Passaic County has experienced one death and no injuries from past flood events.[28] Section 7 of this Plan includes a much more detailed discussion of flood impacts on the county, in particular the history of NFIP claims, and the number of FEMA "repetitive loss" properties.

Occurrences of the Flood Hazard

The NCDC database indicates that there have been 59 flood events in Passaic County in the period from 1950 to 2007, with damages slightly over $23.2 million. Of these 59 events, five flood events between 1996 and 2007 have resulted in property damage. Flooding events causing property damage have occurred in 1996, 1999, 2005, and 2007. These events are listed in Table 6.3.7-4 below. Note: additional flood events listed in the NCDC database may have resulted in property and infrastructure damages. Estimated property damages for these floods may not have been listed in the database because either the data was unavailable, or the damages were only minor and therefore not reported to the NCDC.

[27] United States Geological Survey. Summary of April 15 - 18 Flooding in New Jersey
[28] NOAA/NCDC database

Table 6.3.7-4
Flood Events Resulting in Property Damage, Passaic County, 1950 – 2007
(Source: NOAA/NCDC)

Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
1 NJZ002>006 - 011	01/19/1996	12:00 PM	Flood	N/A	0	0	3.0M	0
2 Countywide	09/16/1999	10:25 AM	Flood	N/A	1	0	6.0M	0
3 NJZ002>006 - 011	04/02/2005	09:00 AM	Flood	N/A	0	0	12.0M	0
4 NJZ002>006 - 011	10/08/2005	09:15 AM	Flood	N/A	0	0	35K	0
5 Allwood	04/15/2007	10:00 AM	Flood	N/A	0	0	2.2M	0K
				TOTALS:	1	0	23.235M	0

Note: Coded letters and numbers under Location or County column is a result of output from the NCDC query. See bullets following Table 6.3.5-1 for column heading definitions.

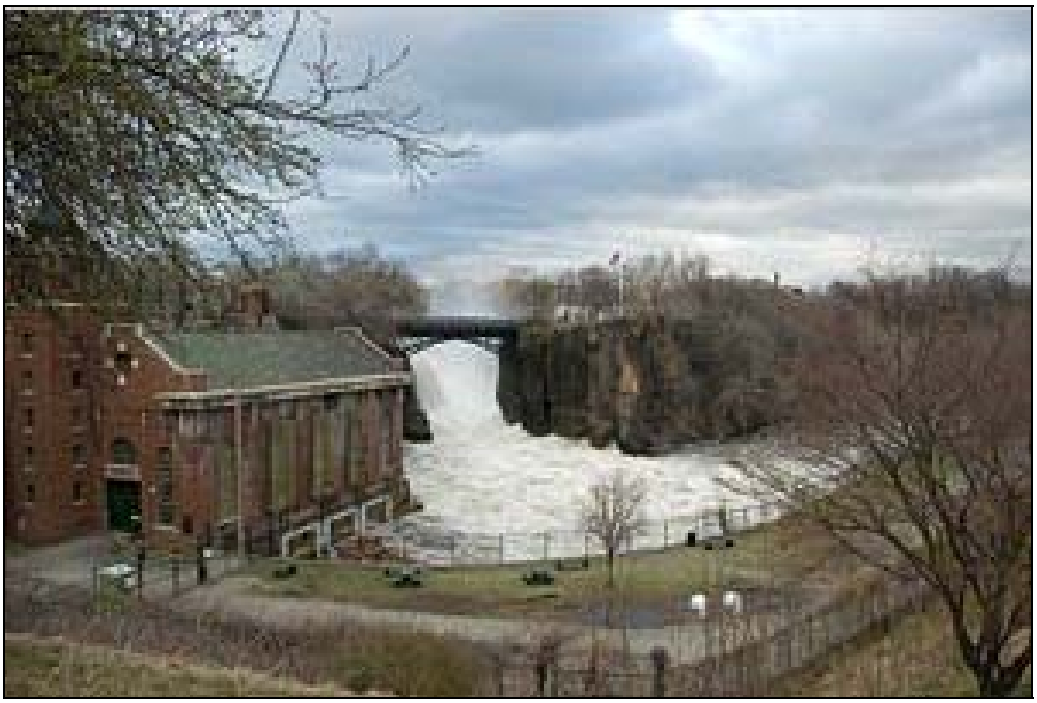
In addition to the 59 flood events listed in the NCDC database between 1993 and 2007, the Passaic County FIS and the USACE indicate that significant flood events also occurred in 1903, 1936, 1945, 1951, 1955, 1968, 1971, 1973, 1975, 1976, 1984 and 1992. The bullets below summarize the more recent floods in Passaic County, including four of the five events listed in the table immediately above. All four floods caused significant property and infrastructure damage that led to a Presidential-Disaster Declaration; the FEMA disaster number is identified after the date of each event.

- 1/19/1996 (DR-1088) - Severe Storms and Flooding. The flash flooding of the afternoon and early evening of January 19th, 1996 led to larger river flooding that extended through the 21st of the month. Strong southerly winds ushered very mild and moisture laden air into the region following a blizzard that hit New Jersey just days earlier. Street flooding became a major problem early on due to the rains and significant snowmelt. River and stream flooding occurred later in the afternoon of the 19th and continued well into the next day. In Passaic County, flood damages were estimated at $3 million.[29]
- 9/16/1999 (DR-1295) - Hurricane Floyd. This fall hurricane put the entire Eastern Seaboard on flood watch, including every county in New Jersey. Although downgraded from a hurricane by the time it hit New Jersey, the storm lasted approximately 18 hours and resulted in rainfall totals of up to 14.45 inches at Pompton Lakes in Passaic County. The Passaic River at Little Falls was above flood stage of seven feet from the 16th through the 20th, with the crest stage of ten feet occurring on the 17th. The Ramapo River at Pompton Lakes was also above its flood stage of 11.8 feet from the 16th to the 18th. The crest stage of 13.02 feet occurred early on the 17th. In Passaic County the storm killed one person who was drowned in their house from floodwaters. The NCDC estimated damages in Passaic County were $6 million.
- 04/02/2005 (DR-1588) – Severe Storms and Flooding. On April 2nd and 3rd heavy rains from an intense low pressure system caused widespread flooding throughout northern New Jersey. The NJ Office of Emergency Management (OEM) estimated that the flooding forced 6,000 residents from their homes and caused a total of $60 million in damages. Minor flooding occurred along portions of Bear Swamp Road. A Presidential-Disaster Declaration was issued in 9 New Jersey Counties, including Passaic. The damages in Passaic County were estimated at $12 million.[30]

[29] NOAA/NCDC database
[30] NOAA/NCDC database

- 4/15/2007 (DR-1694) - Severe Storms and Inland and Coastal Flooding. A seven-day Nor'easter deluged New Jersey with up to nine inches of rain, causing millions of dollars of damage and killing three residents. Statewide damage was estimated at $180 million. Passaic County rainfall ranged from 4.04 inches at Wayne to 8.08 inches at Garrett Mountain. The Passaic River at Little Falls did not fall below flood stage until late on April 23rd.[31]

Figure 6.3.7-3
Swollen Passaic River during the April 2007 Flood
(Source: Wikipedia)



Information provided by the NFIP can be used as an indication of the potential for flooding in Passaic County, and the amount of damage it has caused in the past. Review of prior NFIP flood claims can also help reveal areas of the county that are vulnerable to damages from flooding. In recent years, FEMA has focused considerable attention on insured, repetitive loss (RL) properties. By definition, these are properties that have had two or more flood insurance claim payments of at least $1,000 each over a ten-year period. In Passaic County, 1,049 residential and commercial properties have been identified as repetitive loss properties. Collectively, claim holders have received payments of just over $48.9 million (the figure includes claim payments for both building and contents damages).

Based on past and recent history, certain parts of Passaic County clearly have a high probability of flooding repeatedly in the future. Several areas adjacent to the Passaic River and its tributaries and portions of the Ramapo area of the county have flooded several times in the past. Severe flooding in Passaic County four out of the last twelve years suggests that the repeated flooding in specific areas is likely to occur again in the future.

[31] Cranford Township – Engineering Report on Tax Day Storm (April 15-17, 2007).

6.3.8 Hail

Description of the Hail Hazard

Hail is a form of precipitation comprised of spherical lumps of ice. Known as hailstones, these ice balls typically range from 5 mm–50 mm in diameter on average, with much larger hailstones forming in severe thunderstorms. The size of hailstones is a direct function of the severity and size of the storm. See Appendix D for a more detailed description and definition of the hail hazard.

Location of the Hail Hazard

Hailstorms occur more frequently during the late spring and early summer, when the jet stream migrates northward across the Great Plains. This period has extreme temperature changes from the ground surface upward into the jet stream, which produces the strong updraft winds needed for hail formation. The land area affected by individual hail events is not much smaller than that of a parent thunderstorm, an average of 15 miles in diameter around the center of a storm.

The potential for hail exists over the entire planning area, although the probability is relatively low compared to other parts of the U.S. There are at least a few occurrences of hail almost every year in the planning area, although for the most part they are minor.

Severity of the Hail Hazard

The severity of hailstorms is measured by duration, size of the hail itself, and geographic extent. All of these factors are directly related to the weather phenomena that create the hail, thunderstorms. There is wide potential variation in these severity components. The planning area has a relatively low potential for significant hail events, based on previous records.

Impact on Life and Property

There are no known instances of injuries or death from hail events in Passaic County. The NCDC database indicates there has been no reported property damage in Passaic County from hail events. Presumably there are some damages, but most of these are likely addressed by citizens or insurance companies, and therefore there is no readily available open source record of damages. Damages that do occur are presumably orders of magnitude less than other hazards such as floods or hurricane winds.

Occurrences of the Hail Hazard

The National Climatic Data Center reported 20 hail events in Passaic County from the period 1950 through 2007. Hailstone sizes from the 20 events ranged in diameter from 0.75 inches to 1.75 inches. Table 6.3.8-1 summarizes all Passaic County hail events.

Table 6.3.8-1
Hail Events, Passaic County, 1950 – 2007
(Source: NOAA/NCDC)

Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
1 PASSAIC	06/03/1968	1200	Hail	1.75 in.	0	0	0	0
2 PASSAIC	05/12/1984	1530	Hail	1.00 in.	0	0	0	0
3 PASSAIC	05/21/1985	1542	Hail	0.88 in.	0	0	0	0
4 PASSAIC	07/29/1986	1400	Hail	1.75 in.	0	0	0	0
5 Little Falls	05/29/1995	2125	Hail	1.00 in.	0	0	0	0
6 West Milford	09/07/1998	01:00 PM	Hail	0.75 in.	0	0	0	0
7 Clifton	04/09/2001	06:59 PM	Hail	0.88 in.	0	0	0	0
8 Wayne	05/29/2001	02:10 PM	Hail	0.75 in.	0	0	0	0
9 West Milford	04/19/2002	04:00 PM	Hail	1.75 in.	0	0	0	0
10 Wayne	04/19/2002	04:24 PM	Hail	0.75 in.	0	0	0	0
11 Totowa	05/31/2002	06:05 PM	Hail	0.88 in.	0	0	0	0
12 Clifton	07/19/2002	04:20 PM	Hail	0.75 in.	0	0	0	0
13 West Paterson	03/21/2003	05:46 PM	Hail	0.88 in.	0	0	0	0
14 West Paterson	03/21/2003	06:45 PM	Hail	0.75 in.	0	0	0	0
15 Pompton Lakes	05/12/2004	02:08 PM	Hail	0.88 in.	0	0	0	0
16 West Milford	06/01/2004	03:25 PM	Hail	0.75 in.	0	0	0	0
17 Wanaque	05/26/2006	10:47 AM	Hail	0.75 in.	0	0	0	0
18 West Milford	07/11/2006	03:04 PM	Hail	1.00 in.	0	0	0	0
19 West Milford	08/03/2007	20:15 PM	Hail	0.75 in.	0	0	0K	0K
20 Ringwood	06/22/2008	17:35 PM	Hail	1.00 in.	0	0	0K	0K
				TOTALS:	0	0	0	0

Note: See bullets following Table 6.3.5-1 for column heading definitions.

Based on historical records from the NCDC database, the future probability of hail events in Passaic County is relatively high. Based on historical record, hail events occur approximately every three years. However, property damage and impact to life in Passaic County is considered minimal compared to the potential damage from other hazards.

6.3.9 Hazardous Materials Release – Fixed Site

Description of the Hazardous Material Release-Fixed Site Hazard

Hazardous materials come in the form of explosives, flammable and combustible substances, poisons, and radioactive materials. These substances are most often released as a result of transportation accidents or because of chemical accidents in plants. Hazardous materials in various forms can cause death, serious injury, long-lasting health effects, and damage to buildings, homes, and other property. Many products containing hazardous chemicals are routinely used and stored in homes. These products are also shipped daily on the nation's highways, railroads, waterways, and pipelines. This section focuses on those hazardous materials that occur at facilities which are known as fixed site. The next section (6.3.10) addresses hazardous materials as they relate to transportation routes (off-site). See Appendix D for a more detailed description of the hazardous materials – fixed site hazard.

Location of the Hazardous Material Release-Fixed Site Hazard

Although there is no single, comprehensive source of open-source information about hazardous materials in the state, there are several specific sources that can be queried, and the results combined into a common summary. These sources include the FEMA HAZUS software, the Right-to-Know (RTK) network (which also acts as a switchboard for access to several other related databases), and local officials responsible for administering the Right to Know Hazardous Substance List (RTKHSL) under the New Jersey Worker and Community Right to Know Act. The paragraphs below describe sources of information about hazardous materials in New Jersey.

Right to Know Hazardous Substance List (RTKHSL)

The 2007 RTKHSL contains 2,455 hazardous substances and can be found on the State of New Jersey Department of Health and Senior Services website at located at http://web.doh.state.nj.us/rtkhsfs/rtkhsl.aspx.

FEMA HAZUS

In the spring of 2008 HAZUS version MR1 (v.1.1) was queried to identify hazardous materials for each county in New Jersey. Review of the HAZUS technical manual indicates that the source data for the hazardous materials is from the EPA Toxic Release Inventory (TRI) database queried for the year 1999 (see description under Right-to-Know subsection below and past occurrences of hazardous materials – fixe site). The HAZUS database of hazardous material facilities is limited to facilities where large quantities of chemicals that are considered highly toxic, flammable or highly explosive are stored.[32] The technical documentation recommends that the database be supplemented by local information about hazardous material sites to perform a more detailed vulnerability assessment.

Table 6.3.9-1 summarizes the HAZUS results for municipalities identified as having hazardous material facilities in Passaic County. Although the HAZUS database includes specific chemical and company names, the results have been summarized to include only the municipality name, number of facilities, and chemical quantities (in pounds). More detailed information about the results of the HAZUS query can be obtained from the New Jersey Office of Emergency Management. It should be noted that because of the processes involved in updating HAZUS, data included in periodic updates is frequently not as current as what is available on various State databases. HAZUS is used in this case because it offers the only single county-wide database of materials inventories. The RTK network (described below) supports more detailed site-specific data searches, and is the recommended resource for most planning purposes.

[32] HAZUS – Technical Manual, Chapter 10 – Hazardous Materials Release

Table 6.3.9-1
Passaic County: HAZUS Hazardous Material Inventory
(Source: HAZUS version MR1 (v.1.1))

City Name	No. of Facilities	Chemical Quantities (Pounds)
Clifton, City of	11	72
Haledon, Borough of	1	6
Hawthorne, Borough of	2	31
Passaic, City of	4	7
Paterson, City of	17	196
Totowa, Borough of	3	12
Wayne, Township of	5	31
Total	**43**	**355**

The Right-to-Know Network

The Right-to-Know (RTK) network contains data related to hazardous materials that has been compiled from various EPA databases. Several databases from the RTK site include the following:

- Toxic Release Inventory (TRI). Releases and transfers of toxic chemicals from large facilities. See Occurrences of Hazardous Materials Release – Fixed Site for additional details about the TRI database and releases for Passaic County.
- Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS). Information on potential and actual Superfund Sites. The majority of the sites listed for Passaic County are labeled as having an EPA status of "No further Remedial Action Planned" on the National Priority List.
- Emergency Response Notification System. Toxic chemicals and spills reported to the National Response Center. See past Occurrences of Hazardous Materials Release – Transportation for additional details about this database and a list of past transportation incidents in Passaic County.
- Facility Registry System. Names, addresses, and ID numbers of all facilities regulated by the EPA.
- Biennial Reporting System (BRS). The BRS is one of EPA's primary tools for tracking the generation, shipment, and receipt of hazardous waste. The BRS appears to be the best U.S. hazardous waste tracking database. It contains information from the Hazardous Waste Reports that must be filed every two years under the RCRA program. RCRA (the Resource Conservation and Recovery Act) is the Federal statute that regulates the generation, treatment, storage, disposal, or recycling of solid and hazardous waste. Facilities must report their activities involving hazardous waste to BRS if they fulfill one of two criteria: they are a Large Quantity Generator (LQG) of waste, or they treated, stored, or disposed of RCRA hazardous waste on site in units subject to RCRA permitting requirements. A Large Quantity Generator is defined as any site that generates more than 2,200 lbs of RCRA waste in a single month, accumulates more than 2.2 pounds of RCRA acute hazardous waste in any single month, or accumulates more than 220 lbs of spill cleanup material contaminated with RCRA acute hazardous waste in any month. The RTK site includes BRS records from 1989 through 2005.

Each of the databases listed can be queried from the following website: http://www.rtknet.org/

Table 6.3.9-2 provides a summary of the waste generated in Passaic County for the years 2001, 2003, and 2005 from the BRS. The table identifies Federal tons managed and generated for each of these reporting years. The database identifies the total and Federal waste generated. Federal waste includes only those wastes that have a Federal EPA waste code -- those that do not are wastes regulated by an individual state only.

Table 6.3.9-2
Hazardous Waste – Tons Generated and Tons Managed by Municipality: Passaic County, 2001 – 2005
(Source: The Right-to-know Network (RTKnet.org) – Biennial Reporting System)

City Name	# of Facilities	2001 Federal Tons Generated	Federal Tons Managed	# of Facilities	2003 Federal Tons Generated	Federal Tons Managed	# of Facilities	2005 Federal Tons Generated	Federal Tons Managed
Clifton, City of	13	401.60	403.84	6	146.53	149.16	14	378.59	375.49
Haledon, Borough of	1	50.12	50.12	1	68.73	68.73	1	35.00	35.00
Hawthorne, Borough of	0	0.00	0.00	1	61.46	65.58	4	1,125.58	1,125.59
Little Falls, Township of	2	16.75	16.75	0	0.00	0.00	0	0.00	0.00
Passaic, City of	3	60.29	60.30	3	26.86	26.86	4	122.30	122.30
Paterson, City of	14	6,861.80	6,782.33	10	846.60	854.50	9	1,904.17	1,919.35
Pompton Lakes, Borough of	1	61.98	61.98	0	0.00	0.00	0	0.00	0.00
Ringwood, Borough of	1	1.67	1.67	0	0.00	0.00	1	13,154.00	13,154.00
Totowa, Borough of	6	1,703.57	1,703.24	3	1,106.07	1,141.53	5	494.37	494.37
Wanaque, Borough of	1	369.40	417.36	1	271.66	271.66	2	54.01	1,133.59
Wayne, Township of	7	77.86	77.86	4	42.51	42.41	4	53.14	52.91
Woodland Park, Borough of	1	18.97	18.97	1	18.05	18.05	1	11.71	12.30
Total	**50**	**9,623.99**	**9,594.41**	**30**	**2,588.47**	**2,638.48**	**45**	**17,332.87**	**18,424.90**

Severity of the Hazardous Material Release - Fixed Site Hazard

The severity of a hazardous material release relates primarily to its impact on human safety and welfare and on the threat to the environment.

Threat to Human Safety and Welfare

- Poisoning of water or food sources and/or supply
- Presence of toxic fumes or explosive conditions
- Damage to personal property
- Need for the evacuation of people
- Interference with public or commercial transportation

Threat to the environment

- Injury or loss of animals or plants or habitats that are of economic or ecological importance such as; commercial, recreation or subsistence fisheries (marine plants, crustaceans, shellfish, aquaculture facilities) or livestock; seal haul outs; and marine bird rookeries
- Impact to recreational areas such as public beaches
- Impact to ecological reserves, forests, parks, archaeological and cultural sites

One method of classifying incident severity is by ranking from 1 to 4, with a "Level 1" incident considered minor; a Level 2, moderate; a "Level 3," major; and a "Level 4" severe. Thresholds depend on the type of incident and hazards. Incidents categorized as minor or moderate are often associated with known hazardous materials and limited in the area impacted. Incidents categorized as major or severe are typically associated with a fire, explosion or toxic cloud that impacts a large area, possibly disrupting essential services. Events of this magnitude present an immediate danger to the public, potentially causing deaths and injuries and may require the evacuation of large numbers of the population. Emergency response by local agencies will require assistance from outside resources to adequately respond to the incident.

In Passaic County the severity of hazardous material releases can be ranked by several methods. The EPA Toxic Release Inventory (TRI) database within the Right-to-Know Network described above ranks the top cities for on-site releases, the top chemicals released, and the top companies for releases.

The following two tables (Tables 6.3.9-3 and 6.3.9-4) display the top five on-site releases and the top five chemicals released in Passaic County between 1987 and 2006. The results from the TRI database show that the City of Paterson released approximately 8.7 million pounds during this time period, followed by the City of Clifton with roughly 4.8 million pounds. The top chemical released during this same time period was manganese compounds. These compounds have a variety of uses, including the production of dry-cell batteries, matches, and fireworks.[33]

[33] EPA. Technology Transfer Network – Air Toxics Web site

Table 6.3.9-3
Passaic County: Top 5 Municipalities for On-Site Releases, 1987 - 2006
(Source: Right-to-Know Network – Toxic Release Inventory)

City Name	Quantity Releases (Pounds)
Paterson, City of	8,757,028
Clifton, City of	4,798,823
Passaic, City of	1,848,172
Wane, Township of	1,070,750
Haledon, Borough of	1,036,221

Table 6.3.9-4
Passaic County: Top Chemicals for On-Site Releases, 1987 - 2006
(Source: Right-to-Know Network – Toxic Release Inventory)

Chemical Name	Quantity Releases (Pounds)
Manganese compounds	17,435,153
Methanol	5,564,540
Methyl ethyl ketone	3,180,208
Toluene	2,782,894
Xylene (mixed isomers)	1,690,923

Impact on Life and Property

Hazardous materials incidents (fixed sites) refer to uncontrollable releases of hazardous materials at a facility, which poses a risk to the health, safety, property, and the environment (MSP/EMD). The most well-known example of a large-scale fixed-site hazardous materials incident is that which occurred at the Union Carbide plant in Bhopal, India in 1984. This incident caused 2,500 deaths and injuries to many others. Although incidences of this scale are fairly rare, smaller-scale incidents - those requiring a response and evacuation or other protective measures - are relatively common. Table 6.3.9-5 below illustrates the relatively small number of Hazardous Materials related incidents that led to a Presidentially-Declared Disaster.

Table 6.3.9-5
Hazmat Related Federal Disaster Declarations
(Source: FEMA)

DR - Number	Declared	State	Description
3126	06/10/1998	Kansas	Kansas Grain Elevator Explosion
3094	09/16/1992	Rhode Island	Water Contamination
3092	09/04/1987	Wyoming	Methane Gas Seepage
636	03/17/1981	Kentucky	Sewer Explosion, Toxic Waste
3080	05/21/1980	New York	Chemical Waste, Love Canal
3066	08/07/1978	New York	Chemical Waste, Love Canal
139	11/05/1962	Louisiana	Chlorine Barge Accident
135	10/10/1962	Mississippi	Chlorine Barge Accident

The Office of Hazardous Materials Safety (US DOT) tracks hazardous materials incidents by state. New Jersey has had 65 major incidents since 2001, with 10 injuries reported, and damages totaling $5,739,540, an annual average of $819,934. Based on the moderate intensity of mixed land use in Passaic County (including heavy industrial and commercial uses), the likelihood for continued hazardous material incidents to occur is high within the planning area. Section 7 of this Plan includes a more detailed discussion related to the impacts of hazardous materials within Passaic County.

Occurrences of the Hazardous Material Release - Fixed Site Hazard

To identify past occurrences for fixed sites in Passaic County the Toxic Release Inventory (TRI) Explorer database was queried from the US Environmental Protection Agency's (EPA) website. Beginning in 1986, as part of the Emergency Planning and Community Right-to-Know Act (EPCRA), certain industries as well as federal facilities have been required to report the locations and quantities of chemicals stored on-site to state and local governments in order to help communities prepare to respond to chemical spills and similar emergencies. EPCRA Section 313 requires the EPA and the States to annually collect data on releases and transfers of certain toxic chemicals from industrial facilities, and make the data available to the public as part of the Toxics Release Inventory (TRI).[34] In 1990 Congress passed the Pollution Prevention Act which required that additional data on waste management and source reduction activities be reported under the TRI program.

For Passaic County, the TRI database was queried for the years 2000 through 2006, the most recent year available. For years 2000 – 2006, the results of the query are summarized below in Table 6.3.9-6. The total on site and off-site disposal or releases is reported in pounds, and includes facilities for all industries and chemicals in Passaic County. The table results show the number of facilities reported in the TRI database for Passaic County has declined from a high of 52 in 2001 to 37 in 2006. The quantity of the combined on and off-site disposal and releases has also declined from a high of 828,138 pounds in 2001 to a low of 481,604 pounds in 2006.

[34] EPA – Toxic Release Inventory Program

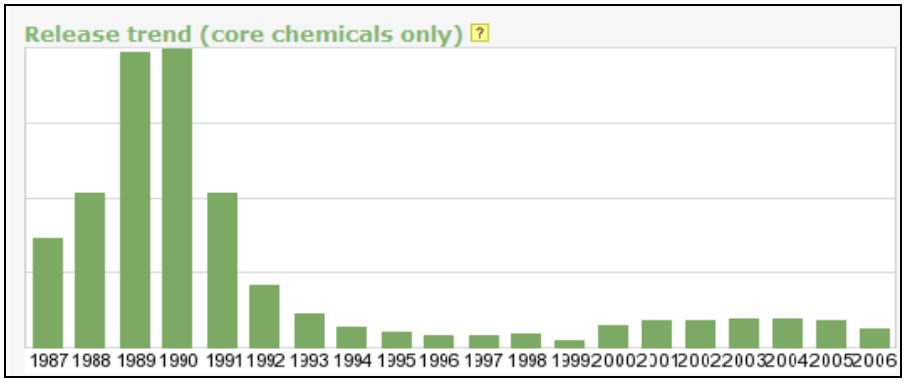
Table 6.3.9-6
Passaic County Toxic Release Inventory: 2000 – 2006
Summary of On-site and Off-site Reported Disposed of or Otherwise Released (in pounds)
(Source: US EPA – Toxic Release Inventory Database)

Year	# of Facilities Reported (TRI Explorer)	Total On-site Disposal or Other Releases (Pounds)	Total Off-site Disposal or Other Releases (Pounds)	Total On- and Off-site Disposal or Other Releases (Pounds)
2000	51	626,904	42,203	669,107
2001	52	594,192	233,946	828,138
2002	46	717,963	52,370	770,332
2003	45	723,517	65,875	789,392
2004	42	699,659	82,493	782,152
2005	42	659,222	76,001	735,223
2006	37	425,006	56,598	481,604
Total	**315**	**4,446,463**	**609,486**	**5,055,949**

The details of the query for year 2006 are included in Appendix E. The table includes the facility address, type of chemical disposed or released, and the quantity of on and off-site releases. The Passaic County results for 2006 have been included as sample, the details for other years can be found by querying the TRI Explorer database within the EPA's website. The database can be queried by navigating to the EPA -TRI home page located at http://www.epa.gov/tri and selecting "Get TRI Data" from the menu on the left side of the page. Then select the link "TRI Explorer", and "Facility" from the reports menu.

The reduction in releases for Passaic County can also be show graphically by displaying the TRI trend for a list of core chemicals during the period 1987 to 2006. For standard comparison purposes, the core chemical list excludes chemicals that have been added or removed within the reporting period. The core chemical restriction is applied to all RTK bar charts that display yearly trends. Figure 6.3.9-1 illustrates that over the past 20 years the pounds released in Passaic County has dramatically been reduced from the peak years in 1989 and 1990. The trend downward continued in the early 1990s, and remained fairly constant in the late 1990s and 2000s.

Figure 6.3.9-1
Passaic County Toxic Release Inventory Trend (Core Chemicals): 1987 – 2006
(Source: Right-to-Know Network – Toxic Release Inventory)



6.3.10 Hazardous Materials Release – Transportation

Description of the Hazardous Material Release- Transportation Hazard

As described in section 6.3.9, hazardous materials come in the form of explosives, flammable and combustible substances, poisons, and radioactive materials. These substances are most often released as a result of transportation accidents or because of chemical accidents in plants. Hazardous materials in various forms can cause death, serious injury, long-lasting health effects, and damage to buildings, homes, and other property. Many products containing hazardous chemicals are used and stored in homes routinely. These products are also shipped daily on the nation's highways, railroads, waterways, and pipelines. This section deals those hazardous materials as they relate to transportation routes (off-site).

Hazardous materials release-transportation incidents refer to uncontrollable releases of hazardous materials during transport, which pose a risk to the health, safety, property, and the environment. Small-scale incidents – those that require a response and implementation of evacuation procedures or other protective actions - are somewhat common along major U.S. highways, but can also occur through other modes of transportation including rail, water transport (shipping and ferries), air, and pipelines. Data collected by the U.S. Department of Transportation (DOT) shows that transportation related hazardous materials incidents are much more likely to occur on highways than through any other mode of transport. See Appendix D for a more detailed description of the hazardous materials – fixed site hazard.

Location of the Hazardous Material Release-Transportation Hazard

In Passaic County, hazardous materials are transported along the county highways, railways, utility transmission pipelines and vessels traveling navigable waterways. In addition, chemicals can also be transported throughout Passaic County and the region by air transportation.

Severity of the Hazardous Material Release-Transportation Hazard

Similar to the fixed site hazardous material releases, the severity of a hazardous material release relates primarily to its impact on human safety and welfare and on the threat to the environment.

Threat to Human Safety and Welfare

- Poisoning of water or food sources and/or supply
- Presence of toxic fumes or explosive conditions
- Damage to personal property
- Need for the evacuation of people
- Interference with public or commercial transportation

Threat to the environment

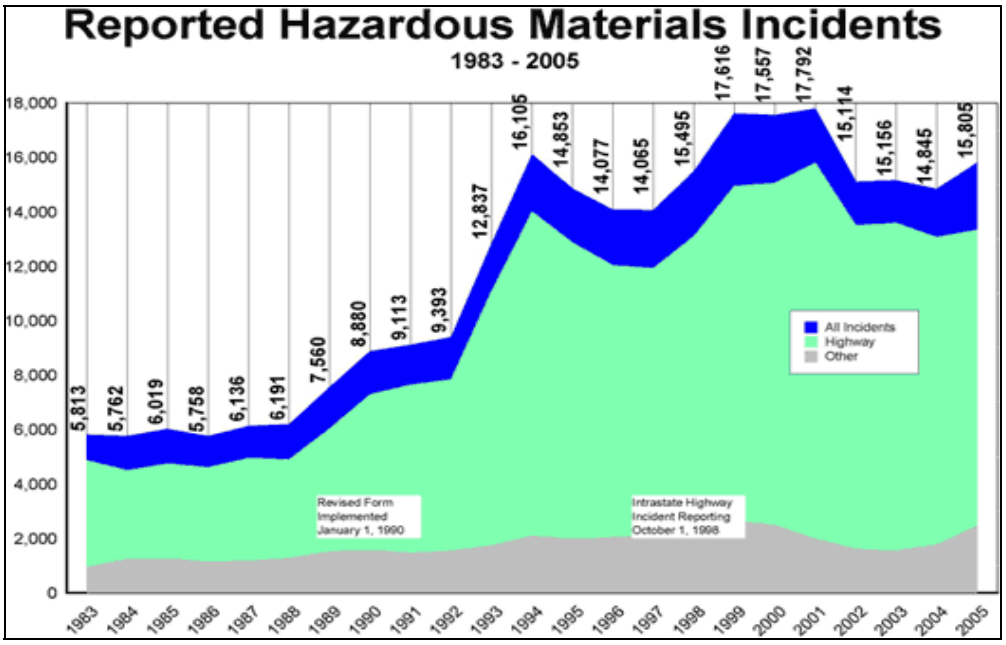
- Injury or loss of animals or plants or habitats that are of economic or ecological importance such as; commercial, recreation or subsistence fisheries (marine plants, crustaceans, shellfish, aquaculture facilities) or livestock; seal haul outs; and marine bird rookeries
- Impact to recreational areas such as public beaches
- Impact to ecological reserves, forests, parks, archaeological and cultural sites

One method of classifying incident severity is by ranking from 1 to 4, with a "Level 1" incident considered minor; a Level 2, moderate; a "Level 3," major; and a "Level 4" severe. Thresholds depend on the sort of incident and hazards. Incidents categorized as minor or moderate are often associated with known hazardous materials and limited in the area impacted. Incidents categorized as major or severe are typically associated with a fire, explosion or toxic cloud that impacts a large area, possibly disrupting essential services. Events of this magnitude present an immediate danger to the public, potentially causing deaths and injuries and may require the evacuation of large numbers of the population. Emergency response by local agencies will require assistance from outside resources to adequately respond to the incident.

Impact on Life and Property

Table 6.3.10-1 shows the reported hazardous materials incidents nationwide between 1983 and 2005. Within the graphic, the transportation related incidents are shaded green. This data shows that the vast majority of hazardous materials incidents relate to highway born transport. The data also visually demonstrates that the number of hazardous materials incidents have been steadily increasing since the 1980s as the interstate commerce has increased. As northern New Jersey, and Passaic County, continues to grow and maintain its importance as part of a transportation corridor, the likelihood for transportation related hazardous materials releases will continue to grow.

Table 6.3.10-1
Reported Hazardous Materials Incidents (1983-2005)
(Source: Office of Hazardous Materials Safety)



Occurrences of the Hazardous Material Release- Transportation Hazard

To identify past hazardous material transportation incidents for Passaic County the US EPA Emergency Response Notification System (ERNS) database was queried from the Right-to-Know website. The ERNS database is a database of incidents reported to the National Response Center. The National Response Center is operated by the U.S. Coast Guard, and has become the central point of contact used for the reporting of many different kinds of incidents involving hazardous materials.[35] The database includes 12 incident types including vessels (ships), railroads, pipelines, and surface transportation.

Table 6.3.10-2 summarizes the past hazardous materials transportation incidents for Passaic County between 1990 and 2003 (the latter is most recent year available in the database). The table lists seven prior incidents, including five road traffic accidents, two vessel collisions and one accident where four container drums fell off a parked truck. There are probably additional incidents (and incident types) that are not reported in the database. However, this was the best available data at the time this Hazard Mitigation Plan was developed. Future Plan updates will review the available data sources and integrate any additional incidents that may be identified.

[35] Right-to-Know Network – Emergency Response Notification System database

Table 6.3.10-2
Passaic County Transportation Incidents: 1990 - 2003
(Source: The Right-to-Know Network (RTKnet.org) – Emergency Response Notification System)

Incident Date	City Near Location	Incident Description	Incident Location	Amount Of Material Released	Name of Material	Remedial Action
7/24/1991	Totowa, Borough of	Tractor Trailer overturned, rupturing fuel tanks	Route 23 & 46	100 gallons	Oil: Diesel	Material was contained after reaching a cement culvert.
7/13/1994	Paterson, City of	Saddle tank accident. Truck backed over median in parking lot and broke crossover line on saddle tank.	Route 20 at 10th Avenue Circle	30 gallons	Oil: Diesel	Absorbents applied to contain spill.
12/12/2002	Clifton, City of	Material released from a tractor trailer accident.	Route 20 South	45 gallons	Oil: Diesel	Fire Department contained material.
4/20/2004	Clifton, City of	Fuel tanker overturned due to unknown causes during transit. Tanker was carrying about 5000 gallons of fuel and driver was sent to hospital with minor injuries.	Corner of Route 3 onto Route 46 West	2 gallons		Absorbents applied to contain spill.
11/23/2006	Paterson, City of	A vehicle struck a utility pole with three transformers. Material was released from the transformers and the vehicle that struck the pole.	245 Totowa	5 gallons	Oil, Misc.: Mineral, Transmission Fluid	Material was pumped out of the storm drain.
12/24/2007	Paterson, City of	An accident at a grade crossing between a passenger train and an unoccupied car. The car was lodged in the ballast. The two occupants got out of the car before being struck by the train.	Unknown	none	na	The car involved was cleared from the track.

6.3.11 High Wind – Straight Line Winds

(Includes Hurricane, Nor'easter, Tropical Storm, and Thunderstorms)

Description of the Straight Line Winds Hazard

For the purpose of this hazard mitigation Plan, straight-line winds are defined as all winds that are not related to tornadoes. This includes winds from hurricanes, nor'easters, tropical storms, and thunderstorms. The first three hazards noted here can all be categorized as tropical cyclones, and are defined as originating over tropical/subtropical waters and having an organized, cyclonic surface wind circulation. As discussed elsewhere in this Plan (in Section 6, and Appendix D), hurricanes are defined as warm-core tropical cyclones with wind speeds of at exceeding 74 mph. Nor'easters are cyclonic storms that typically track up the east coast of the U.S., (often in winter) and often are first felt as a northeast wind. Tropical storms are warm-core tropical cyclones with sustained winds of at least 39 mph (but less than hurricane force winds). Thunderstorms are local storms produced by cumulonimbus clouds, and always accompanied by lightning and thunder. Notably, the first three of these hazards (in particular hurricanes and tropical storms) are measured and categorized primarily by their wind speed. This is also the case with thunderstorms, although as with the other hazards, their severity is also measured by rainfall. These four wind hazards are differentiated from tornadoes in that they are characterized by winds that tend to be in one general direction, rather than by highly localized, high-intensity cyclonic wind flows, as is the case with tornadoes (although in many cases the other events spawn tornadoes). See Appendix D for a more detailed discussion of high wind – straight line winds.

Location of the Straight Line Winds Hazard

The entire planning area is subject to the wind effects from hurricanes, nor'easters, tropical storms, other severe events. The hurricane and tropical storm risk in the United States extends along the entire east coast from Maine to Florida, the Gulf Coast (including Florida, Alabama, Louisiana, and Texas), and Hawaii. The northeast U.S. is at a moderate risk based on historical storm tracks and the number of hurricanes that have made landfall along the Atlantic coastline. Figure 6.3.11-1 shows how the frequency and strength of extreme windstorms vary across the United States. The map is based on a combination of all past occurrences and shows that New Jersey falls within the hurricane susceptible region (shown as cross-hatching). New Jersey is also within wind Zone II, where wind speeds can reach as high as 160 mph (Source: FEMA, Wind Zone map).

Figure 6.3.11-1
Wind Zones in the United States
(Source: FEMA)

The high wind risk from nor'easters extends along the entire east coast. Nor'easters typically occur during the winter months and wind speeds can potentially reach hurricane force. The entire planning area is equally at risk from severe thunderstorms.

Severity of the Straight Line Winds Hazard

The severity of the wind hazard is measured primarily by velocity, although effects are clearly exacerbated by duration and the presence of windborne debris. As discussed in Section 7, inland New Jersey is not particularly prone to high wind hazards, but occasionally tropical storms or thunderstorms are severe enough to cause moderate damage in the area. The eastern portion of Passaic County is potentially more vulnerable from the high winds associated with hurricanes, nor'easters, and tropical storms, which often follow along the coast.

Impact on Life and Property

The NCDC database indicates that Passaic County has experienced 103 thunderstorm and high wind events between 1950 and 2007. During this period there were 2 deaths, 24 injuries and $10 million in property damage. The information in the NCDC database, reflect a significant part of the costs of recovery from strong winds. However, there are also very significant costs associated with interrupted business, lost wages, lost tax base, etc. that are very difficult to quantify but are nevertheless important metrics for determining the severity of the risk. Of these 103 events, a total of six events have exceeded 69 mph since 1950. These six events are summarized in Table 6.3.11-1 below.

Table 6.3.11-1
High Wind Events Over 69 mph, Excluding Tornado Winds, Passaic County, 1950 – 2007
(Source: NOAA/NCDC)

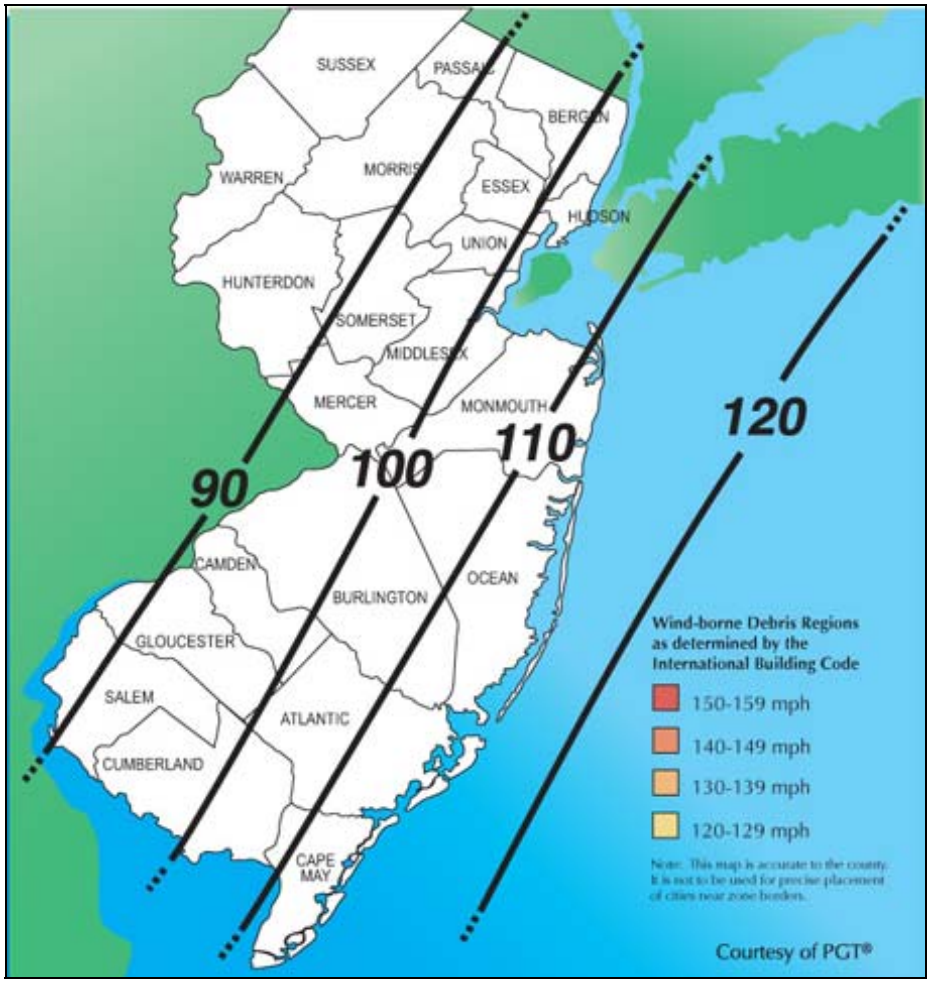
Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
1 PASSAIC	11/20/1989	2028	Tstm Wind	74 kts.	0	0	0	0
2 Wayne	04/04/1995	1242	Thunderstorm Winds	60 kts.	0	0	0	0
3 Wayne	09/09/1999	03:50 PM	Tstm Wind	60 kts.	0	0	0	0
4 NJZ004	03/08/2008	19:16 PM	High Wind	65 kts.	0	0	0K	0K
5 NJZ004	03/08/2008	19:17 PM	High Wind	65 kts.	0	0	0K	0K
6 Clifton	06/10/2008	20:28 PM	Thunderstorm Wind	61 kts.	0	0	2K	0K
				TOTALS:	0	0	2K	0

Note: Coded letters and numbers under Location or County column is a result of output from the NCDC query. See bullets following Table 6.3.5-1 for column heading definitions.

To protect life and property from wind events, all counties within the State of New Jersey, including Passaic County, are required to comply with the design wind loads developed by the International Building Code (IBC) and the International Residential Code (IRC). The building code administered within the incorporated areas of Passaic County require all new construction to be designed and constructed to either 90 or 100 mph wind loads.[36] Figure 6.3.11-2 identifies the minimum design wind speeds for New Jersey.

[36] NJ Department of Community Affairs - Division of Codes and Standards: Bulletin No. 3-4 – Wind Speed Map

Figure 6.3.11-2
American Society of Civil Engineers (ASCE) New Jersey Wind Zone Map
(Source: ASCE Minimum Design Loads for Buildings and other Structures)



Occurrences of the Straight Line Winds Hazard

Between 1950 and 2007, there have been numerous hurricanes, nor'easters, tropical storms, and severe storms that have impacted all or part of Passaic County. The NCDC database shows that Passaic County has been impacted by no hurricanes or tropical storm events between 1950 and 2007. In addition to the NCDC database, NOAA's Historic Hurricane Tracks database was also queried to identify past hurricane events that have impacted Passaic County between 1960 and 2007. The query results identified 11 hurricanes or tropical storms that impacted Passaic County during this time period. Most of these events were downgraded to a tropical depression or less by the time they reached New Jersey.

The National Weather Service, NOAA, and the NCDC do not specifically track nor'easter events. However the one coastal flooding event listed for Passaic County within the Ocean and Lake Surf category of the NCDC database along with other open data sources indicates there have been numerous nor'easters in the past that have impacted the planning area with high winds. Some of the larger nor'easter events occurred in years 1993, 1996, 2006, and 2007. As mentioned above, there have been 103 thunderstorm and high wind events between 1950 and 2007.

Several of the hurricane, tropical storm, and nor'easter events are highlighted below.

- September 27, 1985 – Hurricane Gloria. After brushing the outer banks of North Carolina the storm moved northward just off the Atlantic coast until making landfall as a Category 2 Hurricane near western Long Island, New York. Along the coastline of northern New Jersey sustained winds were approximately 80 mph with gusts over 100 mph. Hurricane Gloria caused one of the largest single power outages at the time, including about 230,000 customers in New Jersey.
- March 16, 1993 (Storm of the Century). One of the most intense nor'easters to ever effect the United States. The "Storm of the Century" label was given to the event due to the record low pressure, wind speeds, temperature and snowfall. Fallen trees from high winds left three million customers without electrical power[37]. Wind gusts of over 70 mph were reported at New York City's LaGuardia airport.
- October 18, 1996. A 5-day nor'easter that lasted from October 18th – 23rd. Record rainfall, flooding, and high winds effected parts of New Jersey from Morris County to Camden County to Hunterdon County.
- September 18, 2003 - Tropical Storm Isabel. Isabel made landfall as a hurricane near Drum Inlet, North Carolina on the 18th and weakened as it tracked farther inland. Winds gusted were recorded up to 62 mph in New Jersey. This resulted in widespread downed trees, tree limbs and power lines. It was one of the worst power outages on record for area utilities. Jersey Central Power and Light reported that 220,000 of its customers lost power while Conectiv Energy reported about 162,000 of its customers lost power.
- February 12, 2006. A Nor'easter that impacted the New Jersey shoreline with strong onshore winds that caused coastal flooding and beach erosion.

The planning area has been impacted by 11 hurricanes or tropical storms over the last 47 years, an average of one of these events about every four years. However, as mentioned, almost all had been downgraded to tropical storm or tropical depression status by the time they reached New Jersey. The county can be considered at low to moderate risk of experiencing the high wind effects from such tropical events. The area is also at moderate risk from nor'easters, which impact the state once or twice a year, although there is no exact definition of a nor'easter. Not all of these relatively common events are severe enough to cause damage or result in disaster declarations. Passaic County has been impacted by high winds from four strong nor'easters over the past 15 years, an average of one event approximately every four years. Note that Section 7 of this hazard mitigation Plan includes a more detailed discussion about wind risk in Passaic County.

6.3.12 High Wind−Tornado

Description of the Tornado Hazard

A tornado is a violent windstorm characterized by a twisting, funnel-shaped cloud extending to the ground. Tornadoes are most often generated by thunderstorm activity (but they also result from hurricanes and other tropical storms) when cool, dry air intersects and overrides a layer of warm, moist air forcing the warm air to rise rapidly.

The damage caused by a tornado is a result of the high wind velocity and wind-blown debris. The destruction caused by tornadoes ranges from light to inconceivable depending on the intensity, size and duration of the storm. Typically, tornadoes cause the greatest damage to structures of light construction such as residential homes (particularly mobile homes). The *Enhanced Fujita Scale for Tornadoes* was developed to measure tornado strength (i.e., magnitude or intensity) and associated types of damages (Table 6.3.12-1).

[37] NOAA/NCDC database

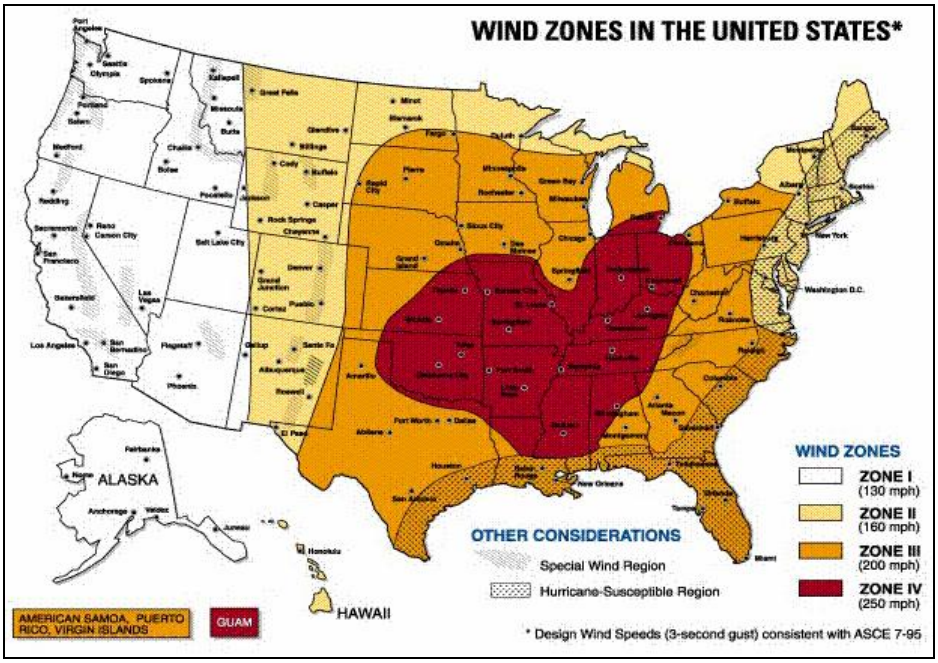
Table 6.3.12-1
Enhanced Fujita Scale for Tornadoes

EF-Scale Number	Intensity Phrase	3 Second Gust (MPH)	Type of Damage Done
F0	Gale	65–85	Some damage to chimneys; breaks branches off trees; pushes over shallow-rooted trees; damages to sign boards.
F1	Moderate	86–110	The lower limit is the beginning of hurricane wind speed; peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off the roads; attached garages may be destroyed.
F2	Significant	111–135	Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light object missiles generated.
F3	Severe	136–165	Roof and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted.
F4	Devastating	166–200	Well-constructed houses leveled; structures with weak foundations blown off some distance; cars thrown and large missiles generated.
F5	Incredible	Over 200	Strong frame houses lifted off foundations and carried considerable distances to disintegrate; automobile sized missiles fly through the air in excess of 100 meters; trees debarked; steel re-enforced concrete structures badly damaged.

Hazard Identification

The US Wind Zone Map (Figure 6.3.12-1) shows the areas affected by extreme windstorms. Developed by the US Army Corps of Engineers, it is based on the history of 40 years of tornadoes and 100 years of hurricanes.

Figure 6.3.12-1
US Wind Zone Map
(Source: USACE, 7-95 and FEMA 386-2, p.2-20)



According to this figure, all of New Jersey is within Zone II. The Design Wind Speed for this zone is indicated as 160 miles per hour (mph). Per Table 6.3.11-1, wind speeds of 160 mph are associated with "severe" conditions.

Historical Occurrences

According to NOAA National Climatic Data Center, there have been a total of 3 recorded tornado events in the County between the years of 1950 and June 2008. As listed in Table 6.3.12-2, 0 deaths, 0 injuries, and $2.553 million in property damages resulted from these events. The magnitude of these tornadoes ranges from F0 to F1 in intensity. The most property damage occurred from an F1 tornado on July 10, 1989. The tornado was 100 yards wide and was on the ground for approximately five miles. The tornado caused an estimated $2.5 million in damages and injured three people.[38] The NCDC database provides no additional details about the event.

Table 6.3.12-2
Historical Tornado Impacts
(Source: NOAA/NCDC)

Location	Date & Time	Magnitude	Deaths/ Injuries	Property Damage
Passaic	7/10/1989	F1	0 / 0	$2,500,000
Passaic	8/13/1990	F0	0 / 0	$0
West Milford	9/11/1997	F1	0 / 0	$53,000

[38] NOAA/NCDC database

New Jersey currently ranks number 37 nationally for frequency of tornadoes. Tornadoes have an impact on Passaic County equally and uniformly. The severity of the tornadoes identified in the NCDC database for Passaic County ranged from F0 to F1.

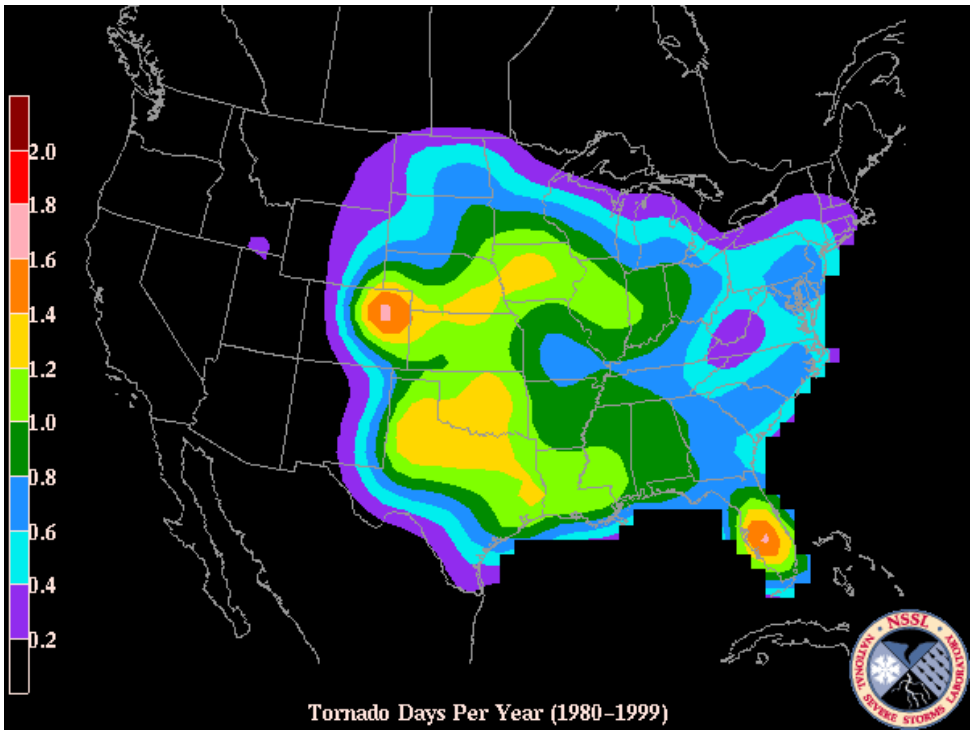
Impact on Life and Property

The NCDC database reports there have been no deaths and three injuries from tornadoes in Passaic County. Tornadoes have caused slightly more than $2.5 million in property damage. The most property damage occurred from an F1 tornado on July 10, 1989. The tornado was 100 yards wide and was on the ground for approximately five miles. The tornado caused an estimated $2.5 million in damages and injured three people.[39] The NCDC database provides no additional details about the event.

Location, Magnitude and Probability

A recent study from NOAA's National Severe Storms Laboratory provided highly accurate and accessible estimates of the long-term threat from tornadoes. Using historical data, the NSSL estimated the daily probability of a tornado occurring near any location in the U.S for any tornado no matter how strong or weak (i.e., no matter what its magnitude). The NSSL map below (Figure 6.3.12-2) can be used to obtain these estimates. For example, the NSSL estimates a probability for any tornado of about 1.3 days per year in south-central Oklahoma, and 0.4 to 0.6 days per year in southern New York.

Figure 6.3.12-2
Probability of a Tornado of any Magnitude
(Source: www.nssl.noaa.gov/primer/tornado/tor_hazardgraph.html)



[39] NOAA/NCDC database

Based on this NOAA NSSL map, the tornado probability for Passaic County is about 0.4 to 0.6 tornado days per year for any tornado.

6.3.13 Ice Storm

Description of the Ice Storm Hazard

Although snow is the weather phenomenon most commonly associated with winter, ice storms can cause significant disruption to business and create treacherous driving conditions (See Section 6.3.16, Severe Storm - Winter Weather, for a detailed discussion of winter weather). The freezing rain that coats all objects in a sheath of ice can cause power outages, structural damage, damaging tree falls. Ice storms occur when rain droplets fall through freezing air and but do not freeze until they touch objects such as trees, roads, or structures. A clear icy sheath, known as a glaze, forms around branches, structures and wires and has been known to bring down high-tension utility, radio, and television transmission towers. See Appendix D for a more detailed description of the ice storm hazard.

Location of the Ice Storm Hazard

All regions of Passaic County have been subject to ice storms. Besides temperature, their occurrence depends on the regional distribution of the pressure systems, as well as local weather conditions. The distribution of ice storms often coincides with general distribution of snow. In Passaic County, as a coastal storm moves northeastward offshore, a cold rain may be falling in the far eastern part of the County, changing to freezing rain in the central region, and snow over the extreme western portion. A locality's distance to the passing storm center is often the crucial factor in determining the temperature and type of precipitation during a winter storm.

The potential for ice storms is uniform for the entire planning area. All people and assets are considered to have the same degree of exposure.

Severity of the Ice Storm Hazard

The severity of the ice storm hazard is dependent on a variety of factors including the surface temperature, duration of the event, and thickness of the ice.

Impact on Life and Property

The NCDC database indicates there have been no deaths, injuries or property damage from previous ice storms in Passaic County. However, ice storms most likely have caused both infrastructure and property damage such as downed electrical power lines and trees falling on houses. In addition ice storms potentially put lives at risk from automobile accidents on ice covered roadways. With no indication of past damages from ice storms, or events that included a wintry mix, this hazard was not selected as part of the more detailed risk assessment.

Occurrences of the Ice Storm Hazard

The NCDC database indicates there have been two ice storms that have impacted Passaic County between 1950 and 2007. In addition to the two ice storms, the database indicates there have been eight snow/ice storm events and one wintry mix event. Both of these event types include a combination of snow, sleet, and freezing rain.

The two ice storm events occurred between 1994 and 2007. The database provides no indication as to why there are no events prior to 1994, although presumably occurrences roughly follow the same pattern and frequency as shown in the NCDC list. A typical event occurred on March 9th, 1994 when a low pressure center moving eastward along a nearly stationary frontal boundary in central New Jersey, caused a significant amount of precipitation to fall. Across the colder interior sections of Passaic County this precipitation fell as sleet and freezing rain. This caused a significant disruption of transportation and commerce as roadways iced over and became extremely dangerous.[40]

Passaic County experiences an event that includes freezing rain or ice as part of a winter storm about once a year, based on the three ice storms, one wintry mix event, and eight snow/ice storm events between 1994 and 2007. Based on previous data, the probability of ice storms occurring in the future is relatively high. However the overall impact to life and property throughout the planning can considered low to moderate.

6.3.14 Landslide (non-seismic)

Description of the Landslide Hazard

A landslide is a natural geologic process involving the movement of earth materials down a slope, including rock, earth, debris, or a combination of these, under the influence of gravity. However, there are a variety of triggers for landslides such as: a heavy rainfall event, earthquakes, or human activity. The rate of landslide movement ranges from rapid to very slow. A landslide can involve large or small volumes of material. Material can move in nearly intact blocks or be greatly deformed and rearranged. The slope may be nearly vertical or fairly gentle (Delano and Wilshusen, 2001). See Appendix D for a more detailed description and definition of the Landslide hazard.

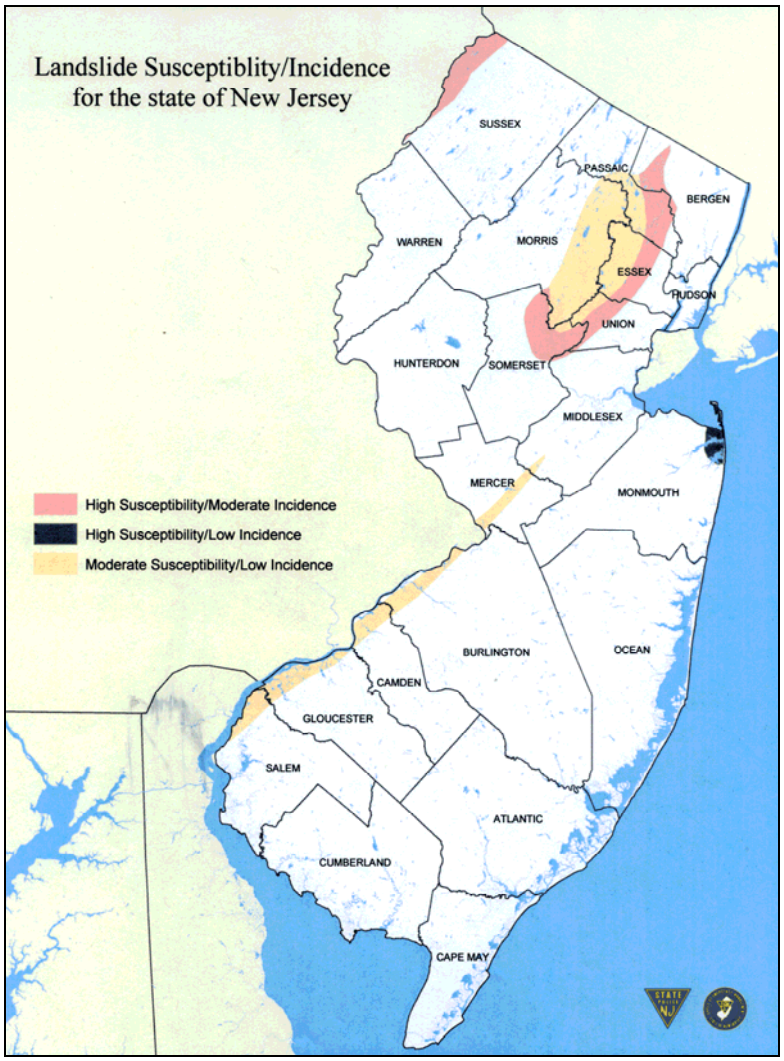
Location of the Landslide Hazard

Landslides are usually associated with mountainous areas but can also occur in areas of generally low relief. In low-relief areas, landslides occur due to steepening of slopes: as cut and fill failures (roadway and building excavations), river bluff failures, collapse of mine waste piles, and a wide variety of slope failures associated with quarries and open-pit mines (USGS, Landslide Types and Process, 2004).

[40] NOAA/NCDC database

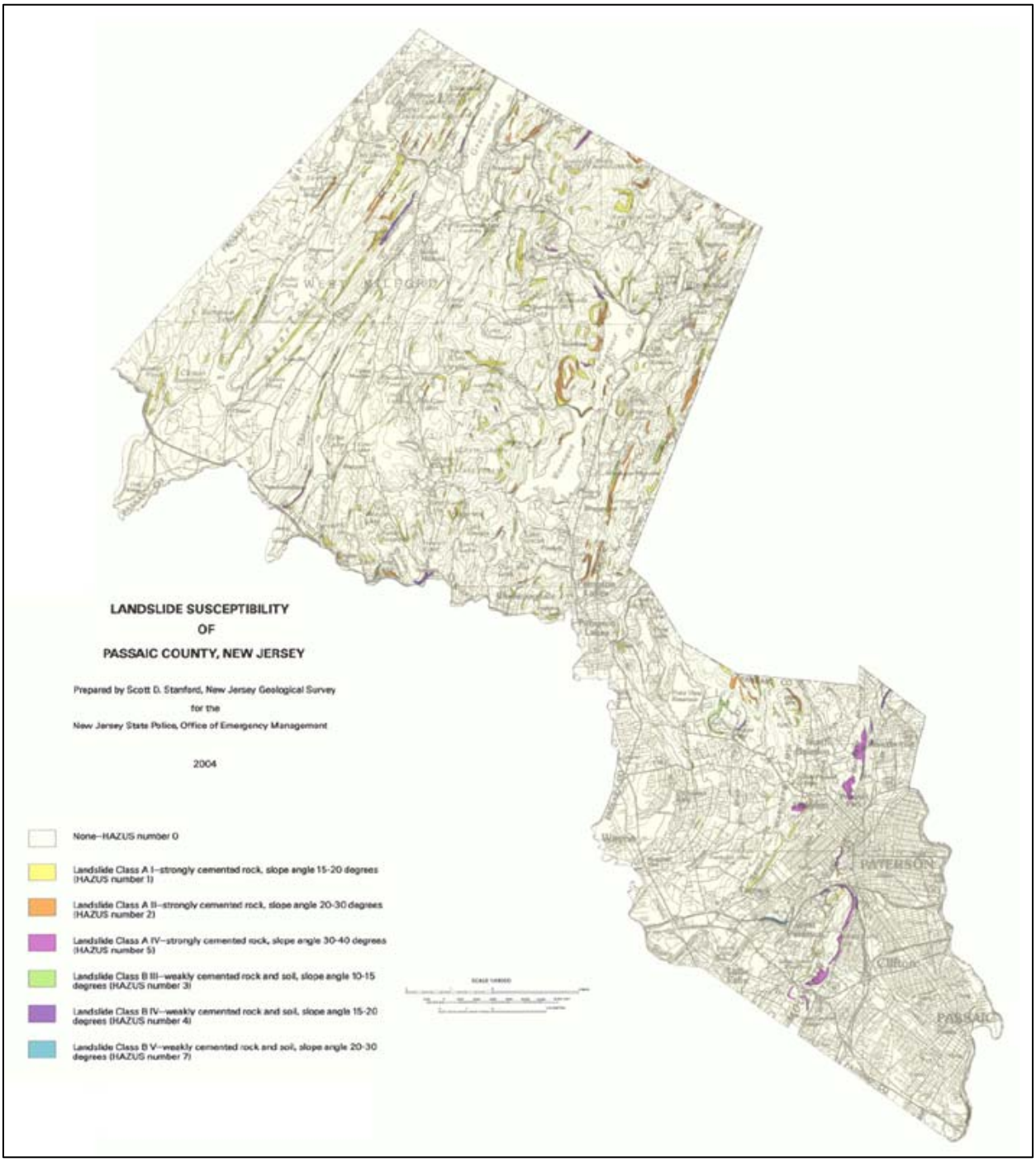
The New Jersey Geological Survey (NJGS) has developed several landslide susceptibility maps for Passaic County and the State of New Jersey. In Passaic County the area most susceptible to landslides is concentrated near the central and southeastern portion of the county. As shown in Figure 6.3.14-1, with the exception of the far southeastern area, the majority of the southeastern portion of the county is shaded red, indicating that the landslide susceptibility is considered high in this area with moderate incidence. The central part of the county is shaded tan, indicating that the landslide susceptibility is considered moderate with low incidence. The landslide susceptibility is considered low in the remainder of the planning area.

Figure 6.3.14-1
New Jersey Landslide Susceptibility/Incidence Map
(Source: New Jersey Geological Survey)



In 2004, as part of the *Earthquake Loss Estimation Study for Passaic County,* the NJGS produced a landslide susceptibility map using six landslide classes from the HAZUS model (HAZUS User Manual Table 9.2 - National Institute of Building Sciences). The six landslide classes are broken down into two general categories; Landslide Class A (strongly connected rock), and Landslide Class B (weakly connected rock). Figure 6.3.14-2 identifies the landslide susceptibility areas in Passaic County based on the color coded landslide classes. The map shows that landslide susceptible areas are concentrated in thin bands along the steep slopes of the mountainous areas of western Passaic County. In this portion of the county, the majority of the landslide susceptibility areas are within the Landslide Classes A I and A II, shaded yellow and orange on the map. These areas are considered to have strongly cemented rock, with a slope angle of either 15 – 20 degrees (shaded yellow) or 20 – 30 degrees (shaded orange). In the southeastern part of the county, portions of Hawthorne and Woodland Park Boroughs fall are within Landslide Class A IV, shaded light purple on the map. These areas are considered to have strongly cemented rock, with a slope angle of 30 – 40 degrees.

Figure 6.3.14-2
Passaic County Landslide Susceptibility Map
(Source: Earthquake Loss Estimation Study for Passaic County, New Jersey: Geologic Component
(New Jersey Geologic Survey, 2004)



Severity of the Landslide Hazard

Landslides are considered highly site specific events and are concentrated in areas of steep slopes. The severity of the landslide hazard depends on a combination of slope angle and the geologic material underlying the slope.

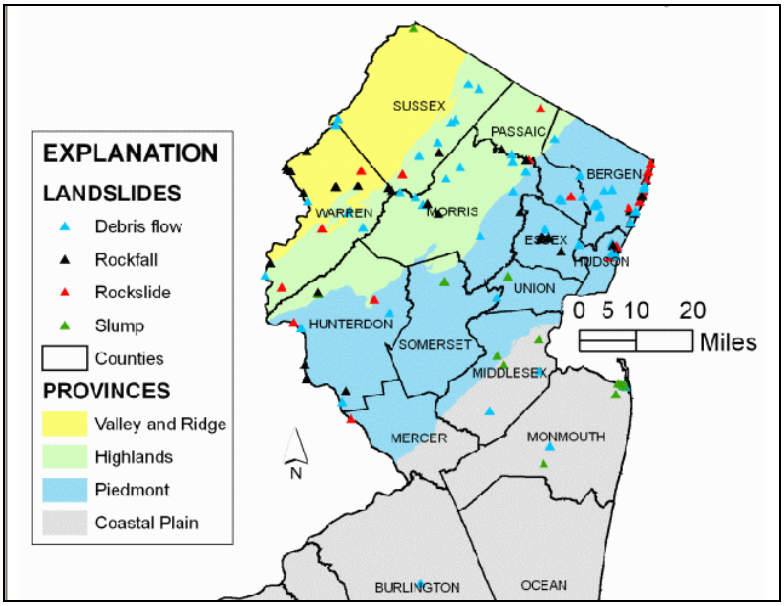
Impact on Life and Property

According to the NJGS, the majority of southeastern Passaic County is moderately to highly susceptible to landslides (as shown in Figure 6.3.14-1). The majority of the high landslide susceptibility area is located within an area that also has a high population density, although to date there are no known instances of injuries or deaths from landside events in Passaic County. Although such risks must be determined on a site-specific basis, there is a reasonable expectation that the potential for damages, deaths and injuries will continue to be minimal.

Occurrences of the Landslide Hazard

The New Jersey Geologic Survey (NJGS) indicates there have been 160 landslides statewide in New Jersey since 1950. As shown in Figure 6.3.14-3, all of these events have occurred in the northern part of the state. In Passaic County five landslides have occurred since 1950. The events are categorized on the map as two rockslides and three debris flows.

Figure 6.3.14-3
Landslides in Northern New Jersey
(Source: New Jersey Geological Survey)



Landslide probabilities are largely a function of surface geology, but are also influenced by both weather and human activities, as noted above. Based on the data from the NJGS, on average Passaic County has experienced a landslide event about every 11 years. There are presumably other small landslides that have occurred in the county that are not reported to the NGJS. The probability of future landslides having a significant impact on property and life in the planning area is relatively low.

6.3.15 Severe Storm - Lightning

Description of the Lightning Hazard

Lightning events are generated by atmospheric imbalance and turbulence due to a combination of conditions. Lightning, which occurs during all thunderstorms, can strike anywhere. Generated by the buildup of charged ions in a thundercloud, the discharge of a lightning bolt interacts with the best conducting object or surface on the ground. The air in the channel of a lightning strike reaches temperatures higher than 50,000 degrees F. See Appendix D for a more detailed description of the lightning hazard.

Location of the Lightning Hazard

Lightning occurs over the entire planning area, particularly during the spring and summer months.

Severity of Lightning Hazard

Severe lightning events can occur anywhere in the planning area. Even during common events, the lightning current can branch off to strike a person from a tree, fence, pole, or other tall object. In addition, electrical current may be conducted through the ground to a person after lightning strikes a nearby tree, antenna, or other tall object. The current also may travel through power lines, telephone lines, or plumbing pipes to a person who is in contact with an electric appliance, telephone, or plumbing fixture. Lightning may use similar processes to damage property or cause fires.

Impact on Life and Property

About 100 deaths and 500 injuries are reported annually across the U.S. from this hazard. According to the NCDC, in Passaic County there were no deaths, four injuries, and no property damages related to lightning from 1950 to 2007. The low injury and death rate from previous lightning events points to a relatively low vulnerability for lightning hazards in the planning area.

Occurrences of the Lightning Hazard

There were three instances of lightning reported in the NCDC database for Passaic County from 1950 to 2007. All three events occurred between 1995 and 1998. The database provides no indication as to why there are no events prior to 1995, although presumably occurrences roughly follow the same pattern and frequency as shown in the NCDC list. Clearly, there are many such events every year, but they are presumably not significant enough to reach the threshold for reporting to NOAA/NCDC for inclusion in the database.

Table 6.3.15-1
Lightning Events, Passaic County, 1950 – 2007
(Source: NOAA/NCDC)

Query Results

3 LIGHTNING event(s) were reported in **Passaic County, New Jersey** between **01/01/1950** and **01/01/2007**.

*Click on **Location or County** to display Details.*

Mag: Magnitude
Dth: Deaths
Inj: Injuries
PrD: Property Damage
CrD: Crop Damage

New Jersey

Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
1 Wayne	07/11/1995	0200	Lightning	N/A	0	0	0	0
2 Hawthorne	07/11/1996	06:30 PM	Lightning	N/A	0	1	0	0
3 West Milford	07/17/1998	04:20 PM	Lightning	N/A	0	3	0	0
				TOTALS:	0	4	0	0

Note: See bullets following Table 6.3.5-1 for column heading definitions.

As noted, like most of the U.S., Passaic County is subject to numerous thunderstorm-related lightning events annually, so the probability of lightning occurring is extremely high. However, the likelihood of events significant enough to cause severe damage is low.

6.3.16 Severe Storm - Winter Weather

Description of the Winter Weather Hazard

Winter storms bring various forms of precipitation that occur only at cold temperatures. These kinds of precipitation include snow, sleet, or a rainstorm where ground temperatures are cold enough to allow icy conditions. These cold weather storms can also take the form of freezing rain or a wintry mix. See Section 6.3.13, Ice Storm, for a detailed discussion of the ice storm hazard.

Heavy snowfall and extreme cold can immobilize an entire region. Even areas that normally experience mild winters can be hit with a major snowstorm or extreme cold. Winter storms can result in flooding, storm surge, closed highways, blocked roads, downed power lines and hypothermia. See Appendix D for a more detailed description of the severe storm - winter weather hazard.

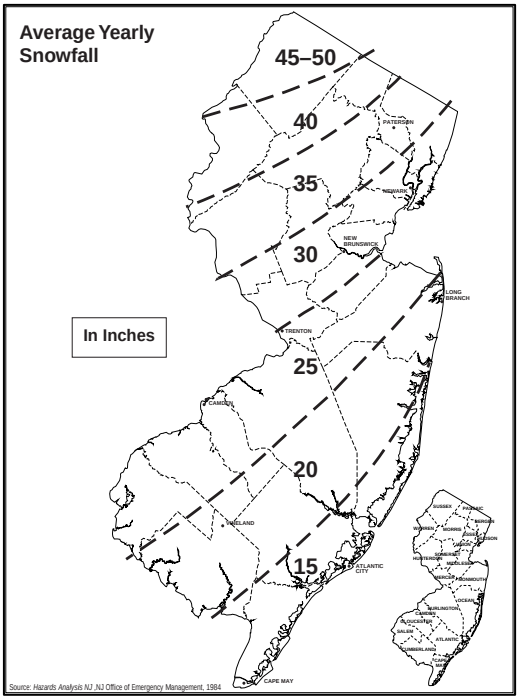
Figure 6.3.16-1
Heavy Snow from the 1993 Storm of the Century
(Source: Popular Mechanics - Science)

Location of the Winter Storm Hazard

The potential for winter storms is uniform for the entire planning area. All people and assets are considered to have the same degree of exposure.

Seasonal snowfall in New Jersey varies from an average of about 15 inches at Atlantic City to about 50 inches in Sussex County. There is, however, significant variation from year to year. February is the month when maximum accumulations on the ground are usually reached. Figure 6.3.16-2 shows that in Passaic County the average yearly snowfall ranges between 35 and 40 inches.

Figure 6.3.16-2
Average Annual Snowfall in New Jersey
(Source: NJOffice of Emergency Managemen)



Severity of Winter Storm Hazard

Although the NCDC database has not categorized any previous storms in Passaic County as blizzards, this is perhaps the most severe type of winter storm, characterized by low temperatures, strong winds, and heavy blowing snow. The NCDC database query results include winter storm events between 1994 and 2007. In mid-March 1993, the eastern U.S. experienced one of the most intense winter storms on record. The event, know as the "Storm of the Century" caused blizzard conditions throughout most of New Jersey dumping as much three feet of snow in some parts of the State.

Impact on Life and Property

The NCDC reports there have been no injuries, deaths, or property damage due to winter weather events in Passaic County. Presumably there are damages from winter weather events, but most likely were never reported to the NCDC. To estimate the winter weather related damages, deaths and injuries in Passaic County, a proportion of the statewide totals were calculated from the NCDC database based on New Jersey population statistics from the 2000 US Census. Section 7 of this Plan (Risk Assessment) includes a more detailed discussion of the severe storm – winter weather hazard, and how the Passaic County figures were calculated.

Occurrences of the Winter Weather Hazard

Winter storms occur frequently enough in Passaic County to be a threat to people and property. Generally, the winter storm season in Passaic County runs from December to March. The NCDC reports that in Passaic County there have been 46 snow and ice events between 1950 and 2007. Although the query results begin in 1950 the first reported event is in 1993. It is unclear why the database does not include any events prior to 1993. Table 6.3.16-3 summarizes some of the major winter storm events that have impacted Passaic County in the past. Based on past history, the probability of winter weather events occurring in the future is relatively high, based on previous data. On average, two to three winter storms occur every year in Passaic County.

Table 6.3.16-3
Summary of Notable Winter Storm Events impacting Passaic County
(Source: NOAA, National Weather Service)

Date(s)	Storm Type	Description
February 7, 1978	Blizzard	This blizzard caused an estimated $24 million in damage Statewide, primarily to dunes, beaches, and public facilities along the beachfront.
March 13, 1993 (DR-3106)	Blizzard	Event known as the "Storm of the Century" affected as many as 26 States from Florida to Maine, the Gulf Coast, and the Ohio Valley. One of the most intense nor'easters to ever effect the United States. The "Storm of the Century" label was given to the event due to the record low pressure, wind speeds, temperature and snowfall. All 21 counties in New Jersey were included in the Presidentially Declared Disaster. In Passaic County snowfall totals ranged from 14-23 inches.
January 7, 1996 (DR-1088)	Blizzard	A State of Emergency was declared for the blizzard that hit the State. Road conditions were dangerous due to the high winds and drifts. Both government and contract snow plowing operations were running at a maximum. Local roads were impassable. This blizzard also brought on coastal flooding with the high tides of Sunday evening and Monday morning, and there were reports of damage to dunes and beaches from the heavy wave activity. More than 400 National Guard personnel were activated for transport assistance, primarily for medic missions. In Passaic County snowfall totals ranged from 17-27 inches.
February 16, 2003	Snow Storm	The combination of the very cold temperatures and the approach of a strong storm system caused widespread snow to break out, starting before sunrise on Sunday, February 16th. Snow continued during the day Sunday, heavy at times, and continued into Sunday night. Precipitation continued on Monday, before finally coming to an end on Tuesday. Total snowfall in Passaic County ranged from 17 to 29 inches. New Jersey requested and was granted a Snow Emergency Declaration for all 21 counties. The President's Day snowstorm tied or set records in all 21 New Jersey counties including Passaic. Statewide, the event resulted in damages estimated at approximately $30.2 million.

6.3.17 Storm Surge

(Includes Hurricanes, Nor'easters, Tropical Storms)

Description of the Storm Surge Hazard

Storm surges are caused by hurricanes, nor'easters, and tropical storms caused that impact coastal areas. Surge is simply water that is pushed toward the shore by the force of the winds swirling around the storm. This advancing surge combines with the normal tides to create the hurricane storm tide, which can increase the mean water level 15 feet or more. In addition, wind driven waves are superimposed on the storm tide. This rise in water level can cause severe flooding in coastal areas, particularly when the storm tide coincides with the normal high tides.[41]
Storm surges are particularly damaging when they occur at the time of a high tide, combining the effects of the surge and the tide. This increases the difficulty of predicting the magnitude of a storm surge since it requires weather forecasts to be accurate to within a few hours. See Appendix D for a more detailed description of the storm surge hazard.

Location of the Storm Surge Hazard

Storm surge vulnerability is closely related to elevation relative to sea level and proximity to the coast, the lower the elevation and closer to the potential sources of flooding, the more likely it is that an area will be negatively impacted by surge. Surge can come directly from the Atlantic Ocean and various bays in the state, and also can occur as a result of backwater effects on rivers. The storm surge hazard associated with hurricanes and other severe storms has historically been responsible for coastal flooding and erosion along the New Jersey coastline. In addition to flooding coastal areas, storm surge can also reach further inland impacting lakes and rivers. In 1992, the USACE–New York District completed the *Passaic River Flood Protection Project, Storm Surge Analysis*. The study area for the analysis included Newark Bay and the tidal portion of its tributaries, the Passaic and Hackensack Rivers. The USACE report indicated that the area along the Passaic River in the southeastern part of the county is considered vulnerable from storm surge as far upstream as Dundee Dam in the City of Clifton.[42] The dam is located along the Passaic River a distance of 17 river miles upstream from its outlet at the Newark Bay. See Figure 6.3.7-2 (Flood section) for a map of the Passaic River.

Severity of the Storm Surge Hazard

Storm surges inundate coastal floodplains by tidal elevation rise in inland bays and ports, and backwater flooding through coastal river mouths. Severe winds associated with low-pressure systems cause increase in tide levels and water surface elevations. Storm systems also generate large waves that run up and flood coastal areas. The combined effects create storm surges that affect the beach, marsh, and low-lying floodplains. Shallow offshore depths can cause storm driven waves and tides to pile up against the shoreline and inside bays. Table 6.3.17-1 highlights the factors that can influence the severity of coastal storms.

[41] NOAA – storm surge description
[42] USACE –New York District. Passaic River Flood Protection Project, Storm Surge Analysis

Table 6.3.17-1
Factors that Influence the Severity of Storm Surge

Factor	Effect
Wind Velocity	The higher the wind velocity the greater the damage.
Storm Surge Height	The higher the storm surge the greater the damage.
Coastal Shape	Concave shoreline sections sustain more damage because the water is driven into a confined area by the advancing storm, thus increasing storm surge height and storm surge flooding.
Storm Center Velocity	Then slower the storm moves, the greater damage. The worst possible situation is a storm that stalls along a coast, through several high tides.
Nature of Coast	Damage is most severe on low-lying island barrier shorelines because they are easily over washed by wave action.
Previous Storm Damage	A coast weakened by even a minor previous storm will be subject to greater damage in a subsequent storm.
Human Activity	With increased development, property damage increases and more floating debris becomes available to knock down other structures.

Impact on Life and Property

In Passaic County there have been no deaths or injuries due to storm surge. No property damage has been reported related to storm surge.

Occurrences of the Storm Surge Hazard

The structure of the NCDC database combines coastal flooding and storm surge events into a category titled "Ocean and Lake Surf." The database indicates there have no storm surge events and one coastal flooding event that have impacted Passaic County between 1950 and 2007. The one event is summarized below in Table 6.3.17-2.

Table 6.3.17-2
Storm Surge Events, Passaic County, 1950 – 2007
(Source: NOAA/NCDC)

Query Results

1 OCEAN & LAKE SURF event(s) were reported in **Passaic County, New Jersey** between **01/01/1950** and **01/01/2007**.

*Click on **Location or County** to display Details.*

Mag: Magnitude
Dth: Deaths
Inj: Injuries
PrD: Property Damage
CrD: Crop Damage

New Jersey

Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
1 Coastal New Jersey	03/03/1994	0200	Coastal Flooding	N/A	0	0	0	0
				TOTALS:	0	0	0	0

Notes: See bullets following Table 6.3.5-1 for column heading definitions.

The coastal flooding event on March 3, 1994 was produced by a powerful nor'easter moving northward along the Atlantic coastline. Strong northeasterly winds of between 35 and 40 mph prevailed for several hours with gust of around 60 mph. The winds also attributed directly to widespread, but relatively minor coastal flooding along with moderate beach erosion.

From the historical data provided in the NCDC database, the probability of future storm surge events occurring along far eastern part of Passaic County is relatively low. No property damage, injuries or deaths is an indication that the future impact on life and property in the planning area will most likely be low.

6.3.18 Wildfire

Description of the Wildfire Hazard

Wildfires are uncontrolled fires often occurring in wildland areas, which can consume houses or agricultural resources if not contained. Wildfire/urban interface is defined as the area where structures and other human development blend with undeveloped wildland. See Appendix D for a more detailed description and definition of the wildfire hazard.

Location of the Wildfire Hazard

The potential for wildfires exists over the entire planning area, although the probability is relatively low because of the predominately urban nature of the planning area, as well as the fire detection and suppression capabilities that exist in the county.

Severity of the Wildfire Hazard

The frequency and severity of wildfires depends on both weather and human activity. In the planning area, severity has historically been very low, and duration a matter of hours to a day. The risk is increased and compounded by increasing development within the zone commonly referred to as the "urban-wildland interface." Within this zone of natural landscape, buildings become additional fuel for fires when fires do occur. Most wildland fires are man-caused and occur in the interface of developed lands and forest and range lands. In particular, the dry conditions, high temperatures, and low humidity that characterize drought periods set the stage for wildfires.

Impact on Life and Property

There are no records of deaths or injuries and no recorded loss of property from wildfires in the planning area.

Occurrences of the Wildfire Hazard

The NCDC database indicates there have been no wildfires in Passaic County since 1950. However, data from the New Jersey Forest Fire Service indicates there have been 403 wildfire incidents in Passaic County between 1996 and 2006. Tables 6.3.18-1 and 6.3.18-2 provide the most recent available data for the number of fire incidents in New Jersey by year and the number of acres burned, for the period 1996 to 2006. As shown in the tables, Passaic County ranks 15th in average annual fire incidents and is below the state average in acres burned per year (although this statistic is skewed because just a few counties account for most of the acres burned).

The same data is depicted graphically in Figures 6.3.18-1 and 6.3.18-2, following the tables. The past wildfire data indicates that the probability of future wildfires occurring in the county is considered moderate, but will most likely have a limited impact on property and life in the planning area.

Table 6.3.18-1
Number of Fire Incidents per Year by New Jersey County: 1996 to 2006
(Source: New Jersey Forest Fire Service)

County	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	Totals	Annual Average
Atlantic	126	214	224	206	155	232	250	163	127	149	251	2,097	190.6
Bergen	1	7	8	8	6	13	4	5	5	5	10	72	6.5
Burlington	99	121	133	140	88	128	109	64	56	71	102	1,111	101.0
Camden	55	138	126	145	124	143	103	45	62	76	110	1,127	102.5
Cape May	59	86	71	84	50	92	80	40	62	52	55	731	66.5
Cumberland	93	151	206	173	100	140	102	58	88	111	117	1,339	121.7
Essex	0	0	0	0	0	0	0	0	1	0	2	3	0.3
Gloucester	34	67	53	72	36	73	78	23	28	68	67	599	54.5
Hudson	0	0	0	0	0	0	0	0	0	1	0	1	0.1
Hunterdon	21	37	28	69	44	66	41	26	14	30	48	424	38.5
Mercer	0	0	0	5	0	4	26	8	1	5	5	54	4.9
Middlesex	18	54	50	87	62	106	106	41	35	75	87	721	65.5
Monmouth	30	30	34	50	35	75	54	42	32	51	69	502	45.6
Morris	62	113	99	139	58	65	87	63	48	53	86	873	79.4
Ocean	196	347	304	412	265	374	287	227	213	228	325	3,178	288.9
Passaic	17	37	50	71	29	61	39	21	13	22	43	403	36.6
Salem	22	36	47	24	10	38	37	15	14	16	20	279	25.4
Somerset	6	50	17	65	15	50	86	41	20	60	59	469	42.6
Sussex	38	137	109	176	85	162	129	102	49	47	101	1,135	103.2
Union	0	0	0	0	0	0	0	0	2	2	4	8	0.7
Warren	33	56	94	129	75	90	144	55	37	107	71	891	81.0
Total	**910**	**1,681**	**1,653**	**2,055**	**1,237**	**1,912**	**1,762**	**1,039**	**907**	**1,229**	**1,632**	**16,017**	**1,456.1**

Note:
(1) The number of incidents includes only those wildfires to which the NJ Forest Fire Service responded to in its designated response area. Numbers are rounded for clarity.

Table 6.3.18-2
State of New Jersey Annual Number of Acres Burned* by Wildfires County: 1996 – 2006
(Source: New Jersey Forest Fire Service)

County	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	Totals	Annual Average
Atlantic	130	2,150	136	188	189	166	206	88	51	55	138	3,497	**318**
Bergen	0.25	49	42	103	8	98	10	2	13	5	12	342	**31**
Burlington	130	282	121	12,857	340	215	57	26	22	26	225	14,301	**1,300**
Camden	61	265	220	171	283	279	806	382	34	404	106	3011	**274**
Cape May	33	69	30	54	178	60	32	26	23	51	57	613	**56**
Cumberland	149	138	222	290	514	994	78	50	52	119	182	2,788	**253**
Essex	0	0	0	0	0	0	0	0	0.25	0	21	21	**2**
Gloucester	44	134	117	173	36	110	111	12	8	359	114	1218	**111**
Hudson	0	0	0	0	0	0	0	0	0	25	0	25	**2**
Hunterdon	7	38	44	108	12	30	21	7	14	10	68	359	**33**
Mercer	0	0	0	4	0	60	19	1	0.25	2	2	88	**8**
Middlesex	26	99	145	196	78	279	118	124	38	117	796	2,016	**183**
Monmouth	81	22	30	33	20	30	24	18	35	26	35	354	**32**
Morris	58	422	37	102	25	52	63	42	25	56	64	946	**86**
Ocean	136	1,023	138	712	123	1,806	4,089	109	141	95	240	8,612	**783**
Passaic	32	18	35	77	16	24	16	32	3	14	106	373	**34**
Salem	58	74	62	37	40	19	30	6	17	13	486	842	**77**
Somerset	2	30	6	164	5	43	32	9	9	26	19	345	**31**
Sussex	17	69	62	84	99	165	112	28	15	45	106	802	**73**
Union	0	0	0	0	0	0	0	0	.5	0.75	1	2	**0**
Warren	51	23	20	1,058	98	32	43	6	19	66	28	1,444	**131**
Total	**885**	**2,755**	**1,331**	**16,223**	**1,875**	**4,296**	**5,661**	**880**	**469**	**1,460**	**2,668**	**42,000**	**3,818**

Figures 6.3.18-1 and 6.3.18-2 summarize by county the average annual wildfire incidents and acres burned in New Jersey between 1996 and 2006. The New Jersey Forest Fire Service indicates there has been an average of 37 wildfire incidents per year in Passaic County between 1996 and 2006. During this same time period, an average of 34 acres burned per year in the county.

Figure 6.3.18-1
Average Annual Wildfire Incidents in New Jersey, 1996 – 2006
(Source: New Jersey Forest Fire Service)

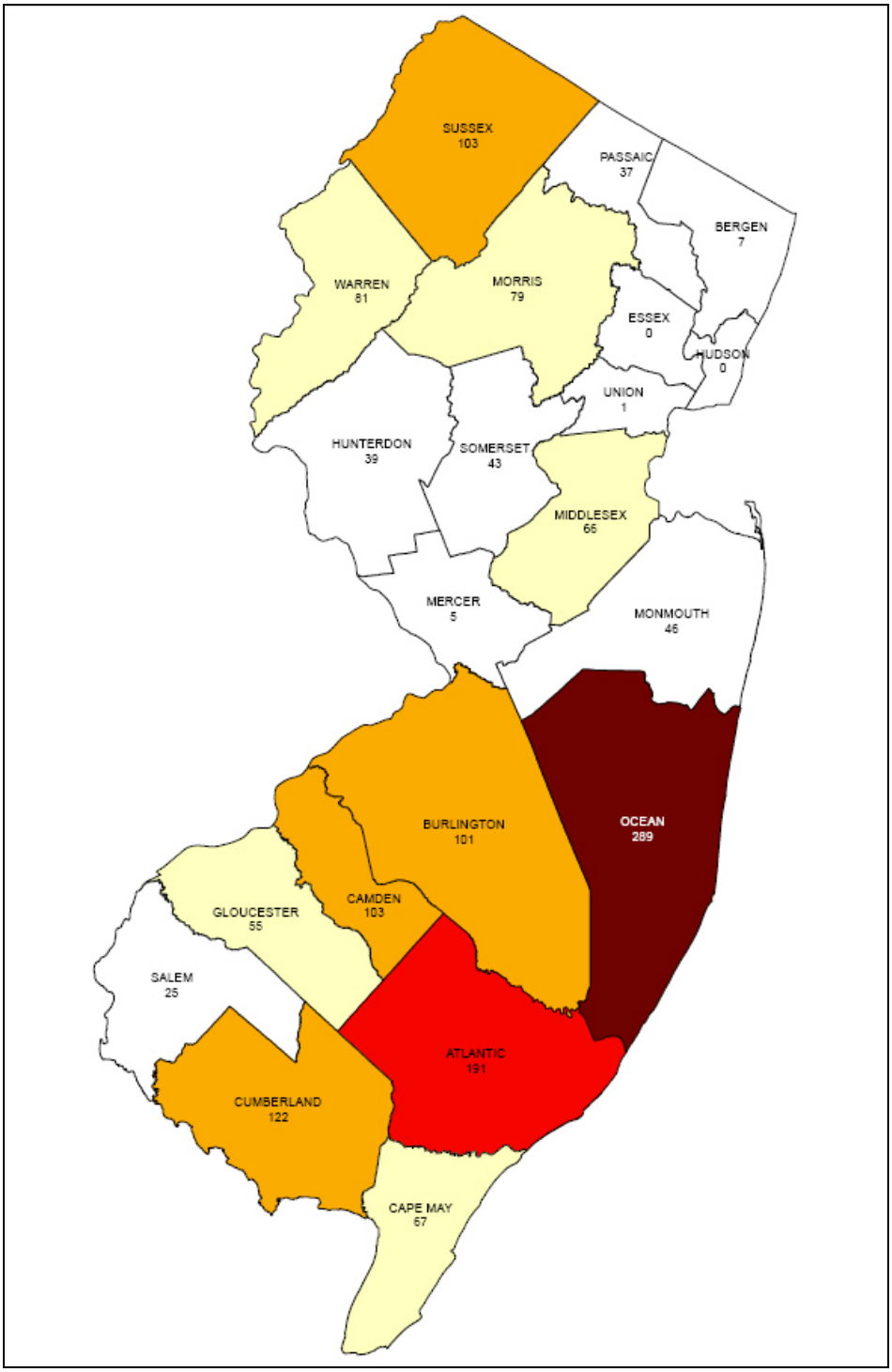
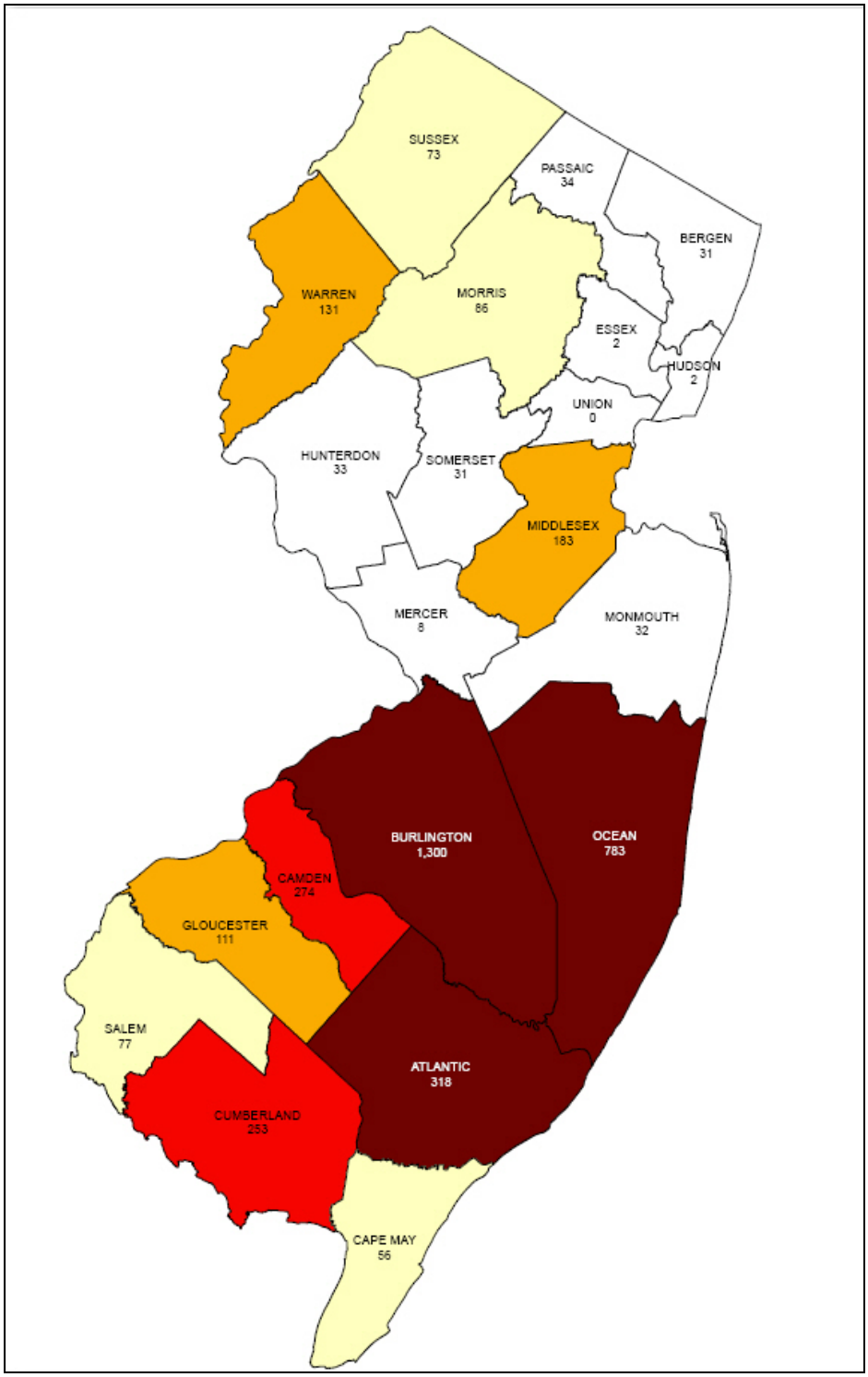


Figure 6.3.18-2
Average Annual Acres Burned from Wildfires in New Jersey, 1996 – 2006
(Source: New Jersey Forest Fire Service)



Data in Tables 6.3.18-1 and 6.3.18-2 indicate that for the reporting period 1996 through 2006, Passaic County was below average in New Jersey for both annual number of wildfires and acres burned by wildfires. With the exception of the acres burned in 1999 and 2006, which were slightly higher than average, year-to-year variation in the numbers of incidents and acres burned is relatively small. There is a high probability of wildfires occurring somewhere in the county every year, but the overall impact of the fires is assumed to be fairly low because the typical annual area burned is small. This trend and these assumptions could change with variations in the weather and antecedent conditions.

6.4 Identifying Hazards of Concern

The table on the following pages lists the hazards, describes the rationale for identifying (or not identifying) hazards as significant, shows sources of information that were consulted for the determination.

It also indicates the hazards identified by PCHMPC for a detailed risk assessment.

Table 6.4-1
Passaic County Hazard Identification

Hazard	Identified Natural Hazard?	Rationale	Sources	Detailed Risk Assessment?
Flood	Yes	Widespread impacts, history of occurrences in the county, significant annual damages	FEMA Flood Insurance Studies, FEMA Flood Insurance Rate Maps, FEMA Public Assistance records, FEMA National Flood Insurance Program claims data, US Army Corps of Engineers (USACE), and National Oceanographic and Atmospheric Administration (NOAA), studies and records.	Yes
High Wind - Straight Line winds (Includes: Hurricane, Nor'easter, Tropical Storm, and Thunderstorms)	Yes	▪ Hurricanes: Relatively low historic probability; potential for widespread impacts. ▪ Tropical Storms: Low to moderate probability; potential for widespread impacts ▪ Nor'easters: Moderate probability of more extreme events, potential for moderately widespread impacts. ▪ Severe Storms: High probability of occurrences, but losses are typically limited	NOAA and National Climatic Data Center (NCDC) records, New Jersey Department of Community Affairs - Division of Codes and Standards, New Jersey State Climatologist (Rutgers)	Yes

Hazard	Identified Natural Hazard?	Rationale	Sources	Detailed Risk Assessment?
Earthquake / Geological	Yes	Relatively low annual probability, but potential for significant consequences.	United States Geologic Survey (USGS), New Jersey Geologic Survey (NJGS).	Yes
Flooding due to Dam Failure	Yes	Low annual probability based on historical data, but impacts potentially significant in site specific areas.	New Jersey Department of Environmental Protection (NJDEP) – Dam Safety and Flood Control.	Yes
Severe Storm - Winter Weather	Yes	High annual probability, widespread impacts, but losses generally limited except in most extreme events.	NOAA, NCDC, National Weather Service (NWS), New Jersey State Climatologist (Rutgers)	Yes
High Wind - Tornado	Yes	High annual probability, widespread impacts, but losses generally limited except in most extreme events.	NOAA -NCDC,, New Jersey State Climatologist (Rutgers), National Weather Service	No
Ice Storm	No	Low to moderate annual probability with impacts relatively limited	NOAA - NCDC, New Jersey State Climatologist (Rutgers), NWS	No
Storm Surge - Hurricane/ Nor'easter/ Tropical Storm	No	Relatively low probability, impacts limited to northeastern coastal areas	NOAA - NCDC,USACE	No
Drought	No	High annual probability, but impacts generally limited.	NOAA – NCDC; New Jersey State Department of Agriculture NJDEP	No
Erosion - Hurricane/Nor'easter/ Coastal Storm	No	Relatively high annual probability, but impacts are limited to northeastern coastal areas.	NOAA, The New Jersey Beach Profile Network (NJBPN), USACE	No
Extreme Temperature - Cold	No	Relatively high annual probability, but impacts are limited.	NOAA - NCDC, New Jersey State Climatologist (Rutgers), National Weather Service	No
Extreme Temperature - Heat	No	Relatively high annual probability, but impacts are limited.	NOAA - NCDC, New Jersey State Climatologist (Rutgers), National Weather Service	No
Landslide (non-seismic)	No	Low probability with losses typically limited	NJGS	No
Severe Storm - Lightning	No	High annual probability, but impacts generally limited	NOAA –NCDC, New Jersey State Climatologist (Rutgers), National Weather Service.	No
Hail	No	High annual probability but impacts are limited in severity and area	NOAA – NCDC, New Jersey State Climatologist (Rutgers), National Weather Service	No

Hazard	Identified Natural Hazard?	Rationale	Sources	Detailed Risk Assessment?
Wildfire	No	High annual probability of site-specific events, but impacts generally limited	NOAA, New Jersey State Forest Fire Service, NJDEP.	No

Note: See Appendix B (Section 6) for a complete listing of all sources.

Summary

As indicated in above table, five natural hazards were identified as hazards of concern. As the regulations indicate, all these identified hazards must be profiled, their vulnerability assessed, and mitigation actions developed for them.

- Flood
- High Wind – Straight Line Winds
- Earthquake/Geological
- Flooding due to Dam Failure
- Severe Storm – Winter Weather

In addition, the PCHMPC recommended including five natural hazards in the more detailed risk assessments in Section 7: Flood, High Wind–Straight-Line Winds, Earthquake/Geological, Flooding due to Dam Failure, and Severe Storm–Winter Weather.

Note on consistency with the New Jersey State Hazard Mitigation Plan

As part of the process of developing the Passaic County Hazard Mitigation plan, the planning team carefully reviewed the updated New Jersey State Hazard Mitigation Plan (SHMP), with the goal of ensuring consistency between the two documents, primarily in the areas of hazard identification, risk assessment and mitigation strategy. The SHMP comprises a shorter list of hazards, but the most significant hazards statewide are part of both documents, and are generally prioritized in the same way. However, the state Plan process did not include a ranking methodology. The SHMP includes all 21 New Jersey counties in the state, and the New Jersey Office of Emergency Management specifically wished to avoid suggesting that some hazards were potentially less significant than others. This was done in order to avoid the potential for local municipalities to accept the state ranking verbatim, and potentially fail to fully explore localized hazards that may be the basis for significant risks.

Summary Description of the County's Vulnerability to Hazards

The DMA 2000 legislation and related FEMA planning guidance require mitigation plans to include discussion of community vulnerability to natural hazards. Vulnerability is generally defined as the damage (including direct damages and loss of function) that would occur when various levels of hazards impact a structure, operation or population. For example vulnerability can be expressed as the percent damage to a building when it is flooded, or the number of days that a government office will be shut down after a wind storm, etc., assuming there is sufficient detailed data available to support the calculations.

Because this Plan includes many jurisdictions and the available data is not very detailed, it is not practical to complete vulnerability assessments on the many individual assets, operations and populations in individual jurisdictions. However, it is appropriate for participating municipalities to embark on a program of addressing these data deficiencies over the next five years in anticipation of the next Plan update. In addition, it is possible to make some general observations as follows based on the hazard identifications and risk assessments that are the subjects of Sections 6 and 7 of this plan.

As illustrated in Section 6 (Hazard Identification), Passaic County is subject to numerous natural and manmade hazards, although in some cases the hazards have rarely impacted the area, or their effects have been relatively minor. As is the case with many parts of the mid-Atlantic, although relatively localized, flooding is the most frequent and most damaging natural hazard in northern New Jersey and Passaic County, However, it is important to recognize that several other hazards present significant risks (i.e. potential for future losses) to the County, even though they have occurred infrequently in the past, or have not caused much damage.

In particular, earthquakes (although improbable) present risks to various communities in the County because there are many relatively old structures that may be prone to failure if shaken by an earthquake. As noted in Section 7, in order to accurately characterize vulnerabilities (and hence risks) at a local level, it will be necessary to study assets on a site-specific basis. Section 7 of this plan also shows that there is some vulnerability to wind in the County, mainly from hurricanes and tropical storms. While severe hurricanes are rare events in this area of the country, tropical storms and nor'easters are fairly common, and many structures in the communities are vulnerable to extreme winds. However, as discussed in text, the vulnerability is widespread, hence the relatively large risk figure. Most of the other hazards are either localized or improbable, and therefore, while various elements in the communities may be vulnerable to such hazards, the likelihood of them occurring in any specific location is very small.

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Section 7
Risk Assessment

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7.1 Interim Final Rule Requirement for Risk Assessments

Requirement §201.6(c)(2): *The plan shall include a risk assessment that provides the factual basis for activities proposed in the strategy to reduce losses from identified hazards. Local risk assessments must provide sufficient information to enable the jurisdiction to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards.*

Requirement §201.6(c)(2)(ii): *[The risk assessment shall include a] description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description shall include an overall summary of each hazard and its impact on the community.*

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

Requirement §201.6(c)(2)(ii)(A): *The plan* ***should*** *describe vulnerability in terms of the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard area.*

Requirement §201.6(c)(2)(ii)(B): *[The plan* ***should*** *describe vulnerability in terms of an] estimate of the potential dollar losses to vulnerable structures identified in paragraph (c)(2)(ii)(A) of this section and a description of the methodology used to prepare the estimate.*

Requirement §201.6(c)(2)(ii)(C): *[The plan* ***should*** *describe vulnerability in terms of] providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions.*

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

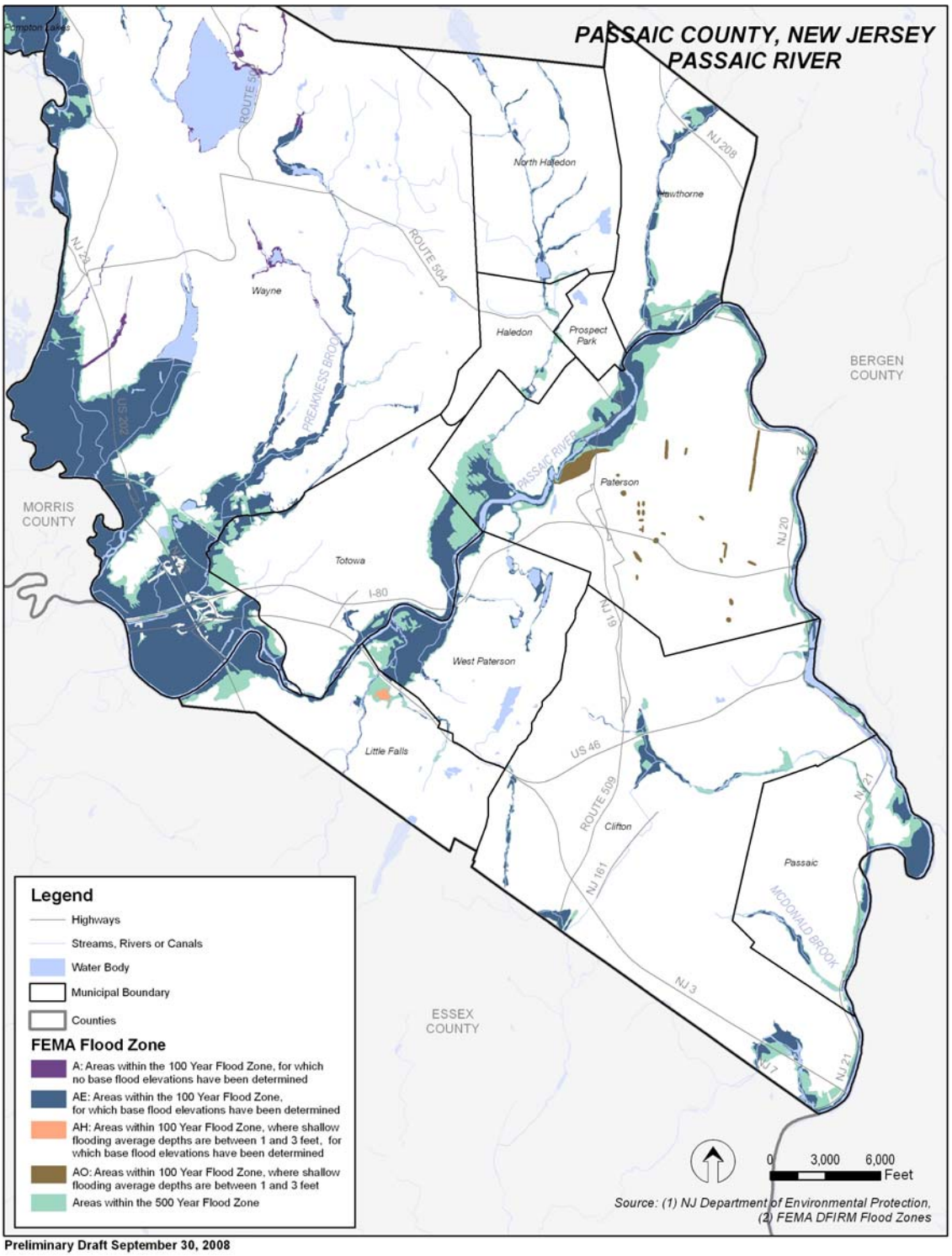
7.2 Overview and Analysis of Passaic County's Vulnerability to Hazards

As discussed in Section 6 of this Plan (Hazard Identification), Passaic County has at least some exposure to as many as 26 hazards, but most of them have such low probability that there is little or no serious risk to the county. Section 6 described the process by which the county reduced the list of 26 possible hazards to the five that create the greatest risk to Passaic County's citizens, assets and operations flood, high wind–straight line winds, severe storm–winter weather, dam failure and earthquake/geological.

This section addresses risks related to these five most significant hazards, including estimates of potential future losses, in accordance with the Federal Emergency Management Agency (FEMA) requirements. The most significant hazard to which Passaic County is exposed to is flooding. The county has a well-established history of floods, mainly along the Passaic River and its tributaries.

As discussed in more detail below (and in Section 6 of this Plan), the flood-prone areas near the Passaic River include both residential and commercial properties. Figure 7.2-1 below identifies the FEMA flood zones along the Passaic County portion of the Passaic River and its tributaries. The county working in coordination with State and Federal agencies has completed some actions to mitigate flood risk to seven flood-prone properties in Wayne Township. Because of the availability of detailed data about historical flood losses (and in some instances, engineered-based information about current conditions), the flood risk subsection of this Plan is more robust than those related to the other hazards that are considered here.

Figure 7.2-1
Floodplain Map of the Passaic County portion of the Passaic River
(Sources: FEMA and New Jersey Department of Environmental Protection)



Preliminary Draft September 30, 2008

7.3 Estimate of Potential Losses (Risk Assessment)

This section describes the risks to Passaic County, including its citizens, residential, government and commercial assets the five most significant hazards, as determined by the Passaic County Hazard Mitigation Planning Committee (HMPC). These include flood, high wind–straight line winds, severe storm–winter weather, dam failure, and earthquake/geological. As noted above, risk is an expression of expected future monetary losses that result from the impacts of natural hazards.

The New Jersey Office of Smart Growth indicates the entire county comprises slightly less than 126,000 acres. The predominant land use within the county is Forest, which represents 47% of the County's total land surface area. The Forest category is followed by Residential, which represents approximately 27% of the land surface area.[1] The U.S. Census Bureau estimated that there were 171,958 housing units in Passaic County as of 2007.[2] Table 7.3-1 summarizes the number of acres per land use category for Passaic County.

Table 7.3-1
Passaic County Estimated Land Use Inventory, 2002
(Source: New Jersey Office of Smart Growth)

Land Use Category	Acres
Forest	59,559
Residential	29,875
Water (Natural and Artificial)	8,958
Industrial and Commercial	8,867
Wetlands	8,705
Other	3,958
Recreational	2,285
Infrastructure	2,007
Agriculture	871
Brush/Scrubland	824
Grand Total	**125,909**

7.3.1 Flood Risk in Passaic County

This subsection of the Plan provides estimates of future flood losses, i.e. risk. Each of the loss calculations is based on best available data, but they must be considered estimates because highly detailed engineering was not performed as part of this planning process. The first subsection provides a general picture of the areas of various land uses in FEMA-designated flood zones in Passaic County.

[1] New Jersey Department of Community Affairs, Office of Smart Growth
[2] U.S. Census Bureau, State and County Quick Facts (Passaic County)

Background and Flood Vulnerability

Table 7.3.1-1 provides the estimated total acreage of Passaic County's predominant asset classes in designated flood zones A through X (see flood zone descriptions below table). Note that the figure below for total acreage - just under 43,000 - is less than the actual total acreage of the entire county. This is because some of the less significant asset classes (e.g. wetlands and military installations) are not included in the total figure below. In addition to some of the categories being excluded, the flood zone for a small portion of Passaic County is undefined, and therefore also excluded from the total.

Table 7.3.1-1
Passaic County: Land Area (in Acres) of Predominant Asset Classes in Designated Flood Zones A through X
(Source: NJDEP – Land Use/Land Cover)

Land Use/Flood Zone	A	AE	AO	AH	X500	X	Total
Agriculture	21	60	0	0	49	570	**700**
Commercial	16	664	51	1	279	4,779	**5,790**
Industrial	6	381	6	3	315	2,364	**3,073**
Major Roadway	7	80	1	0	56	622	**766**
Residential	76	1,273	19	0	669	27,840	**29,876**
Transportation/Communication/Utilities	13	101	2	0	29	435	**580**
Urban	20	189	3	0	92	1,631	**1,934**
Grand Total	**158**	**2,749**	**82**	**4**	**1,489**	**38,241**	**42,719**

The flood zone designations are defined as follows

- Zone A. Areas with a 1% annual chance of flooding and a 26% chance of flooding over the life of a 30-year mortgage. Because detailed analyses are not performed for such areas; no depths or base flood elevations are shown within these zones.
- Zone AE. Areas with a 1% annual chance of flooding and a 26% chance of flooding over the life of a 30-year mortgage. In most instances, base flood elevations (BFEs) derived from detailed analyses are shown at selected intervals within these zones.
- Zone AH. Areas with a 1% annual chance flooding where shallow flooding (usually areas of ponding) can occur with average depths between one and three feet.
- Zone AO. Areas with a 1% annual chance flooding, where shallow flooding average depths are between one and three feet.
- X500. Areas between the limits of the 1% annual chance flooding and 0.2% chance flooding.
- Zone X. Areas outside the 1% annual chance floodplain and 0.2% chance floodplain, areas of 1% annual chance sheet flow flooding where average depths are less than 1 foot, areas of 1% annual chance stream flooding where the contributing drainage area is less than 1 square mile, or areas protected from the 1% annual chance flood by levees. No BFEs or depths are shown within this zone[3].

[3] FEMA, Retrieved from http://www.fema.gov/

Table 7.3.1-2 shows areas and values for various land uses in Passaic County in FEMA-designated flood zones A and AE. The values of the agriculture, commercial, industrial and residential assets and contents were estimated based on data extracted from the FEMA Hazards US (HAZUS) software in the fall of 2007. HAZUS is a FEMA risk assessment software package that can be used to analyze potential losses from floods, hurricane winds and earthquakes, if sufficient data is resident in the program or otherwise available. HAZUS uses current scientific and engineering knowledge coupled with the latest geographic information systems (GIS) technology to produce estimates of hazard-related damage before, or after, a disaster occurs[4] .

The figures in Table 7.3.1-2 should be considered estimates of values. The A and AE flood zone values were determined based on a percentage of the land use data. Note that the roadway value calculation is left out of the value columns because these cannot be identified through open-source methods, and because it is assumed they are not particularly susceptible to the effects of low-level floods. No specific building data was available for the transportation/communication/utilities and urban categories and therefore these categories are also excluded in the value columns of the table. Also note that there is negligible acreage (4 acres) in Passaic County with an AH designation, so this category is not included in the below table.

Table 7.3.1-2
Areas (in Acres) and Values for Various Passaic County Asset Classes in the 100-Year Floodplain (Flood Zones A, AE, and AO)
(Sources: NJDEP, HAZUS Query - Fall 2007)

Land Use	Acres in 100-year Floodplain	Asset Class Total (Acres)	% in 100-year Floodplain	HAZUS (Total Value)	Value in 100-year Floodplain
Agriculture	81	700	11.59%	$51,096,000	$5,924,170
Commercial	731	5,790	12.63%	$8,432,506,000	$1,064,938,464
Industrial	393	3,073	12.80%	$3,306,420,000	$423,325,048
Major Roadway	88	766	11.43%	-------	-------
Residential	1,368	29,876	4.58%	$32,290,303,000	$1,478,435,893
Transportation / Communication / Utilities	116	580	20.04%	-------	-------
Urban	212	1,934	10.95%	-------	-------
Grand Total	**2,989**	**42719**	**7.00%**	**-------**	**-------**

Method 1
Risk Estimate Based on Area of Asset Classes in Various Flood Zones

The first method is to estimate the flood risk in Passaic County using estimates of total acreage and value of structures in FEMA-identified flood zones, as shown in Tables 7.3.1-1 and 7.3.1-2 above. Table 7.3.1-1 shows that the county has 2,998 acres of built area in FEMA designated A, AE and AO flood zones, 1,489 acres in zone X500, and 42,719 acres in zone X. Zones A, AE and AO are designated 100-year flood areas; i.e. they have at least a 1% annual chance of flooding. The X500-year column in Table 7.3.1-1 identifies the area between the 100-year and 500-year flood. The X designation indicates that a particular place is determined outside the 500-year floodplain. In order to estimate the risk to these assets, the total value of the asset classes in each flood zone is multiplied by the probability.

[4] FEMA-HAZUS. Retrieved from http://www.fema.gov/plan/prevent/hazus/

For example,

$2,244,645 (residential/single-unit/low density) X 0.002 (500-year probability) = $4,489 (risk)

It is recognized that this method has some uncertainty because it does not consider the variability of damage within the various flood zones due to the specific location and type of structures. However, it does offer a good proxy calculation to show the overall relative flood risk. Table 7.3.1-3 shows the estimated annual flood risk to these various asset classes. Note that there is negligible area (4 acres) in Passaic County with flood zone designation AH, so risk calculations for that zone are not included in this table.

Table 7.3.1-3
Estimated Annual Flood Risk for Various Passaic County Asset Classes in The 100-year Floodplain (Flood Zones A, AE and AO)
(Sources: HAZUS, RS Means Quick Cost Estimator)

Land Use	Asset Values	Annual Risk	100-Year Risk
Agriculture	$5,924,170	$59,242	$845,379
Commercial	$1,064,938,464	$10,649,385	$151,966,719
Industrial	$423,325,048	$4,233,250	$60,408,484
Residential	$1,478,435,893	$14,784,359	$210,972,802
Total	**$2,972,623,575**	**$29,726,236**	**$424,193,384**

Method 2
Analysis of National Flood Insurance Program Repetitive Loss and Severe Repetitive Loss Data

The second flood risk assessment method is based on an analysis of National Flood Insurance Program (NFIP) data for repetitive flood loss (RL) and severe repetitive loss (SRL) properties. The NFIP defines RL properties as those that have been paid at least two insurance claims of more than $1,000 in a ten-year period. As of March 2008, Passaic County had 1,049 such properties, based on a query of the FEMA BureauNet NFIP interface. The query results indicated that eight of the RL properties had been mitigated through prior action taken by Passaic County or an individual municipality. After deducting the eight mitigated properties, there are a total of 1,041 remaining RL properties in Passaic County. Of this total, there are 996 residential and 45 non-residential. SRL properties are discussed in greater detail further in this section.

Residential Repetitive Loss Properties

Table 7.3.1-4 provides a summary of residential RL claims for municipalities within Passaic County. The table includes the number of RL properties in each municipality, building and contents damages, the total number of claims, and the average claim amounts. As mentioned above, these figures are from an NFIP query performed in March 2008 and include the April 2007 floods.

Table 7.3.1-4
Summary of Residential NFIP RL Statistics, Passaic County, Ordered by Number of Properties in Each Municipality
(Source: FEMA NFIP Query March, 2008)

Municipality Name	Properties	Building	Contents	Total	# Claims	Average
Wayne, Township of	521	$25,245,943	$8,502,131	$33,748,075	2,281	$14,795
Pompton Lakes, Borough of	202	$11,137,730	$4,178,410	$15,316,141	816	$18,770
Little Falls, Township of	137	$5,930,494	$1,357,647	$7,288,141	447	$16,305
Paterson, City of	64	$1,450,523	$1,330,075	$2,780,598	161	$17,271
Woodland Park, Borough of	26	$508,562	$66,883	$575,445	61	$9,434
Totowa, Borough of	22	$471,327	$36,229	$507,556	48	$10,574
Hawthorne, Borough of	6	$172,547	$986,749	$1,159,296	53	$21,874
Wanaque, Borough of	6	$128,892	$53,788	$182,679	15	$12,179
West Milford, Township of	5	$61,236	$23,867	$85,103	12	$7,092
Bloomingdale, Borough of	2	$18,364	$0	$18,364	4	$4,591
Passaic, City of	2	$1,233	$1,657,483	$1,658,716	4	$414,679
Clifton, City of	1	$2,243	$3,507	$5,750	2	$2,875
Haledon, Borough of	1	$6,284	$0	$6,284	2	$3,142
Ringwood, Borough of	1	$20,993	$0	$20,993	2	$10,497
Total / Average	**996**	**$45,156,372**	**$18,196,769**	**$63,353,141**	**3,908**	**$16,211**

The data in Table 7.3.1-4 indicates the greatest flood loss history is located in Wayne Township with 521 residential RL properties, 319 more properties than the second ranked municipality, the Borough of Pompton Lakes. Wayne also has by far the highest building damages, content damages, total claims amount, and total number of claims in Passaic County, although the average claim amount is similar to many of the other municipalities in the sample. Wayne and Pompton Lakes are followed in the ranking by Little Falls Township with 137 RL properties. The municipality of Little Falls is also ranked third in building damages, total claims amount, and total number of claims. There are several patterns in this data that provide insight into residential flood risk in the county. One such pattern is for the municipalities with the highest flood risk (Wayne, Pompton Lakes, and Little Falls) there is a relatively large ratio between the amounts of the claims for building damages versus contents damages. To a degree this may be a result of the flood insurance policies, but it may also suggest that in these areas basements or garages are being flooded, and that over time the owners have limited the amount of contents stored below grade because they are aware of the flood risk.

Non-Residential Repetitive Loss Properties

As noted earlier, as of March 2008, Passaic County had 45 non-residential RL properties in the NFIP database. Table 7.3.1-5 provides a summary of non-residential RL claims for municipalities within Passaic County. The table identifies ten municipalities that have non-residential RL properties, and includes the number of RL properties in each municipality, building and contents damages, the total number of claims, and the average claim amounts.

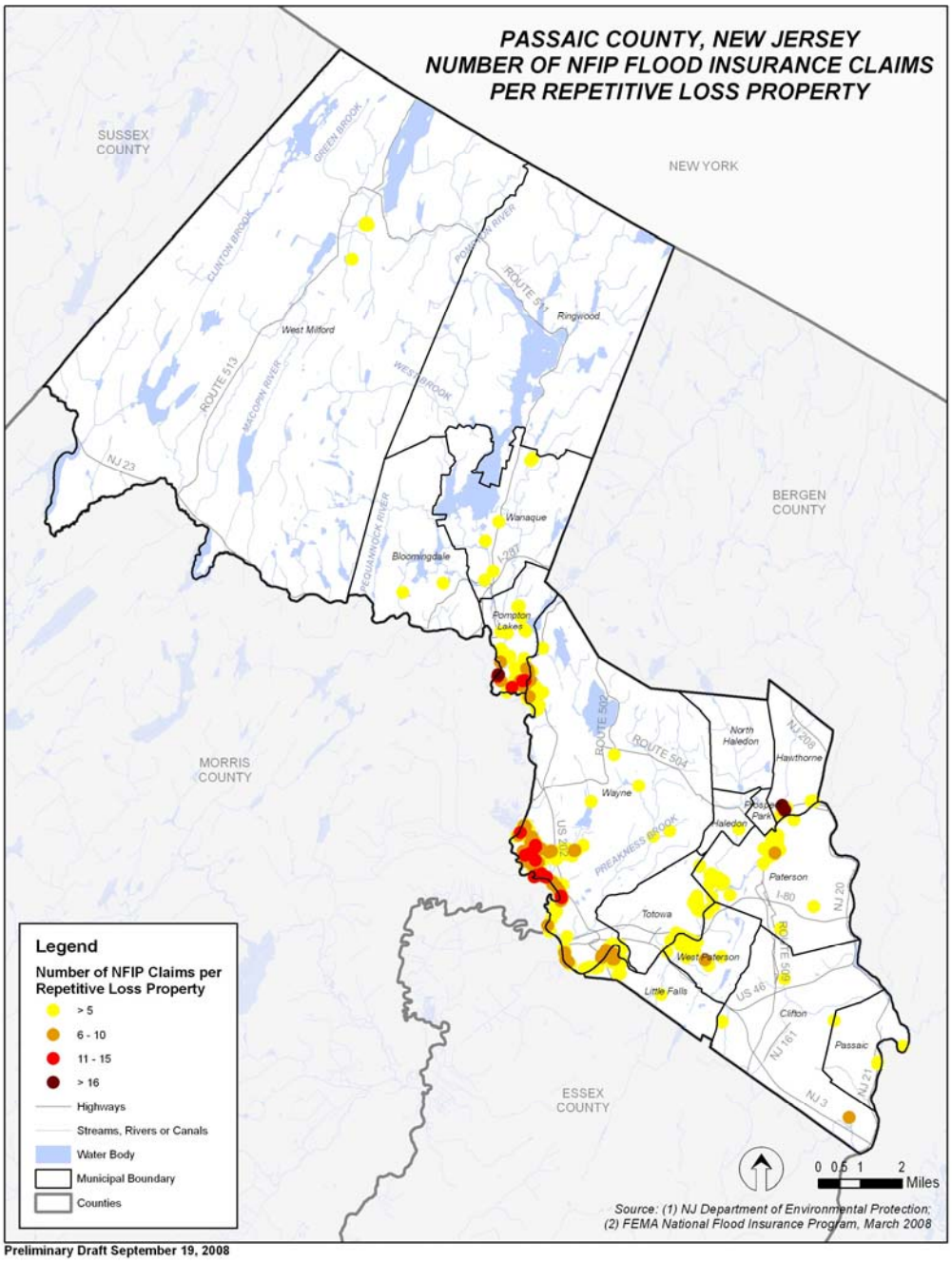
Table 7.3.1-5
Summary of Non-Residential Repetitive Flood Loss Claims in Passaic County, Ordered by Number of Properties in Each Municipality
(Source: FEMA NFIP Query March, 2008)

Municipality Name	Properties	Building	Contents	Total	# Claims	Average
Hawthorne, Borough of	13	$389,763	$1,152,141	$1,541,904	55	$28,035
Wayne, Township of	11	$1,349,513	$653,633	$2,003,146	39	$51,363
Paterson, City of	7	$1,362,077	$336,524	$1,698,601	24	$70,775
Pompton Lakes, Borough of	4	$119,213	$537,122	$656,335	11	$59,667
Passaic, City of	3	$71,790	$95,412	$167,201	7	$23,886
Woodland Park, Borough of	3	$244,650	$0	$244,650	7	$34,950
Little Falls, Township of	2	$3,231	$522,440	$525,671	4	$131,418
Clifton, City of	1	$45,173	$31,102	$76,274	2	$38,137
Totowa, Borough of	1	$53,732	$0	$53,732	4	$13,433
Total / Average	**45**	**$3,639,140**	**$3,328,374**	**$6,967,514**	**153**	**$45,539**

The data indicates that the Borough of Hawthorne has the highest number of non-residential repetitive loss properties and total number of claims. Although Hawthorne has the highest number properties and claims, there also appears to be moderate to high flood loss history in the Township of Wayne and the City of Paterson. These municipalities have the highest building damages and total claims value for non-residential properties in Passaic County. It is also notable that Little Falls Township has the highest average claim, with an average value of $131,418, although there are a relatively small number of claims in the data set. It should be noted that the low ratio of structure to contents claims values is typical for non-residential RL properties, because inventories are often higher value and more vulnerable to flood damages than structures themselves.

The series of maps below display information about the residential and non-residential repetitive flood loss insurance claims in Passaic County. The first map (Figure 7.3.1-1) highlights the numbers of insurance claims by property. The second map (Figure 7.3.1-2) shows the cumulative amounts of insurance claims for the same properties.

Figure 7.3.1-1
Number of NFIP Flood Insurance Claims Per Repetitive Loss Property in Passaic County
(Sources: FEMA, NJDEP)



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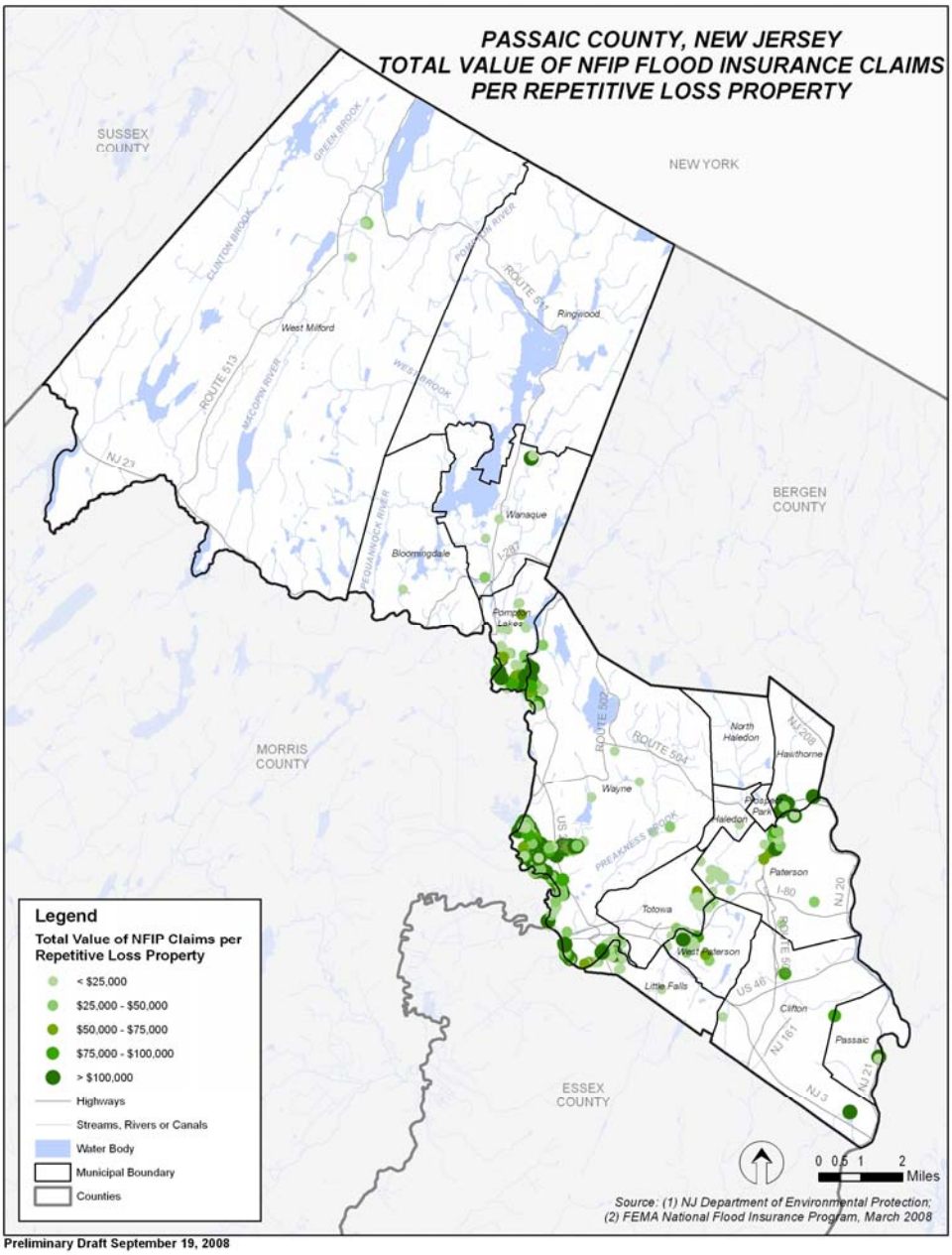
Note: 82 of the 1,041 RL property addresses could not be mapped because of inconsistencies in NFIP RL data, and were therefore excluded from this version of the hazard mitigation plan. The unmapped properties are located in the Townships of Little Falls and Wayne, the Boroughs of Hawthorne, Ringwood, Totowa, Woodland Park and Pompton Lakes, and the Cities of Passaic and Paterson.

The following map highlights the total value of NFIP RL flood insurance claims per property in Passaic County.

Figure 7.3.1-2
Value of NFIP Flood Insurance Claims Per Repetitive Loss Property in Passaic County
(Sources: FEMA, NJDEP)



Note: 82 of the 1,041 RL property addresses could not be mapped because of inconsistencies in NFIP RL data, and were therefore excluded from this version of the hazard mitigation plan. The unmapped properties are located in the Townships of Little Falls and Wayne, the Boroughs of Hawthorne, Ringwood, Totowa, Woodland Park and Pompton Lakes, and the Cities of Passaic and Paterson.

The RL claims can be further broken down by focusing on individual street level data. Table 7.3.1-6 provides a summary of residential RL claims for individual streets within Passaic County with four or more RL properties. The data displayed in the table summarizes the NFIP RL data for 66 of the 191 individual streets in the county that include a RL property. The building, contents, and total claims data has been combined for streets that include four or more RL properties. Address data about individual sites is omitted for reasons of confidentiality. The data shows that Fayette Avenue in Wayne Township has the most RL properties in Passaic County. Fayette Avenue has 53 RL properties and 240 prior NFIP claims totaling $3,782,829. The data also shows that Wayne Township has six of the ten streets in the county with the most RL properties.

Table 7.3.1-6
Summary of Residential NFIP RL Statistics, Passaic County, ordered by number of Properties on each Street
(Source: FEMA NFIP query March, 2008)

Municipality Name	Street Name	Properties	Building	Contents	Total	# of Claims	Average (Per Policy)
Wayne, Township of	Fayette Avenue	53	$2,998,316	$784,513	$3,782,829	240	$15,762
Little Falls, Township of	William Street	46	$2,403,581	$530,921	$2,934,502	171	$17,161
Pompton Lakes, Borough of	Riveredge Road	39	$2,441,121	$897,429	$3,338,551	165	$20,234
Wayne, Township of	River Road	38	$1,506,551	$513,517	$2,020,068	227	$8,899
Wayne, Township of	Riverside Drive	32	$1,686,733	$301,379	$1,988,113	132	$15,061
Little Falls, Township of	Louis Street	30	$1,842,548	$537,713	$2,380,260	114	$20,879
Wayne, Township of	Riverlawn Drive	29	$1,227,816	$242,094	$1,469,910	97	$15,154
Wayne, Township of	Dorsa Avenue	24	$1,394,228	$585,130	$1,979,358	124	$15,963
Pompton Lakes, Borough of	Poplar Avenue	21	$1,762,611	$830,343	$2,592,955	101	$25,673
Wayne, Township of	Ryerson Avenue	20	$1,419,649	$545,818	$1,965,467	124	$15,851
Little Falls, Township of	Zeliff Avenue	20	$484,444	$48,375	$532,818	49	$10,874
Wayne, Township of	Brookside Road	18	$624,902	$175,740	$800,641	80	$10,008
Pompton Lakes, Borough of	Haroldson Place	18	$786,466	$119,947	$906,413	67	$13,529
Pompton Lakes, Borough of	Lincoln Avenue	18	$1,346,307	$511,722	$1,858,029	92	$20,196
Wayne, Township of	West Road	17	$287,716	$201,410	$489,126	69	$7,089
Wayne, Township of	Grand Street	16	$872,555	$187,446	$1,060,001	54	$19,630
Wayne, Township of	Whitmore Avenue	16	$775,706	$299,201	$1,074,907	74	$14,526
Wayne, Township of	Edith Court	15	$830,211	$309,550	$1,139,761	46	$24,777
Wayne, Township of	Boulevard Drive	14	$692,618	$199,275	$891,893	54	$16,517
Wayne, Township of	Hobson Avenue	13	$459,619	$133,792	$593,410	62	$9,571
Wayne, Township of	Monmouth Avenue	13	$709,198	$214,901	$924,099	74	$12,488
Wayne, Township of	Kent Avenue	12	$661,994	$137,447	$799,441	50	$15,989
Pompton Lakes, Borough of	Madison Place	12	$373,965	$89,001	$462,965	32	$14,468
Wayne, Township of	North Road	12	$320,634	$129,117	$449,751	38	$11,836
Wayne, Township of	Winding Way	12	$729,082	$176,481	$905,563	47	$19,267
West Paterson, Borough of	Bergen Boulevard	11	$275,305	$28,402	$303,707	24	$12,654

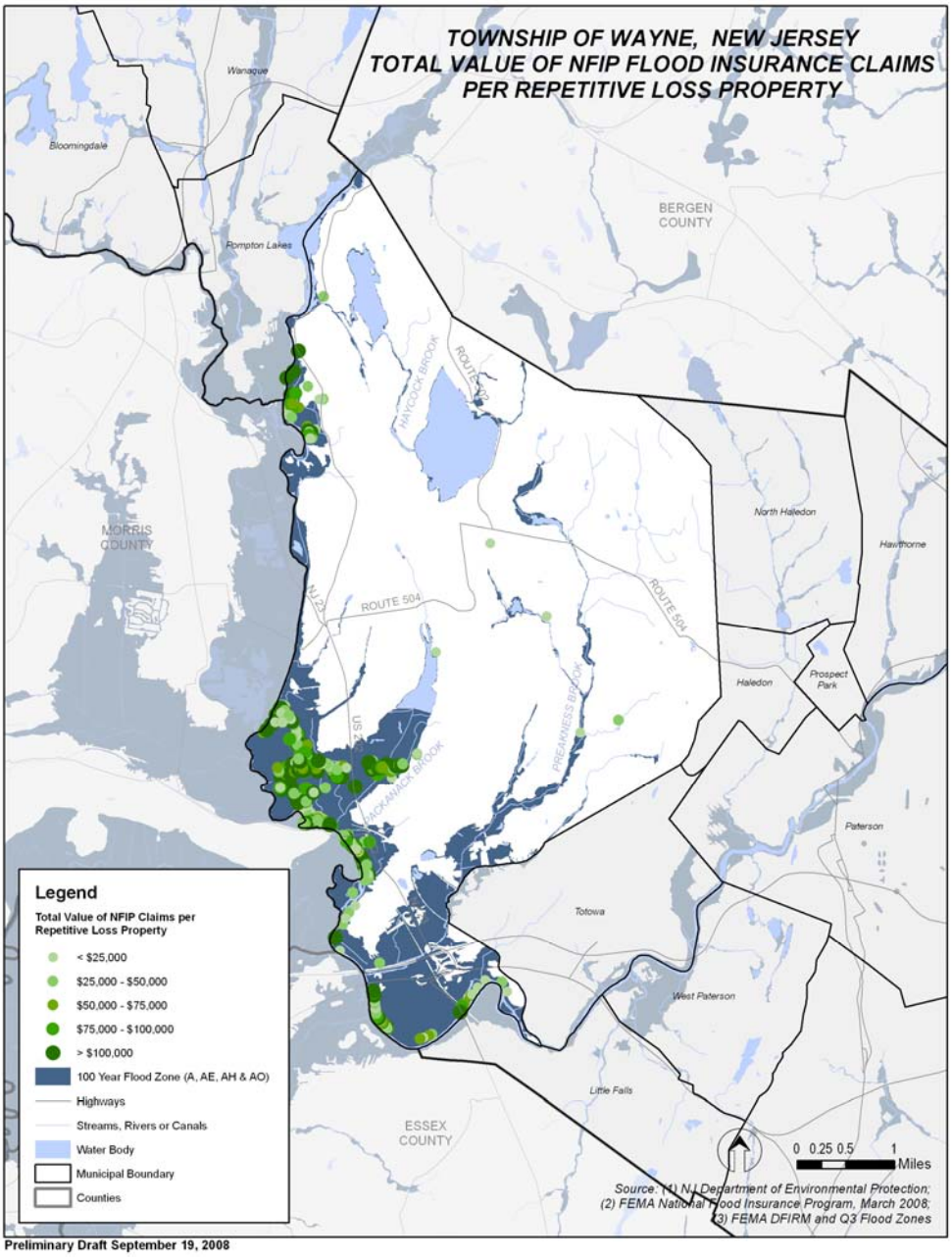
Municipality Name	Street Name	Properties	Building	Contents	Total	# of Claims	Average (Per Policy)
Wayne, Township of	Clark Street	11	$730,361	$255,600	$985,961	56	$17,606
Pompton Lakes, Borough of	Dawes Highway	11	$548,565	$224,751	$773,316	29	$26,666
Pompton Lakes, Borough of	Magnolia Avenue	11	$762,702	$200,710	$963,412	44	$21,896
Pompton Lakes, Borough of	Washington Avenue	10	$627,378	$251,862	$879,240	29	$30,319
Wayne, Township of	Broadway	8	$431,639	$158,602	$590,240	29	$20,353
Wayne, Township of	Ford Street	8	$406,253	$223,055	$629,308	37	$17,008
Wayne, Township of	Lyons Avenue	8	$718,874	$263,542	$982,416	50	$19,648
Wayne, Township of	Newark Avenue	8	$476,549	$140,941	$617,490	23	$26,847
Pompton Lakes, Borough of	Pine Street	8	$411,657	$85,105	$496,762	25	$19,870
Little Falls, Township of	Woodcliff Avenue	8	$210,504	$49,469	$259,973	21	$12,380
Wayne, Township of	Fairfield Road	7	$344,748	$139,588	$484,336	25	$19,373
West Paterson, Borough of	McBride Avenue	7	$149,038	$31,964	$181,002	19	$9,526
Totowa, Borough of	Norwood Terrace	7	$203,454	$28,495	$231,949	16	$14,497
Pompton Lakes, Borough of	Central Avenue	6	$94,883	$12,451	$107,334	16	$6,708
Pompton Lakes, Borough of	Laurel Avenue	6	$600,317	$341,682	$942,000	62	$15,194
Paterson, City of	North 1st Street	6	$170,869	$2,931	$173,800	16	$10,863
Pompton Lakes, Borough of	Ringwood Avenue	6	$116,796	$50,562	$167,358	14	$11,954
Paterson, City of	E Holsman Street	5	$128,279	$0	$128,279	13	$9,868
Paterson, City of	East Main Street	5	$184,165	$0	$184,165	12	$15,347
Wayne, Township of	Maple Lane	5	$199,666	$34,361	$234,027	16	$14,627
Wayne, Township of	Northwest Road	5	$89,789	$29,909	$119,698	21	$5,700
Wayne, Township of	Pocahontas Trail	5	$204,134	$39,761	$243,895	20	$12,195
Pompton Lakes, Borough of	Walnut Avenue	5	$256,712	$125,685	$382,397	35	$10,926
Pompton Lakes, Borough of	Willow Avenue	5	$278,628	$173,381	$452,009	22	$20,546
Little Falls, Township of	East Woodcliff Avenue	4	$60,319	$2,228	$62,547	9	$6,950
Wayne, Township of	Ferrara Avenue	4	$153,176	$116,404	$269,580	16	$16,849
Wayne, Township of	Ferri Street	4	$194,764	$109,689	$304,453	19	$16,024
Little Falls, Township of	Garden Street	4	$212,854	$67,439	$280,293	12	$23,358
Paterson, City of	Hillman Street	4	$136,529	$0	$136,529	12	$11,377
Wayne, Township of	Kenneth Street	4	$57,675	$12,579	$70,254	12	$5,855

Municipality Name	Street Name	Properties	Building	Contents	Total	# of Claims	Average (Per Policy)
Wayne, Township of	Mack Street	4	$199,871	$77,855	$277,726	12	$23,144
Little Falls, Township of	Parkway	4	$143,119	$19,403	$162,521	10	$16,252
Paterson, City of	Richmond Avenue	4	$47,582	$188	$47,770	9	$5,308
Little Falls, Township of	Riverview Circle	4	$114,386	$16,897	$131,283	12	$10,940
Wayne, Township of	Spring Road	4	$96,759	$72,423	$169,181	19	$8,904
Pompton Lakes, Borough of	Sunset Road	4	$154,995	$25,875	$180,869	11	$16,443
Paterson, City of	Totowa Avenue	4	$67,469	$2,050	$69,519	10	$6,952
Wayne, Township of	Walker Avenue	4	$149,433	$48,738	$198,171	19	$10,430
Wayne, Township of	Water Street	4	$107,546	$32,451	$139,996	24	$5,833
Wayne, Township of	Wayne Street	4	$198,892	$36,036	$234,928	16	$14,683
Total / Average	**------**	**804**	**$39,355,204**	**$12,235,324**	**$51,590,527**	**3,279**	**$15,732**

Note: The NFIP claims data in this table is limited to streets that include four or more properties, and therefore includes 804 of the 996 residential RL properties.

The following three maps highlight the total value of NFIP RL flood insurance claims per property for the Wayne and Little Falls Townships and Pompton Lakes Borough. Maps are shown for these municipalities based on the order of Table 7.3.1-4.

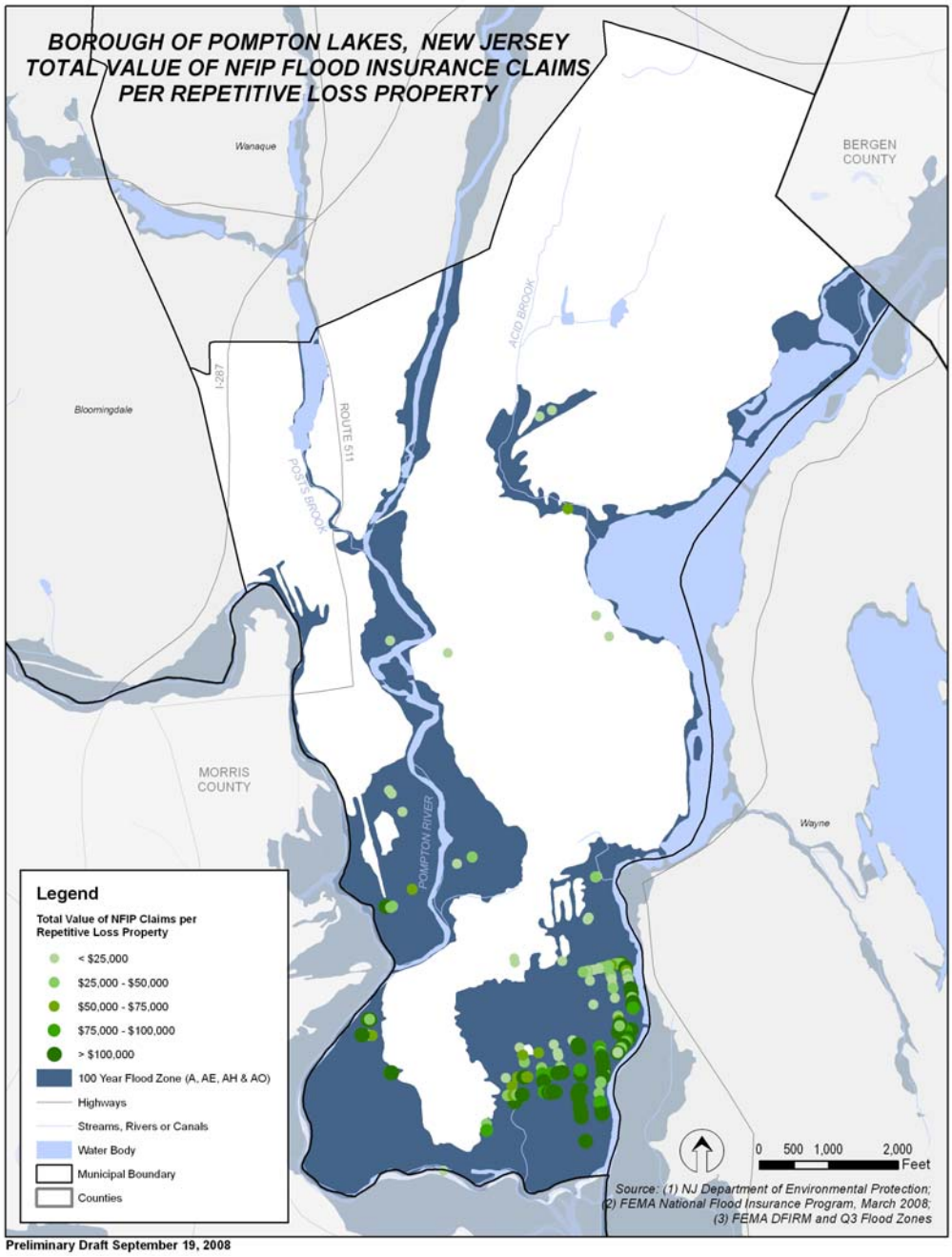
Figure 7.3.1-3
Value of NFIP Flood Insurance Claims Per RL Property in Wayne Township
(Sources: FEMA, NJDEP)



Note: 47 of the 521 RL property addresses in Wayne Township could not be mapped because of inconsistencies in NFIP RL data, and were therefore excluded from this version of the hazard mitigation plan.

The following map highlights the total value of NFIP RL flood insurance claims per property in Pompton Lakes Borough, New Jersey.

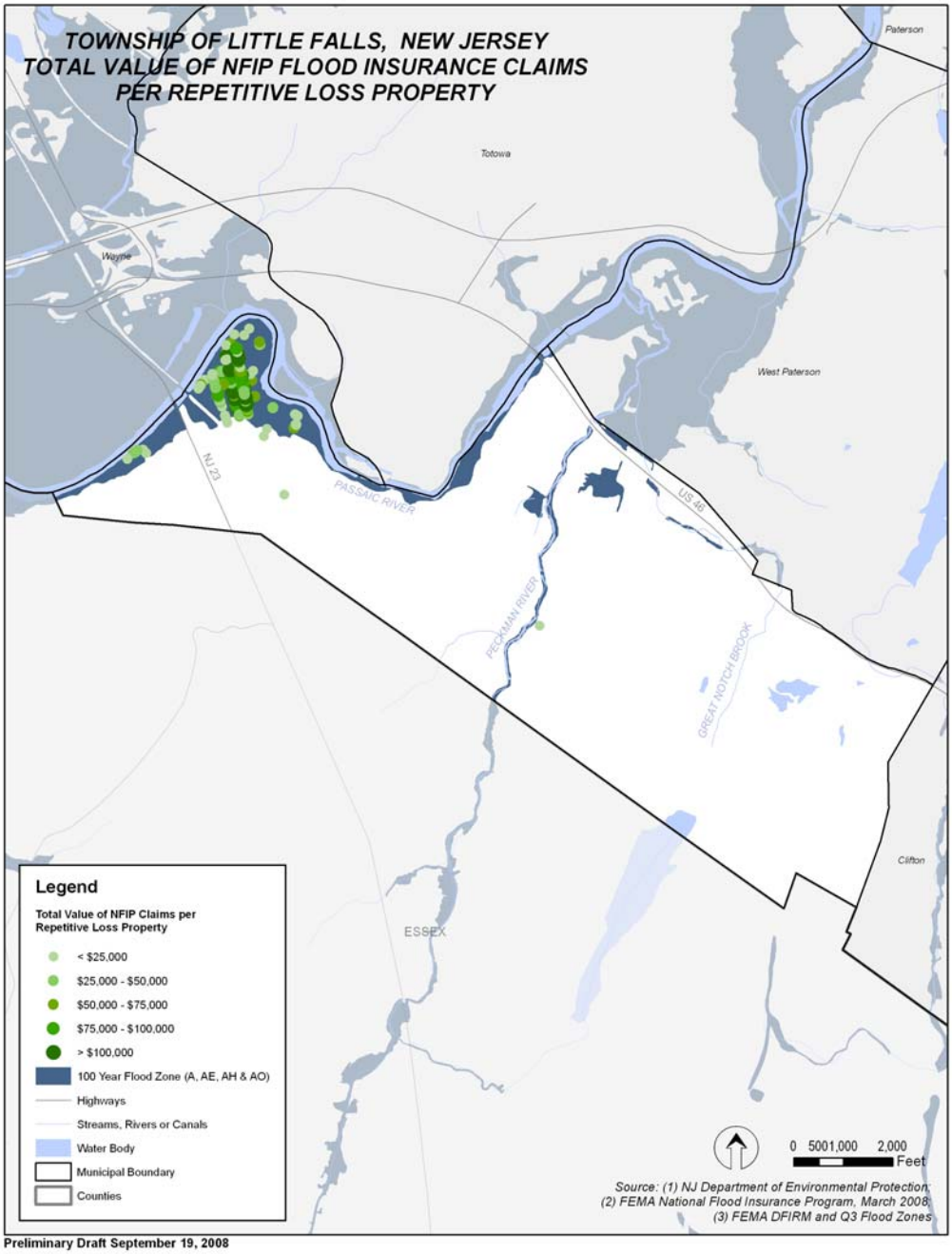
Figure 7.3.1-4
Value of NFIP Flood Insurance Claims Per RL Property in Pompton Lakes Borough
(Sources: FEMA, NJDEP)



Note: 11 of the 202 RL property addresses in Pompton Lakes Borough could not be mapped because of inconsistencies in NFIP RL data, and were therefore excluded from this version of the hazard mitigation plan.

The following map highlights the total value of NFIP RL flood insurance claims per property in Little Falls Township, New Jersey.

Figure 7.3.1-5
Value of NFIP Flood Insurance Claims Per RL Property in Little Falls Township
(Sources: FEMA, NJDEP)



Note: Five of the 137 RL property addresses in Little Falls Township could not be mapped because of inconsistencies in NFIP RL data, and were therefore excluded from this version of the hazard mitigation plan.

In the past few years Passaic County has completed projects to mitigate damages to more than 90 residential properties, most of which are in Wayne Township. Table 7.3.1-7 (a) shows data that were obtained through a 2007 query of FEMA/NFIP records. That database indicated that eight residential properties had been mitigated in Passaic County. The table summarizes the NFIP claims history for these properties.

Table 7.3.1-7 (a)
Mitigated RL Properties in Passaic County
(Source: FEMA NFIP Query July 2007)

Municipality Name	Street Name	# of Claims	Cumulative NFIP Claims Paid	Mitigation Type
Little Falls, Township of	Greyrock Avenue	2	$17,566	Acquisition
Wayne, Township of	Listed as POB	4	$24,207	Acquisition
Wayne, Township of	Fayette Avenue	2	$18,537	Acquisition
Wayne, Township of	Fairfield Road	5	$39,287	Acquisition
Wayne, Township of	Fairfield Road	2	$12,410	Acquisition
Wayne, Township of	Island Street	3	$35,891	Acquisition
Wayne, Township of	M. Fairfield Road	3	$18,523	Acquisition
Wayne, Township of	Water Street	3	$35,774	Acquisition
Total	**----------**	**24**	$202,195	

The next table (7.3.1-7 (b)) shows data provided by Wayne Township. The data indicate that in addition to the properties in the table above, a total of 69 residential sites have been mitigated in Wayne Township, all as part of the Hoffman Grove Acquisition project. The information was provided by Wayne Township.

Table 7.3.1-7 (b)
Mitigated Properties in Wayne Township, Passaic County
(Source: Wayne Township, March 2009; list dated November 2007)

Street Name	# of Properties	Mitigation Type
Brookside Road	11	Acquisition/Demolition
Main Road	4	Acquisition/Demolition
North Road	5	Acquisition/Demolition
Northwest Road	3	Acquisition/Demolition
River Road	29	Acquisition/Demolition
Spring Road	5	Acquisition/Demolition
West Road	12	Acquisition/Demolition
Total	**69**	**---**

Flood Risk to Residential Properties

Residential flood risk is calculated by a methodology that uses the NFIP claims history in conjunction with FEMA default present-value coefficients from the benefit-cost analysis software modules. To perform this calculation, the RL data were reviewed to determine an approximate period over which the claims occurred. This is not an exact method, because there are numerous properties in the database, and insurance policies come into force at different times, and are cancelled and reinstated periodically. These variables are not part of the query output. With the exception of a few claims in the 1970s, almost all of the claims in the most recent NFIP query occurred between the early 1980s and the present, a period of 28 years.

As shown in Table 7.3.1-8, there have been 3,908 residential RL claims in this 28-year period, for an average number of claims per year of 261. Based on a 100-year planning horizon and a present value coefficient of 14.27 (the coefficient for a 100-year planning horizon using the mandatory Office of Management and Budget (OMB) discount rate of 7%), the projected flood risk to these properties is calculated, and shown at the bottom of the table. It must be understood that individuals can obtain and cancel flood insurance policies, and the flood hazard depends on many variables, including the weather, so this projection is simply an estimate of potential damages. Nevertheless, it offers a useful metric that can be used in assessing the potential cost effectiveness of mitigation actions.

Table 7.3.1-8
Projected 100-year Flood Risk in Passaic County
RL Areas
(Source: FEMA NFIP Query March, 2008)

Data	Value
Period in years	28
Number of claims	3,908
Average claims per year	140
Total value of claims	$63,353,141
Average value of claims per year	$2,262,612
Projected risk, 100-year horizon	$32,287,476

The next table (7.3.1-9) shows risk projections for the three streets that appear to have the most risk in the county, based on NFIP RL records. The streets with the most risk are located in Wayne and Little Falls Townships. These projections are done in the same manner as the calculation described above. Fayette Avenue and William Street are somewhat similar in terms of the average amount of claims and projected risk, while River Road appears to have less long-term risk based on this methodology. This risk figure is a good basis for determining the total amount that can be spent (either overall, or per typical property) on mitigation actions, although the ultimate cost effectiveness is also a function of the effectiveness and useful life of the project itself.

Table 7.3.1-9
Projected 100-year Flood Risk, Select Streets in Passaic County with Highest Number of RL Claims in the NFIP Database
(Source: FEMA NFIP, Query March, 2008)

Fayette Avenue (Wayne Township)	
Total number of paid claims	240
Average number of paid claims per year	8.5
Total value of claims	$3,782,829
Average value of paid claims per year	$135,101
Projected risk, 100-year horizon	$1,927,892
Number of claimants	53
Projected risk per policy, 100-year horizon	$36,375
River Road (Wayne Township)	
Total number of paid claims	227
Average number of paid claims per year	8.1
Total value of paid claims	$2,020,068
Average value of paid claims per year	$72,145
Projected risk, 100-year horizon	$1,029,513
Number of claimants	38
Projected risk per policy, 100-year horizon	$27,092
William Street (Little Falls Township)	
Total number of paid claims	171
Average number of paid claims per year	6.1
Total value of paid claims	$2,934,502
Average value of paid claims per year	$104,804
Projected risk, 100-year horizon	$1,495,548
Number of claimants	46
Projected risk per policy, 100-year horizon	$32,512

Flood Risk to Non-Residential Properties

As with the residential flood loss history, the past claims information can be used to project future flood losses, as shown in Table 7.3.1-10 below. The methodology is the same as what is described in the residential section. The table results show that the projected 100-year risk is highest in the City of Paterson, followed by Pompton Lakes Borough.

Table 7.3.1-10
Projected 100-year Flood Risk, Select Non-Residential
RL Municipalities in Passaic County, ordered by 100-year risk
(Source: FEMA NFIP, Query March, 2008)

Municipality Name	Properties	Total Claims	Average	# Claims	100-year risk
Paterson, City of	7	$1,698,601	$70,775	24	$1,009,960
Pompton Lakes, Borough of	4	$656,335	$59,667	11	$851,446
Wayne, Township of	11	$2,003,146	$51,363	39	$732,946
Hawthorne, Borough of	13	$1,541,904	$28,035	55	$400,054
Little Falls, Township of	2	$525,671	$131,418	4	Note 1
Clifton, City of	1	$76,274	$38,137	2	Note 1
Woodland Park, Borough of	3	$244,650	$34,950	7	Note 1
Passaic, City of	3	$167,201	$23,886	7	Note 1
Totowa, Borough of	1	$53,732	$13,433	4	Note 1
Total / Average	**45**	**$6,967,514**	**$45,539**	**153**	**-------**

Note 1: These Municipalities have insufficient claims history for this calculation methodology to be valid.

Severe Repetitive Loss Properties

In 2004 FEMA began to develop the Severe Repetitive Loss (SRL) Grant Program in an effort to reduce or eliminate flood damages to residential properties that met certain minimum requirements. FEMA initiated the program early in 2008. An SRL property is defined as a residential property that is covered under an NFIP flood insurance policy and:

- has at least four NFIP claim payments (including building and contents) over $5,000 each, and the cumulative amount of such claims payments exceeds $20,000; or
- for which at least two separate claims payments (building payments only) have been made with the cumulative amount of the building portion of such claims exceeding the market value of the building.

As of March 2008 Passaic County had 199 properties on the SRL list. The SRL properties are located in Wayne and Little Falls Townships, the Borough of Pompton Lakes, and the City of Paterson.

Table 7.3.1-11 provides loss estimates for SRL properties at the municipality level, as calculated by FEMA and the NFIP. The table shows that 117 of the 199 SRL properties in Passaic County are located in Wayne Township. Wayne also has the highest number of paid claims and cumulative claims. As part of their initiation into the SRL grant program, FEMA provided States with actuarial calculations of risk (maximum benefits of mitigation) for 30- and 100-year planning horizons. The data provided by FEMA includes more details about claims histories at the policy level, but that information is not included here because of data confidentiality restrictions. The information can be obtained from Passaic County on a need-to-know basis. The table shows that Wayne Township also has the highest 30-year and 100-year risk.

The columns labeled “30-year Risk” and “100-year Risk” show the expected future losses over those respective planning horizons, for the four municipalities in Passaic County that include an SRL property. As noted, the FEMA/NFIP calculations include these figures on the level of individual addresses and policies. It should be noted that the FEMA methodology does not express a complete range of potential risk (and benefits if the data is used in a Benefit-Cost Analysis (BCA) for a mitigation project), so individual properties should not be dropped from consideration for mitigation based solely on this calculation. More extensive risk assessment and benefit-cost

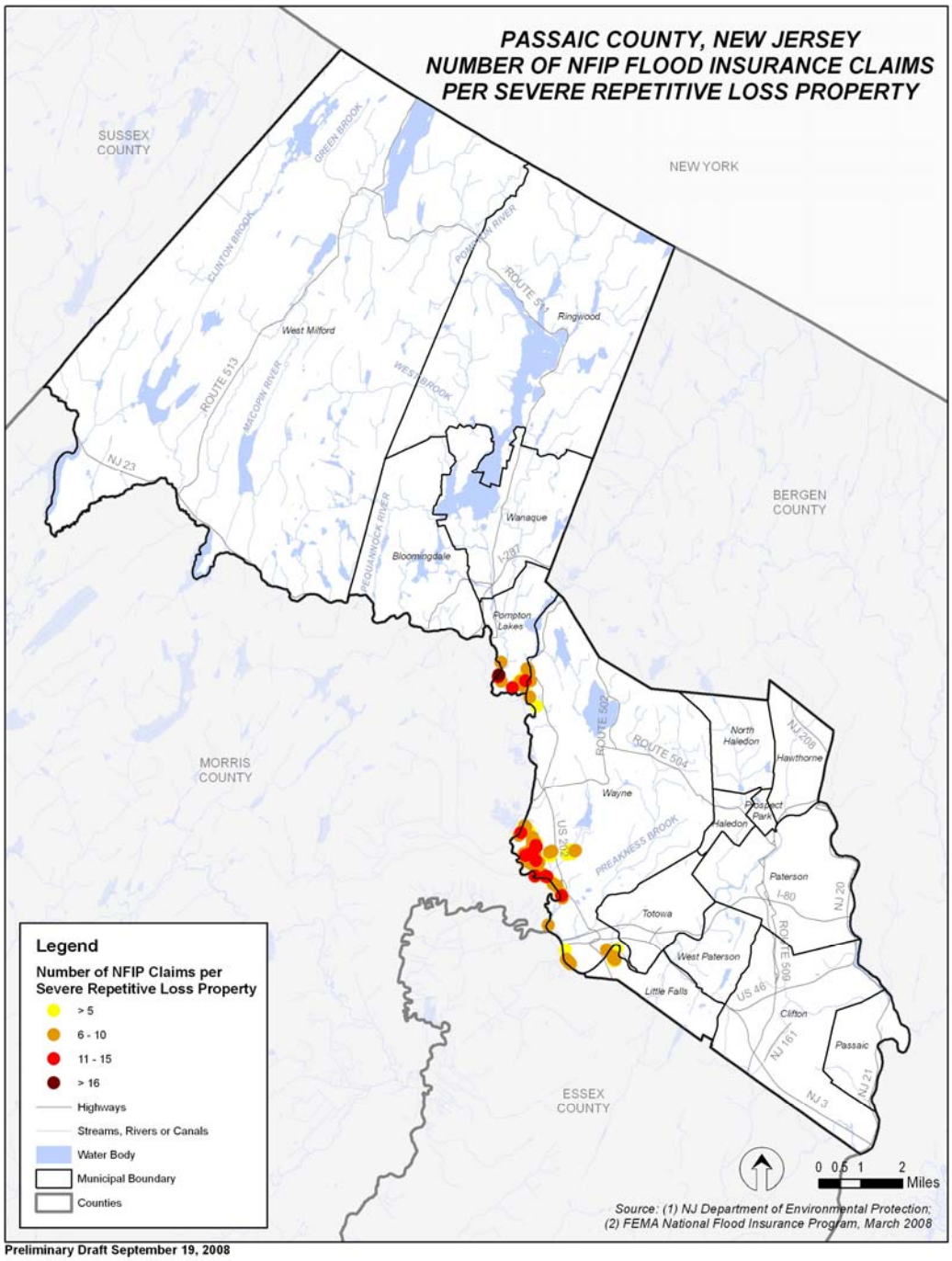
analysis would include additional loss calculations that would likely increase the apparent risk along with the concomitant benefits of reducing or eliminating it.

Table 7.3.1-11
FEMA NFIP Actuarial Calculation of Potential Maximum Benefits for Mitigating SRL Properties in Passaic County, ordered by Number of Properties in each Municipality
(Source: FEMA/NFIP, Query March 2008)

Municipality Name	Properties	Paid Claims	Cumulative Claims	30-year Risk	100-year Risk	Average Payment
Wayne, Township of	117	796	$19,409,991	$9,172,631	$10,547,678	$24,384
Pompton Lakes, Borough of	56	361	$10,749,641	$4,980,910	$5,727,586	$29,777
Little Falls, Township of	25	117	$3,117,546	$1,651,332	$1,898,880	$26,646
Paterson, City of	1	4	$90,766	$115,372	$132,667	$22,692
Total / Average	**199**	**1,278**	**$33,367,945**	**$15,920,245**	**$18,306,811**	**$26,110**

The series of maps below display information about the SRL properties in Passaic County. The first map (Figure 7.3.1-6) highlights the numbers of insurance claims by property. The second map (Figure 7.3.1-7) shows the cumulative amounts of insurance claims for the same properties.

Figure 7.3.1-6
Number of NFIP Flood Insurance Claims Per Severe Repetitive Loss Property in Passaic County
(Sources: FEMA, NJDEP)

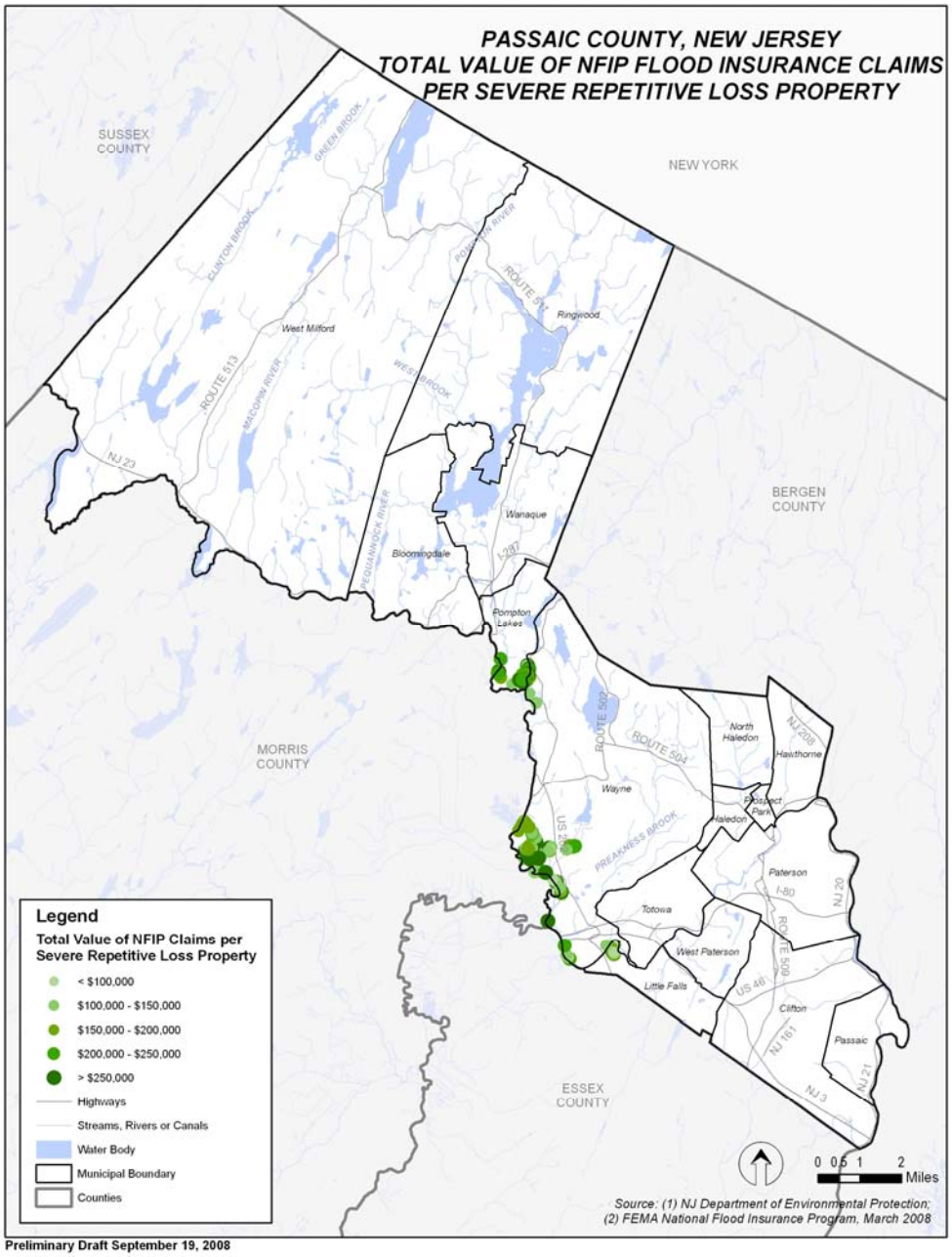


Preliminary Draft September 19, 2008

Note: Three of the 199 SRL property addresses could not be mapped because of inconsistencies in NFIP repetitive loss data, and were therefore excluded from this version of the hazard mitigation plan. The unmapped properties are located in the Township of Wayne and City of Paterson.

The following map highlights the total value of NFIP severe repetitive loss flood insurance claims per property in Passaic County.

Figure 7.3.1-7
Value of NFIP Flood Insurance Claims Per Severe Repetitive Loss Property in Passaic County
(Sources: FEMA, NJDEP)



Note: Three of the 199 SRL property addresses could not be mapped because of inconsistencies in NFIP repetitive loss data, and were therefore excluded from this version of the hazard mitigation plan. The unmapped properties are located in the Township of Wayne and City of Paterson.

Flood Risk to Passaic County Public Assets

Detailed engineering assessments are required to accurately calculate flood risk to public facilities. Without an engineering study, the best source of vulnerability and risk data about public facilities is from insurance records or FEMA Public Assistance (PA) program Project Worksheets (PWs). After Presidentially-Declared Disasters, FEMA engineers visit communities to determine the nature and dollar amount of damages, so that federal funds can be provided to the community.

In the past ten years Passaic County has experienced two Presidentially-declared disasters. The events occurred in September 1999 and April 2007. In 1999, Hurricane Floyd initially made landfall on September 16, along eastern North Carolina near Cape Fear as a Category 2 storm. As it continued in a northeast direction along the Eastern U.S. coastline Hurricane Floyd weakened to a tropical depression near the mid-Atlantic area. The tropical depression produced extreme rainfall totals of 10 to14 inches in some parts of New Jersey. After the event, portions of ten States from Florida to Connecticut received Presidential Disaster Declarations. On September 18, 1999 a Presidentially-declared disaster was declared for 12 counties in central and northern New Jersey (FEMA DR-1295). The flash flooding and overbank riverine flooding from Hurricane Floyd caused a total of 57 deaths, six of which were in New Jersey. The FEMA Project Worksheets estimated the infrastructure damages in New Jersey from Hurricane Floyd at slightly over $53 million. Of this total, just over $5.8 million was allocated to Passaic County. Table 7.3.1-12 summarizes the two disasters.

From April 14th to the 20th, 2007 most of the State of New Jersey was impacted by the effects of severe storms and coastal and inland flooding. The strong spring storm, know as a "Northeaster", impacted the East Coast from South Carolina to Maine. On April 26, 2007, a Presidentially-declared disaster was declared for 15 Counties in New Jersey (FEMA DR-1694).

Table 7.3.1-12
Summary of Presidentially-Declared Disasters in Passaic County
(Source: FEMA – Disaster Declarations Database)

Disaster #	Disaster Declaration Date	# Counties Affected	Type of Disaster
DR-1295	09/18/1999	12	Hurricane Floyd
DR-1694	4/26/2007	15	Severe storms and Flooding

To document storm related damages after a declared disaster, FEMA prepares PWs that are assigned a category of work (categories A – G). Table 7.3.1-13 summarizes the Public Assistance funds provided for each of the declared disasters broken down by PA category (see PA category descriptions below table).

Table 7.3.1-13
Project Worksheet Summary for DR-1295 and DR-1694,
by FEMA Public Assistance Program Category, Passaic County
(Source: FEMA Region II, September 2007)

Disaster #	Cat. A	Cat. B	Cat. C	Cat. D	Cat. E	Cat. F	Cat. G	Total
DR-1295	$1,223,240	$554,237	$223,136	$8,980	$140,923	$72,120	$1,532,154	$3,754,789
DR-1694	$584,088	$906,023	$120,840	$0	$56,979	$88,064	$292,499	$2,048,494
Total	$1,807,329	$1,460,260	$343,975	$8,980	$197,902	$160,183	$1,824,653	$5,803,282

The FEMA Public Assistance categories are generally defined as follows:

- Category A: Emergency work, primarily debris clearance.
- Category B: Emergency protective measures.
- Category C: Permanent repair work, roads and bridges.
- Category D: Permanent repair work, water control facilities.
- Category E: Permanent repair work, public buildings.
- Category F: Permanent repair work, utilities.
- Category G: Permanent repair work, parks and recreation facilities.

Table 7.3.1-14 shows the amounts for each applicant that applied for Public Assistance in Passaic County, broken down by PA category for disasters DR-1694 and DR-1295. The majority of the damages were from flooding, but a small percentage assumed to be related to other hazards, such as high winds.

Table 7.3.1-14
Project Worksheet Summary for All Passaic County Applicants (Federal Disaster Numbers DR-1694 and 1295)
by FEMA Public Assistance Program Category, ordered by Dollar Amount of Total Assistance
(Source: FEMA Region II, September 2007)

Applicant Name	Cat. A	Cat. B	Cat. C	Cat. D	Cat. E	Cat. F	Cat. G	TOTAL
Wayne, Township of	$619,495	$351,939	$1,555	$0	$13,810	$6,445	$388,221	$1,381,466
Passaic County	$132,805	$103,206	$33,825	$0	$3,168	$0	$667,120	$940,125
Paterson, City of	$88,486	$367,417	$73,878	$0	$13,979	$72,619	$48,121	$664,500
Woodland Park, Borough of	$140,572	$106,182	$3,701	$0	$11,900	$5,000	$92,334	$359,689
West Milford, Township of	$191,638	$7,029	$62,104	$0	$0	$0	$5,581	$266,352
North Haledon, Borough of	$22,537	$21,853	$4,500	$0	$0	$8,938	$171,290	$229,117
Little Falls, Township of	$157,805	$26,599	$0	$4,227	$1,112	$0	$37,288	$227,031
Totowa, Borough of	$69,307	$132,867	$2,600	$0	$1,890	$16,260	$0	$222,924
Hawthorne, Borough of	$72,844	$76,141	$3,124	$0	$4,303	$3,500	$52,783	$212,695
Clifton, City of	$97,185	$63,250	$6,046	$0	$7,809	$0	$20,558	$194,848
Pompton Lakes, Borough of	$127,957	$34,458	$4,000	$0	$0	$0	$1,996	$168,411
Haledon, Borough of	$5,545	$28,913	$40,909	$0	$3,983	$3,470	$79,694	$162,514
Ringwood, Borough of	$8,862	$18,118	$77,433	$0	$0	$1,055	$16,763	$122,232
Passaic, City of	$28,180	$21,995	$27,500	$0	$0	$0	$42,846	$120,521
Passaic County, Preakness Healthcare Center	$3,355	$4,619	$0	$0	$26,005	$0	$49,310	$83,289
Passaic County - Technical	$0	$0	$0	$0	$0	$0	$60,490	$60,490
Clifton Board of Education	$16,234	$0	$0	$0	$39,700	$0	$0	$55,934
Pompton Lakes Borough Municipal Utilities Authority	$0	$5,750	$0	$0	$0	$42,897	$0	$48,647
West Milford Township Board of Education	$0	$2,141	$0	$2,918	$38,861	$0	$2,800	$46,720
Passaic County Regional Hospital #1	$0	$0	$0	$0	$0	$0	$45,451	$45,451
Bloomingdale, Borough of	$7,200	$16,806	$0	$0	$0	$0	$16,300	$40,306

Applicant Name	Cat. A	Cat. B	Cat. C	Cat. D	Cat. E	Cat. F	Cat. G	TOTAL
Wayne Township Board of Education	$0	$33,397	$0	$0	$2,830	$0	$0	$36,227
Hawthorne Board of Education	$3,960	$0	$0	$0	$0	$0	$19,721	$23,681
Wanaque, Borough of	$8,774	$14,033	$0	$0	$0	$0	$0	$22,807
Ringwood Board of Education	$3,588	$0	$0	$0	$16,250	$0	$0	$19,838
Woodland Park Board of Education	$1,000	$0	$0	$0	$12,302	$0	$0	$13,302
West Milford Township Municipal Utilities Authority	$0	$9,738	$0	$1,835	$0	$0	$0	$11,573
Passaic County Community College	$0	$9,418	$0	$0	$0	$0	$0	$9,418
Little Falls Board of Education	$0	$0	$0	$0	$0	$0	$5,986	$5,986
Prospect Park	$0	$4,392	$0	$0	$0	$0	$0	$4,392
Passaic County Manchester HS District	$0	$0	$2,800	$0	$0	$0	$0	$2,800
Grand Total	**$1,807,329**	**$1,460,260**	**$343,975**	**$8,980**	**$197,902**	**$160,183**	**$1,824,653**	**$5,803,282**

The data in Table 7.3.1-13 identifies that the applicant Wayne Township has received the most FEMA Public Assistance funds in the county over the last ten years. The Township has received a combined total of just under $1.4 million in PA funds from Hurricane Floyd and the April 2007 flood. Of this total, nearly half was for debris removal (Category A). The applicant Passaic County received the second highest amount of PA funds over this time period, with approximately $940,000 in assistance.

The table also shows that for FEMA categories C - G (permanent work), the highest estimated damages were related to Category G, park and recreational facilities. For all applicants in Passaic County, this category totaled slightly more than $1.8 million, or about 31% of the grand total. This analysis uses previous flood damages, as shown by PWs from two previous disasters, to indicate a rough dollar value of assets at risk by PA category. As mentioned above, without a detailed engineering study the PW records offer the best source of vulnerability and risk data about public facilities.

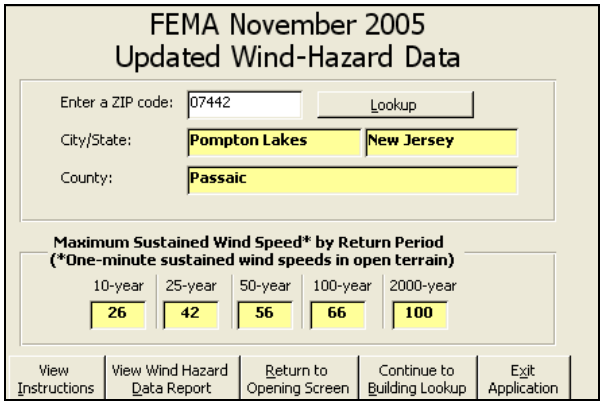
Table 7.3.1-13 is a summary of a more detailed FEMA database of Project Worksheets, which includes specific information about the location and nature of damages, based on post-event FEMA inspections. The summary data can be used by the county as one means of identifying general vulnerabilities, by examining categories of damages, where damages have occurred and/or which applicants appear to have the most vulnerability. In New Jersey, the FEMA PW data is not as rich a source of information as it would be in other States that experience more disasters, but it nevertheless offers an additional perspective on damages to public facilities, particular if the more detailed information is reviewed. It should be understood that damages alone are not a strong indicator of vulnerabilities, because in many cases facilities that were damaged in prior events have been replaced with stronger facilities or themselves hardened to better resist hazards.

7.3.2 Wind Risk in Passaic County

This subsection describes the risk assessment for hurricane winds in Passaic County. The calculations are done using the FEMA Full Data Hurricane Wind Benefit-Cost Analysis (BCA) module. Data about various asset classes were extracted from the FEMA HAZUS database version MR1 (v.1.1) in Fall 2007.

The first step in the risk assessment process is to determine wind profiles for the county, using the FEMA wind hazard and damage function database (BCA Toolkit). Figure 7.3.2-1 shows the wind hazard profiles for Passaic County at ZIP code 07442. This ZIP code (for the Borough of Pompton Lakes Public Library) was used because it is near the central geographic point in the county. There is very little wind speed differential across the county, so these figures can be considered reasonably accurate for all of Passaic County.

Figure 7.3.2-1
Passaic County Wind Hazard Profiles
(Source: FEMA wind hazard database (BCA Toolkit))



The wind risk assessment for the county was then conducted using the FEMA Hurricane Wind BCA software and the FEMA wind database on the BCA Toolkit Version 3.0. All figures are based on 100-year time horizon and a 7% discount rate to determine net present value of the risk. Table 7.3.2-1 shows the expected annual number of hurricane wind storms in Passaic County by class.

Table 7.3.2-1
Expected Annual Number of Wind Storms by Class, Passaic County
(Source: FEMA Full-Data Hurricane Wind BCA module)

EXPECTED ANNUAL NUMBER OF WIND STORMS			
Storm Class	**Wind Speed (mph)**	**Default Estimate**	**User Estimate**
0	60-73	1.057E-02	
1	74-95	3.712E-03	
2	96-110	4.355E-04	
3	111-130	1.643E-04	
4	131-155	5.014E-05	
5	>155	2.122E-05	

Note: User Estimate column is intentionally left blank. This column can be used to override the default estimates calculated by the module.

Estimated Hurricane Wind Risk to Public and Private Assets

Damage functions for all structure types are verbatim from the FEMA software; the FEMA/HAZUS structure and roof types used in the analysis are noted in Table 7.3.2-2. Note that the data are intended only to provide a general estimate of potential wind risk. Specific mitigation projects will require more detailed engineering assessments. The major roadways, transportation, communications and utilities classes were not assessed as part of this Plan because most of these are unique and require detailed engineering studies to be accurate.

Table 7.3.2-2
Abbreviations for HAZUS Structure Types
(Source: HAZUS)

HAZUS Structure Type	Roof Type	Abbreviation
Wood framed non-engineered gable	Gable	WMUH1 #1
Steel frame engineered commercial	Flat	SECBL #28
Masonry industrial – RM	Flat	MLRI #25
Pre-engineered metal building	Flat	SPMBL #42
Masonry non-engineered reinforced gable	Gable	MERBL #13
Concrete engineered commercial	Flat	CECBL #35
Masonry non-engineering reinforced hip	Hip	MERBL #14

A query from HAZUS version MR1 (v.1.1) in the fall of 2007 was used as the basis for total structure and content values for each land use category for Passaic County. The HAZUS query results include only the estimated dollar value for each category and not the total square footage. The results for Passaic County are shown in Table 7.3.2-3. Following this table is a description of how the square footage estimates were calculated.

Table 7.3.2-3
Passaic County: Square Footage and Value for Predominant Asset Classes
(Source: HAZUS version MR1 (v.1.1), Fall 2007)

Land Use Category	HAZUS Building Type	Total Square Footage	Structure Value (HAZUS)	Contents Value (HAZUS)
Agriculture	SPMBL #42	277,696	$25,548,000	$25,548,000
Commercial	SECBL #28	26,684,188	$4,109,365,000	$4,323,141,000
Education	MERBL #13	812,424	$138,112,000	$151,606,000
Government	CECBL #35	647,426	$109,415,000	$124,916,000
Industrial	MLRI #25	11,100,713	$1,354,287,000	$1,952,133,000
Religious	MERBL #14	1,260,249	$258,351,000	$258,351,000
Residential	WMUH1 #1	172,188,416	$21,523,552,000	$10,766,751,000
Total	**-------**	**212,971,111**	**$27,518,630,000**	**$17,602,446,000**

The online RS Means Quickcost Estimator was used to estimate the dollar per square foot cost for each land use category. The ZIP code 07442 for the Borough of Pompton Lakes was again used because of its central location in the county. For each asset, estimates were made about the average building square footage and a typical facility type for each land use category. Table 7.3.2-4 summarizes the assumptions and results for each land use category, with the exception of residential which was estimated at $125 per square foot.

Table 7.3.2-4
Passaic County: Predominant Asset Classes
Assumptions and Results of RS Means Quickcost Estimator
(Source: RS Means Quickcost Estimator)

Land Use Category	Average Building SF	Building Type	$ Per SF Cost	Basis Construction Type	Construction Cost
Agriculture	25,000	Warehouse (Representing Barn/storage)	$92	Tilt-up Concrete Panels/Steel Frame	$2,308,723
Commercial	35,000	Office 2-4 Story	$154	Face Brick with Concrete Block Back Up/ Wood Joist	$5,383,831
Education	50,000	Jr. High School, 2-3 story	$170	Face Brick with Concrete Block Back Up/ Steel Frame	$8,501,920
Government	30,000	Police Station	$169	Limestone with Concrete Block Backup	$5,058,266
Industrial	75,000	Factory (3 Story)	$122	Face Brick, Common Brick backup / Steel Frame	$9,160,983
Religious	5,000	Church	$205	Decorative Concrete Block / Wood Arch	$1,026,375

The output from the Quickcost Estimator includes construction low, medium, and high cost ranges. The medium construction cost was used in the present analysis. Figure 7.3.2-2 provides a sample of the RS Means output for the education category, a 2-3 story Jr. High School. Note that although the ZIP code for the Borough of Pompton Lakes was entered as the project location, the estimating tool changed the location to Paterson, New Jersey. This is most likely a result of Paterson being the closest city included in the Quickcost Estimator database.

Figure 7.3.2-2
RS Means Quickcost Estimator
Education Asset Class Results
(Source: RS Means Quickcost Estimator)

RSMeans QuickCost Estimator

Project Title:	{Not Provided}
Model:	School, Jr High, 2-3 Story
Construction:	Face Brick with Concrete Block Back-up / Steel Frame
Location:	PATERSON, NJ
Stories:	2
Story Height (l.f.):	15
Floor Area (s.f.):	50,000
Data Release:	2008
Wage Rate:	Union
Basement:	Not included

Costs are derived from a building model with basic components. Scope differences and market conditions can cause costs to vary significantly.

Cost Ranges	Low	Med	High
Total:	$5,801,850	$6,446,500	$8,058,125
Contractor's Overhead & Profit:	$1,450,463	$1,611,625	$2,014,531
Architectural Fees:	$399,416	$443,795	$554,744
Total Building Cost:	**$7,651,728**	**$8,501,920**	**$10,627,400**

Wind risk for Passaic County assets is then calculated using the FEMA Full-Data Hurricane Wind BCA module and the wind damage functions in the FEMA wind hazard database (BCA Toolkit). The assessment uses a 100-year time horizon. Data parameters used in the Wind BCA Module as part of the risk assessment are described in Table 7.3.2-5.

Table 7.3.2-5
Data Parameters Entered into BC Module for each Asset Class

Data Field	Values per Category
Rental Cost of Temporary Building Space	▪ Government: $1 per SF/Month ▪ Agriculture: $1 per SF/Month ▪ Education: $1 per SF/Month ▪ Commercial: $1 per SF/Month ▪ Industrial: $2 per SF/Month ▪ Religious: $1 per SF/Month ▪ Residential: $1 per SF/Month
Other Costs of Displacement	▪ Government: $352,639 per month ▪ Agriculture: $862,000 per month ▪ Education: $698,292 per month ▪ Commercial: $29,371,779 per month ▪ Industrial: $20,875,578 per month ▪ Religious: $1,327,898 per month ▪ Residential: $200,486,368 per month
One Time Displacement Cost	▪ Government: Equal to Building SF ▪ Agriculture: Equal to Building SF ▪ Education: Twice the building SF ▪ Commercial: Equal to Building SF ▪ Industrial: Twice the building SF ▪ Religious: Equal to Building SF ▪ Residential: Equal to Building SF
Annual Budget	▪ Education: $150 per SF ▪ Government: $200 per SF ▪ Remaining Categories: $0
Estimated Net Income of Commercial Business	▪ Commercial: $100 per SF ▪ Industrial: $200 per SF ▪ Agriculture: $25 per SF ▪ Remaining Categories: $0

The data parameters described above are then used in the FEMA Hurricane Wind BCA module to calculate hurricane wind risk for Passaic County. Tables 7.3.2-6 and 7.3.2-7 summarize the results of the analysis. The last column *100-year Wind Risk* indicates the estimated cumulative wind damages over a 100-year planning horizon, using the mandated 7% discount rate for net present value.

In Table 7.3.2-6, the data is sorted by 100-year risk. This table shows the wind risk by building category and the total wind risk for Passaic County assets from hurricanes. Although these figures seem relatively high, it should be noted that this hazard (hurricane wind) affects all the assets in Passaic County about equally, whereas flooding generally affects only those assets or operations that are close to flood sources. The last column *100-year Wind Risk* indicates the cumulative expected wind damages over a 100-year planning horizon, using the mandated 7% discount rate for net present value. This table shows that the residential category has the highest 100-year risk. Table 7.3.2-7 sorts the data by risk per square foot. When sorted by risk per square foot, the government and commercial categories move to the top of the list.

Table 7.3.2-6
Estimated Hurricane Wind Risk to Passaic County Assets, ordered by 100-year Risk
(Sources: HAZUS Query, Fall 2007, FEMA Hurricane Wind BCA Module)

Land Use Category	HAZUS Structure Type	Total SF	Risk per SF	Annual Building Damages	Annual Content Damages	Annual Displacement Costs	Business Income Lost	Annual Public Services Lost	Total Annual Damages	100-yr Risk
Residential	WMUH1	172,188,416	$0.61	$4,028,930	$1,405,731	$1,928,873	$0	$49,867	$7,413,401	$105,783,678
Commercial	SECBL	26,684,188	$2.40	$1,910,221	$1,616,891	$741,510	$193,253	$20,547	$4,482,422	$63,960,805
Industrial	MLRI	11,100,713	$2.37	$590,567	$458,575	$616,791	$167,214	$7,042	$1,840,189	$26,258,127
Government	CECBL	647,426	$2.82	$52,626	$46,720	$18,516	$0	$10,075	$127,937	$1,825,567
Religious	MERBL	1,260,249	$0.80	$36,587	$21,582	$11,730	$0	$454	$70,353	$1,003,880
Education	MERBL	812,424	$1.09	$25,279	$19,804	$12,773	$0	$4,322	$62,178	$887,266
Agriculture	SPMBL	277,696	$1.20	$10,636	$7,729	$4,440	$485	$123	$23,413	$334,089
Total	**-----**	**212,971,111**	**----**	**$6,654,846**	**$3,577,032**	**$3,334,633**	**$360,952**	**$92,430**	**$14,019,893**	**$200,053,412**

Table 7.3.2-7
Estimated Hurricane Wind Risk to Passaic County Assets, ordered by Risk per Square Foot
(Sources: HAZUS Query, Fall 2007, FEMA Hurricane Wind BCA Module)

Land Use Category	HAZUS Structure Type	Total SF	Risk per SF	Annual Building Damages	Annual Content Damages	Annual Displacement Costs	Business Income Lost	Annual Public Services Lost	Total Annual Damages	100-yr Risk
Government	CECBL	647,426	$2.82	$52,626	$46,720	$18,516	$0	$10,075	$127,937	$1,825,567
Commercial	SECBL	26,684,188	$2.40	$1,910,221	$1,616,891	$741,510	$193,253	$20,547	$4,482,422	$63,960,805
Industrial	MLRI	11,100,713	$2.37	$590,567	$458,575	$616,791	$167,214	$7,042	$1,840,189	$26,258,127
Agriculture	SPMBL	277,696	$1.20	$10,636	$7,729	$4,440	$485	$123	$23,413	$334,089
Education	MERBL	812,424	$1.09	$25,279	$19,804	$12,773	$0	$4,322	$62,178	$887,266
Religious	MERBL	1,260,249	$0.80	$36,587	$21,582	$11,730	$0	$454	$70,353	$1,003,880
Residential	WMUH1	172,188,416	$0.61	$4,028,930	$1,405,731	$1,928,873	$0	$49,867	$7,413,401	$105,783,678
Total	**-----**	**212,971,111**	**----**	**$6,654,846**	**$3,577,032**	**$3,334,633**	**$360,952**	**$92,430**	**$14,019,893**	**$200,053,412**

Figure 7.3.2-3 is a sample of the results for the Education category from the Hurricane Wind Module. The summary of expected annual damages and benefits for each category was used to populate Tables 7.3.2-6 and 7.3.2-7 above.

Figure 7.3.2-3
Hurricane Wind Benefit Cost Module
Education Asset Class: Summary of Expected Annual Damages and Benefits
(Source: FEMA Hurricane Wind BCA Module)

BENEFIT-COST RESULTS

Hurricane Wind Risk Assessme Education MERBL #13

Building Type Selected	Other		
Project Description			
Discount Rate	7.00%	Project Useful Life (years)	100
Present Value Coefficient	14.27		

SUMMARY OF EXPECTED ANNUAL DAMAGES AND BENEFITS

	Expected Annual Damages Before Mitigation	Expected Annual Damages After Mitigation	Expected Annual Benefits	Present Value of Annual Benefits
Building Damages	$25,279	$0	$25,279	$360,710
Contents Damages	$19,804	$0	$19,804	$282,589
Displacement Costs	$12,773	$0	$12,773	$182,256
Business Income Lost	$0	$0	$0	$0
Rental Income Lost	$0	$0	$0	$0
Public Services Lost	$4,322	$0	$4,322	$61,672
Total Losses & Benefits	$62,177	$0	$62,177	$887,226

PROJECT BENEFITS	GRAPH	$887,226
PROJECT COSTS		$1
BENEFITS MINUS COSTS		$887,225
BENEFIT-COST RATIO		**887225.64**

FEMA Disclaimer: The results produced by this analysis are neither conclusive evidence that the proposed project is cost-effective, nor a guarantee that a project is eligible for any government grant for whatever purpose.

Table 7.3.2-8 summarizes hurricane wind risk for the 16 municipalities within Passaic County. The municipal-level calculation is done proportionally, using the value of local structural exposure compared to the county-level values. This proportion is then multiplied by the same values that are shown in Table 7.3.2-6 to estimate the local risk. It should be noted that these techniques produce risk figures that are very general, and should be used for the purpose of planning and prioritizing where additional study should be conducted.

Table 7.3.2-8
Estimated Hurricane Wind Risk for Assets in the 16 Passaic County Municipalities, ordered by Total 100-year Risk
(Sources: HAZUS Query, Fall 2007, FEMA Hurricane Wind BCA Module)

Municipality Name	Residential	Commercial	Industrial	Agricultural	Education	Government	Religious	Total 100-yr Risk
Paterson, City of	$24,114,934	$14,605,862	$6,948,437	$22,100	$226,333	$729,109	$219,765	$46,866,540
Clifton, City of	$18,619,509	$11,399,670	$4,984,012	$38,002	$122,543	$173,589	$159,466	$35,496,790
Wayne, Township of	$15,804,172	$11,611,100	$4,468,035	$63,371	$149,814	$169,768	$151,714	$32,417,973
Passaic, City of	$10,401,842	$9,344,188	$3,007,121	$12,606	$116,517	$402,738	$147,782	$23,432,793
West Milford, Township of	$7,684,211	$2,400,924	$503,937	$33,778	$34,338	$9,627	$65,300	$10,732,114
Totowa, Borough of	$2,762,553	$3,976,829	$2,885,940	$29,462	$30,926	$25,494	$38,480	$9,749,685
Hawthorne, Borough of	$4,614,961	$2,418,637	$1,458,665	$37,583	$45,272	$98,874	$97,287	$8,771,278
Woodland Park, Borough of	$2,758,198	$1,976,912	$478,712	$10,292	$19,960	$35,922	$18,034	$5,298,030
Little Falls, Township of	$2,749,470	$2,020,135	$365,267	$12,985	$37,396	$43,197	$27,565	$5,256,015
Ringwood, Borough of	$3,533,771	$858,437	$318,986	$20,845	$13,619	$0	$24,830	$4,770,488
Pompton Lakes, Borough of	$2,804,171	$934,221	$305,375	$16,817	$45,073	$5,573	$12,741	$4,123,971
Wanaque, Borough of	$2,642,755	$537,541	$137,099	$8,435	$9,084	$30,450	$17,326	$3,382,689
North Haledon, Borough of	$2,327,181	$622,804	$84,342	$10,605	$3,007	$8,259	$3,482	$3,059,679
Bloomingdale, Borough of	$2,191,961	$457,180	$219,657	$6,421	$13,420	$40,444	$8,195	$2,937,278
Haledon, Borough of	$1,719,699	$551,471	$28,812	$10,788	$10,349	$30,300	$9,582	$2,361,001
Prospect Park, Borough of	$1,054,291	$244,894	$63,731	$0	$9,617	$22,224	$2,331	$1,397,089
Total	**$105,783,678**	**$63,960,805**	**$26,258,127**	**$334,089**	**$887,266**	**$1,825,567**	**$1,003,880**	**$200,053,412**

7.3.3 Severe Storm–Winter Weather Risk in Passaic County

The Nation Oceanic and Atmospheric Association (NOAA) National Climatic Data Center (NCDC) database lists 46 winter storm/snow/ice events from 1993 to 2007 for Passaic County. The website does not indicate why the data does not extend to 1950. As mentioned in Section 6, the NCDC reported no damages from winter weather events for Passaic County. For the risk assessment in this subsection, estimated property damages and casualties from winter weather for Passaic County were derived based on a proportion of the statewide NCDC statistics for New Jersey. Passaic County accounts for 5.8% of the total population of the state (2000 US Census population for New Jersey: 8,414,350). The total damages, deaths, and injuries for Passaic County were estimated at 5.8% of the statewide totals for New Jersey winter weather from the NCDC database. Table 7.3.3-1 shows various data parameters used in the risk estimate.

Table 7.3.3-1
Data Parameters for Passaic County Winter Storm Risk Assessment, 1994-2007
(Source: NOAA/NCDC)

Data	Value
Winter storm events(1993-2007)	46
Average annual number of winter storm events	3.28
Total damages(1993-2007)	$3,948,350
Annual damages	$282,025
Deaths(1993-2007)	0.34
Annual deaths	0.024
Value of single death (FEMA, estimated 2008 value)	$3,000,000
Estimated annual cost of deaths from winter storms	$72,000
Injuries (1994-2007)	2.26
Annual injuries	0.16
Value of single injury (FEMA, estimated 2008 value)	$20,000
Estimated annual cost of injuries from winter storms	$3,200

After determining the annual figures for damages, deaths, and injuries for the county, the risk assessment comprises a simple projection of expected future damages (risk) based on the annualized damages, multiplied by a standard present value coefficient of 14.27. This represents a 100-year time horizon and a 7% discount rate (the latter is required under federal Office of Management and Budget guidelines).

Table 7.3.3-2
Estimate of Risk to Passaic County from Winter Storms
(Source: NOAA/NCDC)

Data	Value
Annual damages to Passaic County	$282,025
Projected risk from direct winter storm damages	$4,024,497
Estimated annual cost of deaths	$72,000
Projected risk from winter storm-related deaths	$1,027,440
Estimated annual cost of injuries	$3,200
Projected risk from winter storm-related injuries	$45,664
Estimated total risk from winter storms (100-year horizon)	**$5,097,601**

The winter weather risk for Passaic County can be analyzed in greater detail by focusing on individual municipalities. Specific municipality-level winter weather data was not available for Passaic County from the NCDC database or other sources. In the absence of this data, the winter weather damages for each municipality were calculated as a proportion of the Passaic County population. In the year 2000, the United States Census Bureau reported that the total population in Passaic County was 489,049. For each municipality, the percentage of the county population was calculated. The total winter weather damages for each municipality were then calculated by multiplying the percent of the county population by $3,948,350 the total winter weather damages for the county.

Table 7.3.3-3 provides a summary of the winter weather risk for each of the 16 municipalities within Passaic County. For each municipality, the annual damages were calculated by dividing the total damages by 14, the number of years reported in the NCDC database. The last column (100-year Winter Weather Risk) indicates the estimated cumulative wind damages over a 100-year planning horizon, using the mandated 7% discount rate for net present value. The table shows that the City of Paterson has the highest 100-year winter weather risk in the county.

Table 7.3.3-3
Estimated Winter Storm Risk to the 16 Passaic County Municipalities from Winter Storms, Ordered By 100-Year Risk
(Sources: NOAA/NCDC, United States Census Bureau)

Municipality Name	Population	% of County Population	Total Damages	Annual Damages	100-Year Risk
Paterson, City of	149,222	30.51%	$1,204,748	$86,053	$1,227,982
Clifton, City of	78,672	16.09%	$635,160	$45,369	$647,410
Passaic, City of	67,861	13.88%	$547,878	$39,134	$558,444
Wayne, Township of	54,069	11.06%	$436,527	$31,181	$444,946
West Milford, Township of	26,410	5.40%	$213,222	$15,230	$217,334
Hawthorne, Borough of	18,218	3.73%	$147,084	$10,506	$149,920
Ringwood, Borough of	12,396	2.53%	$100,079	$7,149	$102,010
Woodland Park, Borough of	10,987	2.25%	$88,704	$6,336	$90,415
Little Falls, Township of	10,855	2.22%	$87,638	$6,260	$89,328
Pompton Lakes, Borough of	10,640	2.18%	$85,902	$6,136	$87,559
Wanaque, Borough of	10,266	2.10%	$82,883	$5,920	$84,481
Totowa, Borough of	9,892	2.02%	$79,863	$5,705	$81,404
Haledon, Borough of	8,252	1.69%	$66,623	$4,759	$67,908
North Haledon, Borough of	7,920	1.62%	$63,942	$4,567	$65,176
Bloomingdale, Borough of	7,610	1.56%	$61,440	$4,389	$62,624
Prospect Park, Borough of	5,779	1.18%	$46,657	$3,333	$47,557
Total	**489,049**	**-----**	**$3,948,350**	**$282,025**	**$4,024,497**

7.3.4 Dam Failure Risk in Passaic County

This subsection of the Plan discusses the dam failure risk in Passaic County. As described in Section 6, Hazard Identification and Profiling, the New Jersey Department of Environmental Protection (NJDEP) – Bureau of Dam Safety and Flood Control indentifies 142 dams in Passaic County. In Section 6, Table 6.3.1-2 lists these dams, including the NJDEP hazard classification, which ranks the potential for loss of life and infrastructure and property damages downstream if a dam failure were to occur. The NJDEP has established three hazard classifications: high (H), significant (S), and low (L). See Table 6.3.1-2 in Section 6 for a list of the dams and hazard classifications. The descriptions of the hazard classifications at the bottom of the table are repeated below

- H = High Hazard: Loss of life likely (if failure were to occur)
- S = Significant Hazard: Loss of life not likely but the potential for significant property damage
- L = Low Hazard: Loss of life not likely and minimal infrastructure or property damage other than the structure itself

The Passaic County HMPC reviewed the inventory of dams from the NJDEP and determined that the dams shown in Table 7.3.4-1 dams would be selected for further analysis as part of the dam failure risk assessment. All of these facilities are classified as High Hazard dams by the NJDEP. The dams are summarized below in Table 7.3.4-1.

Table 7.3.4-1
Summary of Passaic County Dams Selected for Risk Assessment
(Source: NJDEP – Bureau of Dam Safety and Flood Control)

Municipality Name	Dam Name	River/Stream	Height (ft)	Length (feet)	Last Date Inspected
West Milford Township	Clinton Reservoir	Clinton Brook	55.5	1,530	12/12/2006
West Milford Township	Charlotteburg	Pequannock River	102	675	12/21/2006
Ringwood Borough	Monksville	Pompton River-TR	150	2,170	11/1/2006
Pompton Lakes Borough	Pompton Lakes	Ramapo River	30	290	11/1/2006
Wanaque Borough	Raymond	Wanaque River	188	1,603	11/1/2006
Woodland Park Borough	New Street Reservoir	Slippery Rock Brook	26	449	6/5/2006

The HMPC and its consulting engineers determined that to estimate downstream dam failure vulnerabilities, a geographic information system would be used to establish a 500-foot-wide stream buffer extending 1.5 miles downstream of each high hazard dam. This area is then used in combination with population, housing and land use data to determine the degree of exposure downstream. The downstream buffer is shown only to identify the population and development downstream of the dam. *It is important to note that the buffer zone is intended for general planning purposes only, and does not indicate the downstream inundation area if a dam failure were to occur. Inundation areas and zones of potential high- velocity flow are highly site-specific and require detailed engineering study to accurately characterize risk.*

Figures 7.3.4-1 through 7.3.4-6 show commercial, industrial, and residential land use types for each census block intersecting the 500 foot buffer downstream of these dams. Each map is followed by two tables (Tables 7.3.4-2 – 7.3.4-7) that identify the population, housing units and the number of acres for each land use category displayed on the map.

Figure 7.3.4-1 is a map of Clinton Reservoir Dam, which is located along Clinton Brook in West Milford Township. The map identifies the land use / land cover for the census blocks intersecting a 500 foot wide stream buffer.

Figure 7.3.4-1
Clinton Reservoir Dam
Land Use / Land Cover for Census Blocks Intersecting a 500 Foot-Wide Buffer
(Source: NJDEP)

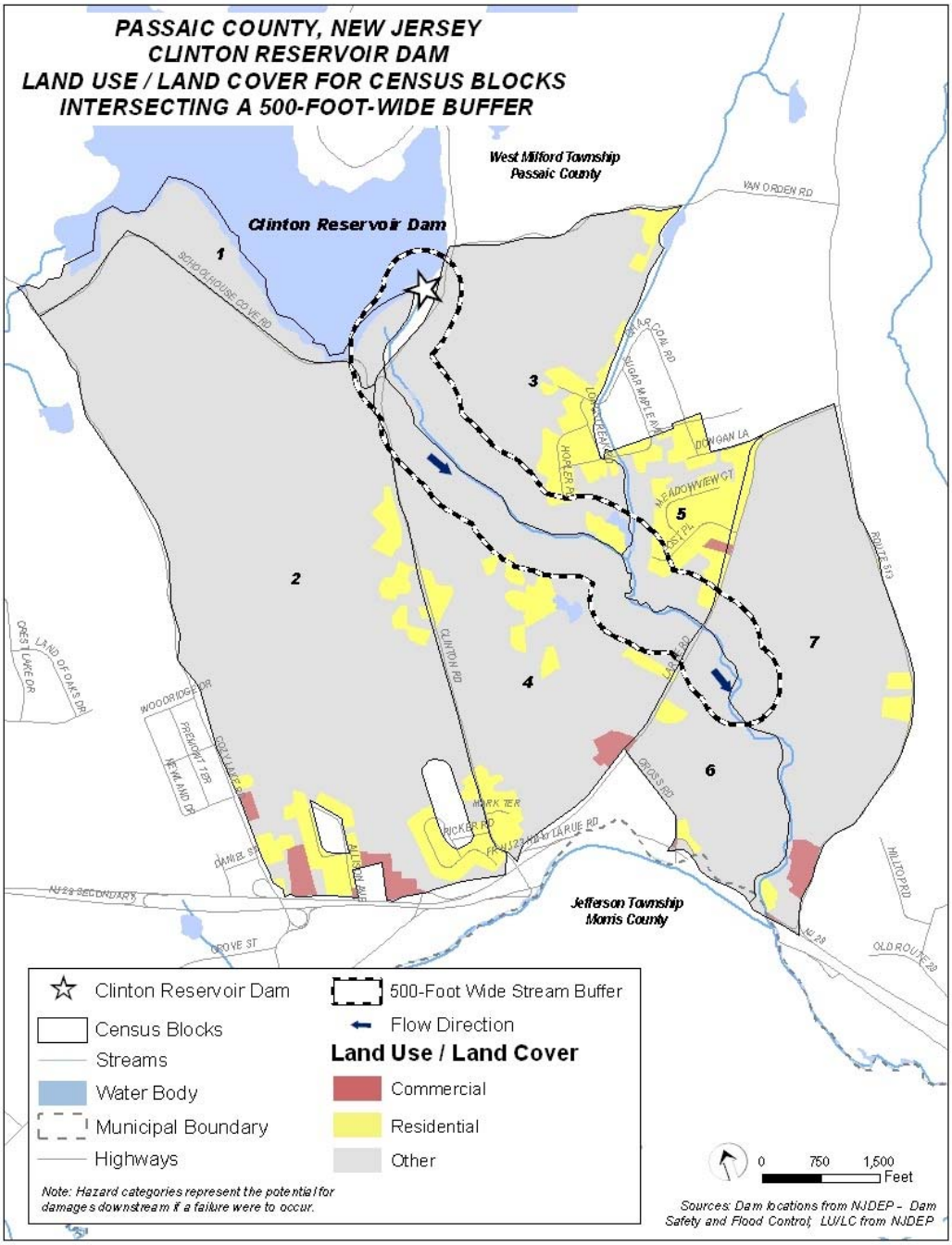


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Table 7.3.4-2 identifies the population and housing units for each of the seven census blocks included on the Clinton Reservoir Dam map (Figure 7.3.4-1). There are a total of 541 residents and 191 housing units within the selected census blocks located along the 500 foot wide stream buffer downstream of Clinton Reservoir Dam.

Table 7.3.4-2
Population and Housing Units for Selected Census Blocks Intersecting the 500-Foot-Wide Stream Buffer Downstream of Clinton Reservoir Dam
(Source: US Census Bureau – 2000 Population)

Map ID	Block Number	Population	Housing Units
1	1010	0	0
2	2016	228	74
3	2009	6	3
4	2015	72	23
5	2014	186	64
6	2024	11	3
7	2025	38	24

Table 7.3.4-3 identifies the number of acres within each of the seven census blocks for the four land use categories identified on the Clinton Reservoir Dam map (Figure 7.3.4-1). The table shows that the "other" land use category has the highest acreage within the selected census blocks, followed by residential and commercial uses.

Table 7.3.4-3
Land Use / Land Cover (in acres) for Selected Census Blocks Intersecting the 500-Foot-Wide Stream Buffer Downstream of Clinton Reservoir Dam
(Source: NJDEP – Land Use Land Cover)

Map ID	Block Number	Commercial (Acres)	Other (Acres)	Residential (Acres)	Grand Total
1	1010	0.00	65.16	0.00	65.16
2	2016	9.89	507.25	42.88	560.01
3	2009	0.00	181.50	30.28	211.78
4	2015	3.29	218.99	25.38	247.66
5	2014	0.85	28.44	41.22	70.50
6	2024	0.44	87.05	3.49	90.98
7	2025	**5.02**	**211.02**	**152.45**	**225.24**

Figure 7.3.4-2 is a map of Charlotteburg Dam, which is located along the Pequannock River in West Milford Township. The map identifies the land use / land cover for the census blocks intersecting a 500 foot wide stream buffer.

Figure 7.3.4-2
Charlotteburg Dam
Land Use / Land Cover for Census Blocks Intersecting a 500 Foot-Wide Buffer
(Source: NJDEP)

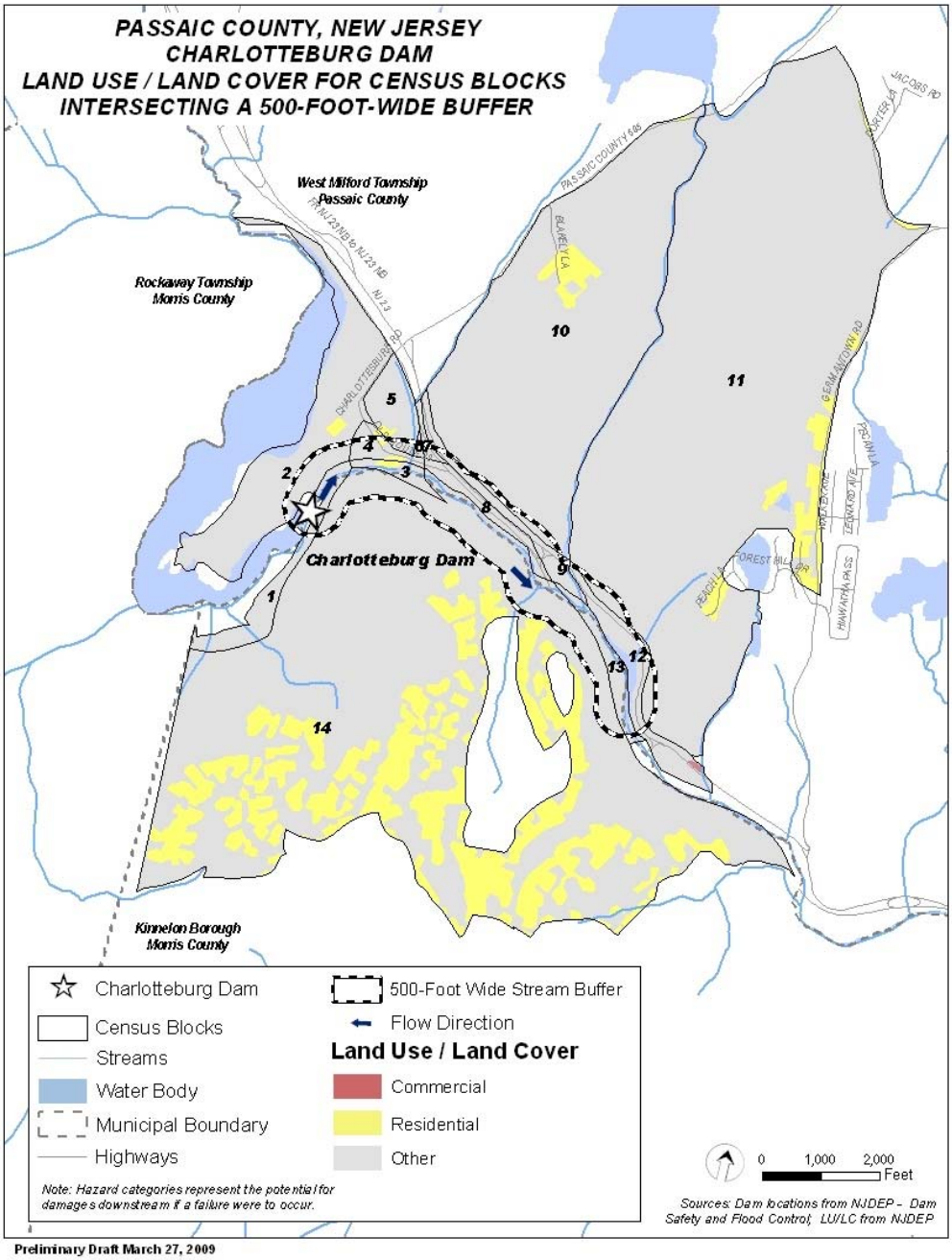

Table 7.3.4-4 identifies the population and housing units for each of the 14 census blocks included on the Charlotteburg Dam map (Figure 7.3.4-2). There are a total of 910 residents and 324 housing units within the selected census blocks located along the 500 foot wide stream buffer downstream of Charlotteburg Dam.

Table 7.3.4-4
Population and Housing Units for Selected Census Blocks Intersecting the 500-Foot-Wide Stream Buffer Downstream of Charlotteburg Dam
(Source: US Census Bureau – 2000 Population)

Map ID	Block Number	Population	Housing Units
1	9007	0	0
2	3037	0	0
3	9008	0	0
4	3038	0	0
5	3036	3	1
6	3039	0	0
7	3040	0	0
8	3041	0	0
9	3031	0	0
10	3032	43	18
11	3008	67	26
12	3030	0	0
13	9002	0	0
14	9003	797	279

Table 7.3.4-5 identifies the number of acres within each of the 14 census blocks for the four land use categories identified on the Charlotteburg Dam map (Figure 7.3.4-2). The table shows that the "other" land use category has the highest acreage within the selected census blocks, followed by residential and commercial uses.

Table 7.3.4-5
Land Use / Land Cover (in acres) for Selected Census Blocks Intersecting the 500-Foot-Wide Stream Buffer Downstream of Charlotteburg Dam
(Source: NJDEP – Land Use Land Cover)

Map ID	Block Number	Commercial (Acres)	Other (Acres)	Residential (Acres)	Grand Total
1	9007	0.00	26.66	0.00	26.66
2	3037	0.00	122.72	1.42	124.14
3	9008	0.00	6.78	1.07	7.85
4	3038	0.00	8.70	1.38	10.07
5	3036	0.00	21.42	0.85	22.27
6	3039	0.00	1.09	0.00	1.09
7	3040	0.00	3.41	0.00	3.41
8	3041	0.00	13.34	0.00	13.34
9	3031	0.00	18.70	0.00	18.70
10	3032	0.00	369.93	11.72	381.65
11	3008	0.00	788.07	30.38	818.45
12	3030	0.62	32.84	0.00	33.46
13	9002	0.00	14.95	0.00	14.95
14	9003	0.00	706.76	254.92	961.68

Figure 7.3.4-3 is a map of Monksville Dam, which is located along the Pompton River in Ringwood Borough. The map identifies the land use / land cover for the census blocks intersecting a 500 foot wide stream buffer.

Figure 7.3.4-3
Monksville Dam
Land Use / Land Cover for Census Blocks Intersecting a 500 Foot-Wide Buffer
(Source: NJDEP)

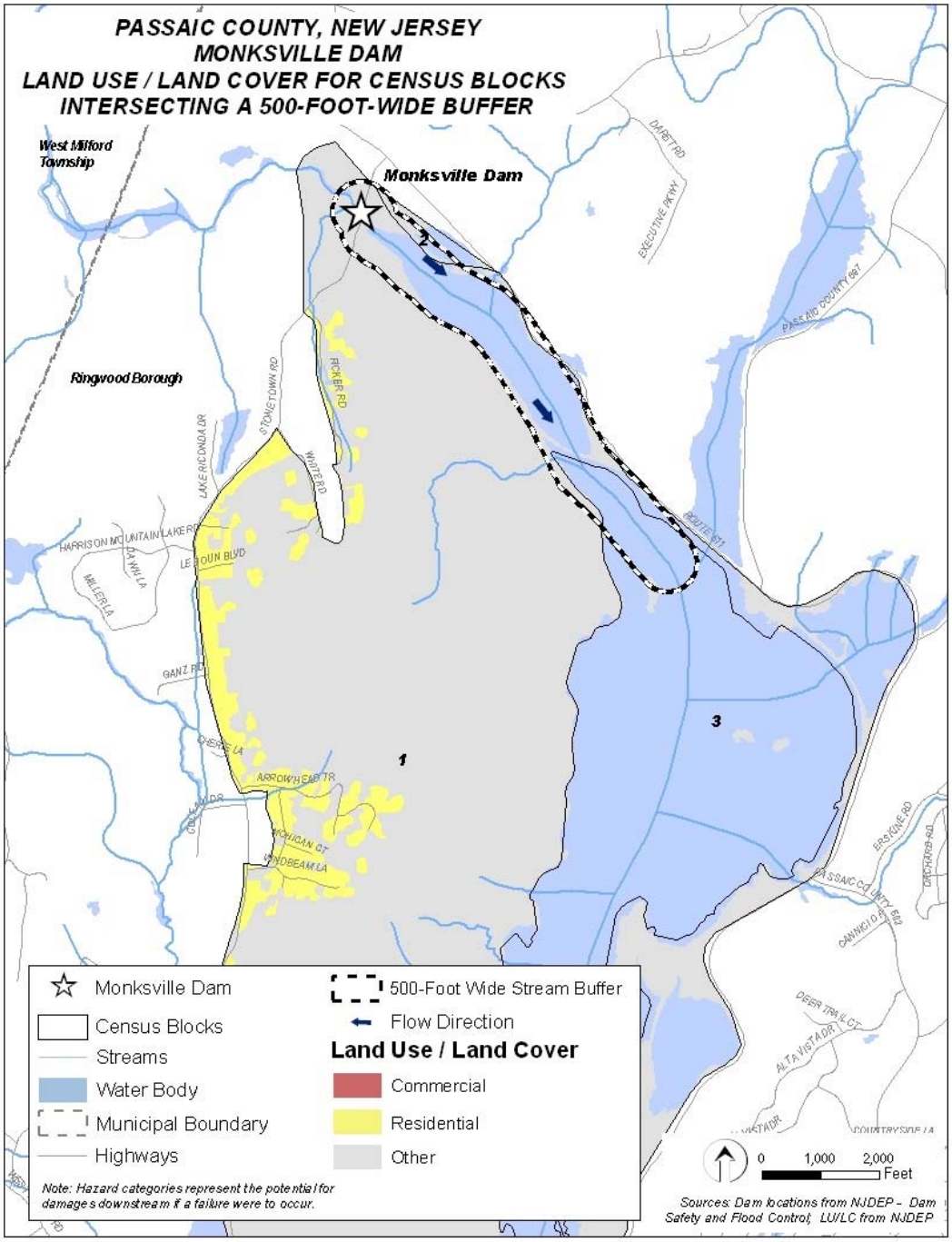

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Table 7.3.4-6 identifies the population and housing units for each of the three census blocks included on the Monksville Dam map (Figure 7.3.4-3). There are a total of 495 residents and 157 housing units within the selected census blocks located along the 500 foot wide stream buffer downstream of Monksville Dam.

Table 7.3.4-6
Population and Housing Units for Selected Census Blocks Intersecting the 500-Foot-Wide Stream Buffer Downstream of Monksville Dam
(Source: US Census Bureau – 2000 Population)

Map ID	Block Number	Population	Housing Units
1	4041	495	157
2	4042	0	0
3	4997	0	0

Table 7.3.4-7 identifies the number of acres within each of the three census blocks for the land use categories identified on the Monksville Dam map (Figure 7.3.4-3). The table shows that the "other" land use category has the highest acreage within the selected census blocks, followed by residential and commercial uses.

Table 7.3.4-7
Land Use / Land Cover (in acres) for Selected Census Blocks Intersecting the 500-Foot-Wide Stream Buffer Downstream of Monksville Dam
(Source: NJDEP – Land Use Land Cover)

Map ID	Block Number	Commercial (Acres)	Other (Acres)	Residential (Acres)	Grand Total
1	4041	3.99	2,353.12	168.87	2,525.99
2	4042	0.00	15.03	0.00	15.03
3	4997	0.00	821.27	0.00	821.27

Figure 7.3.4-4 is a map of Pompton Lakes Dam, which is located along the Ramapo River in Pompton Lakes Borough and Wayne Township. The map identifies the land use / land cover for the census blocks intersecting a 500 foot wide stream buffer.

Figure 7.3.4-4
Pompton Lakes Dam
Land Use / Land Cover for Census Blocks Intersecting a 500 Foot-Wide Buffer
(Source: NJDEP)

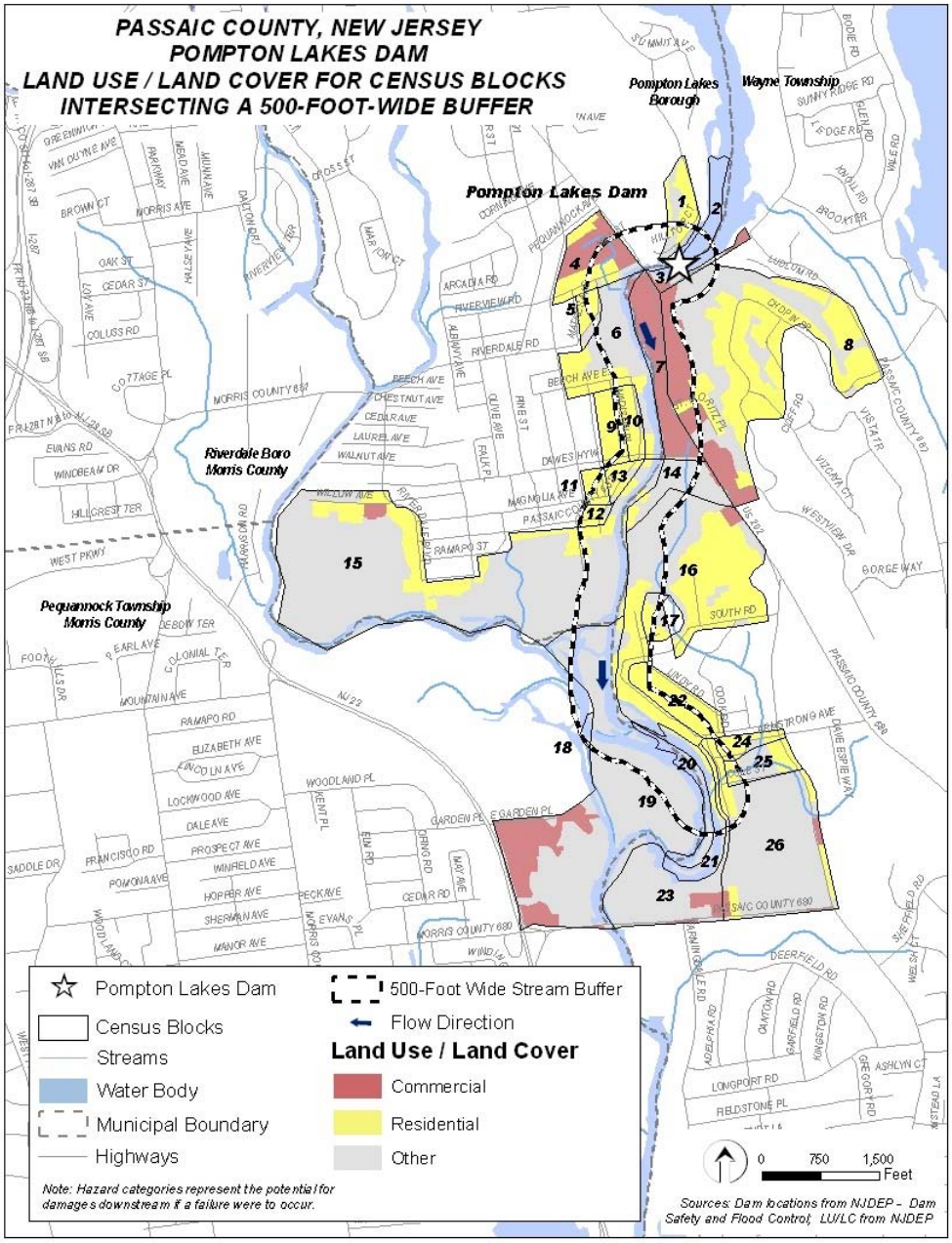

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Table 7.3.4-8 identifies the population and housing units for each of the 26 census blocks included on the Pompton Lakes Dam map (Figure 7.3.4-4). There are a total of 1,680 residents and 585 housing units within the selected census blocks located along the 500 foot wide stream buffer downstream of Pompton Lakes Dam.

Table 7.3.4-8
Population and Housing Units for Selected Census Blocks Intersecting the 500-Foot-Wide Stream Buffer Downstream of Pompton Lakes Dam
(Source: US Census Bureau – 2000 Population)

Map ID	Block Number	Population	Housing Units
1	3011	23	9
2	3998	0	0
3	2013	0	0
4	4002	81	26
5	4001	49	21
6	4000	106	37
7	4000	30	10
8	5000	219	73
9	4012	111	32
10	4013	91	29
11	5006	46	14
12	5008	15	6
13	5007	48	15
14	4001	7	3
15	5000	217	61
16	4002	388	154
17	4003	16	5
18	1998	0	0
19	1000	4	2
20	1999	0	0
21	4999	0	0
22	4010	87	31
23	4015	5	2
24	4012	52	19
25	4013	36	15
26	4014	49	21

Table 7.3.4-9 identifies the number of acres within each of the 26 census blocks for the four land use categories identified on the Pompton Lakes Dam map (Figure 7.3.4-4). The table shows that the "other" land use category has the highest acreage within the selected census blocks, followed by residential and commercial uses.

Table 7.3.4-9
Land Use / Land Cover (in acres) for Selected Census Blocks Intersecting the 500-Foot-Wide Stream Buffer Downstream of Pompton Lakes Dam
(Source: NJDEP – Land Use Land Cover)

Map ID	Block Number	Commercial (Acres)	Other (Acres)	Residential (Acres)	Grand Total
1	3011	0.00	3.75	5.46	9.22
2	3998	0.00	6.14	0.00	6.14
3	2013	1.36	2.44	0.00	3.79
4	4002	8.87	1.08	6.70	16.65
5	4001	0.00	1.03	2.82	3.85
6	4000	0.78	17.55	9.26	27.59
7	4000	15.27	1.08	0.06	16.41
8	5000	16.29	33.73	50.11	100.13
9	4012	0.00	0.00	7.16	7.16
10	4013	0.00	0.51	4.60	5.11
11	5006	0.00	0.02	3.15	3.17
12	5008	0.00	0.30	1.85	2.14
13	5007	0.00	0.43	2.78	3.20
14	4001	0.33	9.14	1.00	10.47
15	5000	1.22	118.67	22.34	142.23
16	4002	1.06	27.20	41.53	69.79
17	4003	0.00	1.87	2.24	4.10
18	1998	0.00	0.90	0.00	0.90
19	1000	16.33	86.58	1.16	104.07
20	1999	0.00	6.53	0.00	6.53
21	4999	0.00	7.95	1.57	9.51
22	4010	0.00	0.00	11.63	11.63
23	4015	2.59	23.25	1.30	27.14
24	4012	0.00	0.60	3.73	4.33
25	4013	0.00	4.32	3.70	8.02
26	4014	1.57	45.65	6.39	16.65

Figure 7.3.4-5 is a map of Raymond Dam, which is located along the Wanaque River in Wanaque Borough. The map identifies the land use / land cover for the census blocks intersecting a 500 foot wide stream buffer.

Figure 7.3.4-5
Raymond Dam
Land Use / Land Cover for Census Blocks Intersecting a 500 Foot-Wide Buffer
(Source: NJDEP)

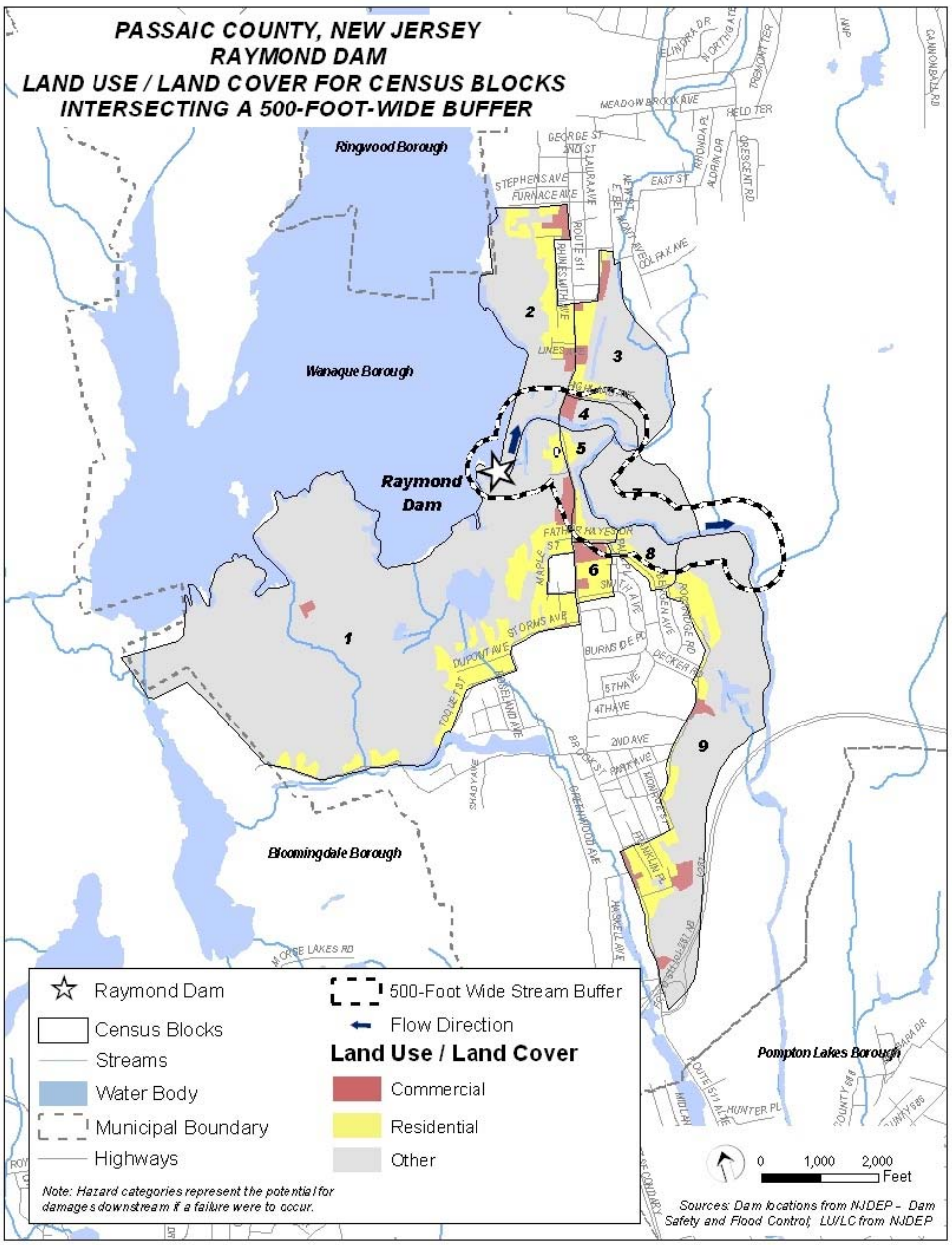

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Table 7.3.4-10 identifies the population and housing units for each of the nine census blocks included on the Raymond Dam map (Figure 7.3.4-5). There are a total of 1,483 residents and 585 housing units within the selected census blocks located along the 500 foot wide stream buffer downstream of Raymond Dam.

Table 7.3.4-10
Population and Housing Units for Selected Census Blocks Intersecting the 500-Foot-Wide Stream Buffer Downstream of Raymond Dam
(Source: US Census Bureau – 2000 Population)

Map ID	Block Number	Population	Housing Units
1	9004	470	171
2	3007	326	119
3	3017	135	64
4	4000	7	3
5	4001	44	22
6	5000	106	41
7	4002	0	0
8	4003	150	68
9	4006	245	91

Table 7.3.4-11 identifies the number of acres within each of the nine census blocks for the four land use categories identified on the Raymond Dam map (Figure 7.3.4-5). The table shows that the "other" land use category has the highest acreage within the selected census blocks, followed by residential and commercial uses.

Table 7.3.4-11
Land Use / Land Cover (in acres) for Selected Census Blocks Intersecting the 500-Foot-Wide Stream Buffer Downstream of Raymond Dam
(Source: NJDEP – Land Use Land Cover)

Map ID	Block Number	Commercial (Acres)	Other (Acres)	Residential (Acres)	Grand Total
1	9004	5.69	490.08	59.90	555.67
2	3007	4.68	70.42	22.69	97.78
3	3017	4.30	57.05	10.50	71.85
4	4000	2.14	12.87	0.00	15.01
5	4001	0.86	13.17	7.65	21.67
6	5000	4.88	0.33	8.71	13.91
7	4002	0.00	49.80	0.00	49.80
8	4003	0.00	10.43	8.13	18.56
9	4006	7.32	148.36	35.93	191.60

Figure 7.3.4-6 is a map of New Street Dam, which is located along Slippery Rock Brook in Woodland Park Borough. The map identifies the land use / land cover for the census blocks intersecting a 500 foot wide stream buffer.

Figure 7.3.4-6
New Street Reservoir Dam
Land Use / Land Cover for Census Blocks Intersecting a 500 Foot-Wide Buffer
(Source: NJDEP)

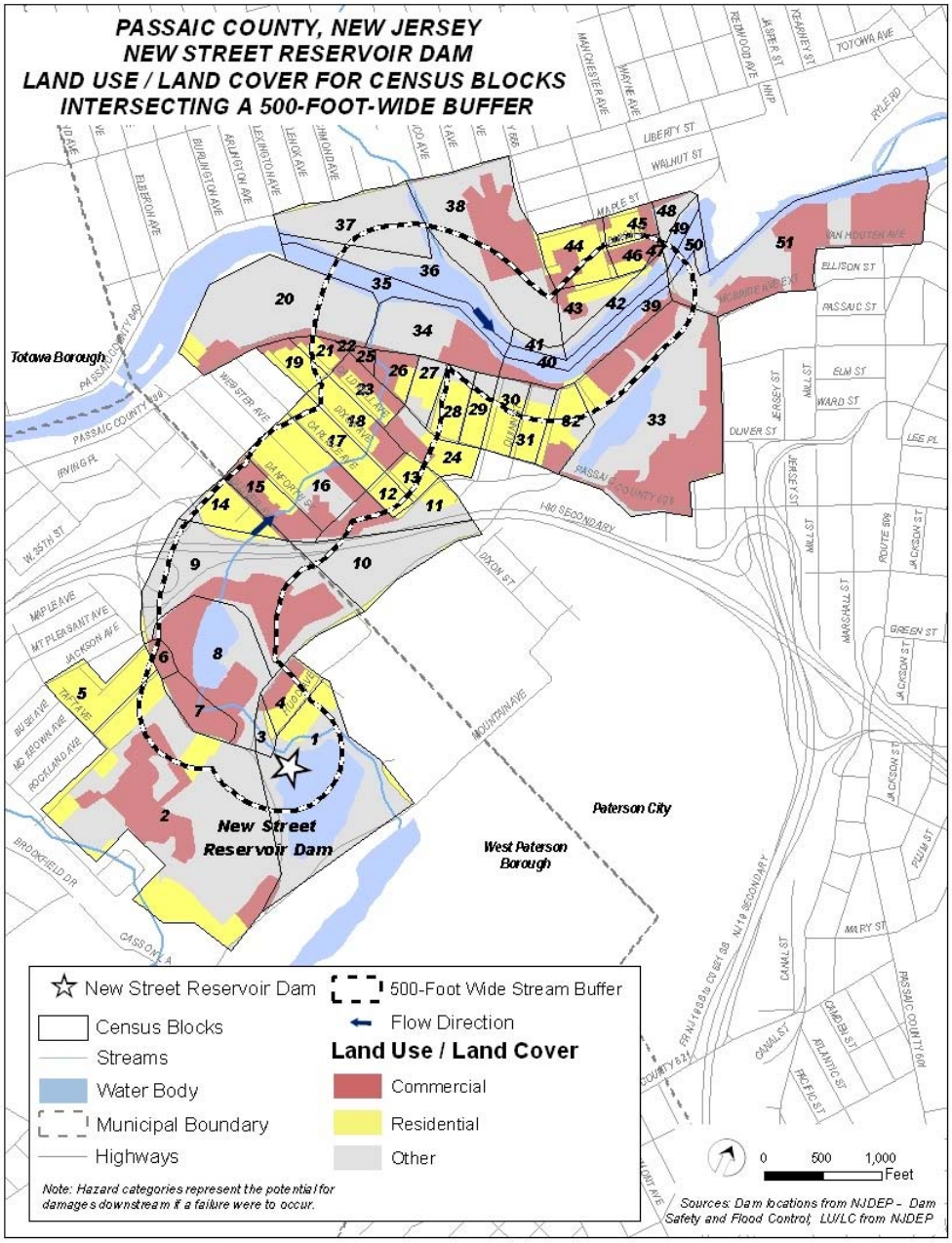


Table 7.3.4-12 identifies the population and housing units for each of the 51 census blocks included on the New Street Reservoir Dam map (Figure 7.3.4-6). There are a total of 4,101 residents and 1,435 housing units within the selected census blocks located along the 500 foot wide stream buffer downstream of New Street Reservoir Dam.

Table 7.3.4-12
Population and Housing Units for Selected Census Blocks Intersecting the 500-Foot-Wide Stream Buffer Downstream of New Street Reservoir Dam
(Source: US Census Bureau – 2000 Population)

Map ID	Block Number	Population	Housing Units
1	1013	41	17
2	9004	140	42
3	1011	0	0
4	1012	9	4
5	1007	157	65
6	1008	0	0
7	1010	0	0
8	1009	3	1
9	1002	9	4
10	2010	0	0
11	2008	61	27
12	2009	63	25
13	2007	53	19
14	2000	44	20
15	3008	168	73
16	3007	297	110
17	3006	197	64
18	3005	167	54
19	4002	96	37
20	3001	53	21
21	4001	45	14
22	4000	7	4
23	3004	216	64
24	2006	157	49
25	3002	33	11
26	3003	51	18
27	1010	93	31
28	1009	110	43
29	1008	110	41
30	1004	165	54
31	1005	186	58
32	1002	113	27
33	1000	87	29
34	3000	127	66
35	3999	0	0
36	3998	0	0
37	3008	0	0

Map ID	Block Number	Population	Housing Units
38	3000	0	0
39	1003	0	0
40	1999	0	0
41	3999	0	0
42	6999	0	0
43	6000	84	26
44	6001	318	70
45	5004	182	49
46	5006	186	44
47	5007	30	7
48	5005	0	0
49	5999	0	0
50	1998	0	0
51	1001	243	147

Table 7.3.4-13 identifies the number of acres within each of the 51 census blocks for the four land use categories identified on the New Street Reservoir Dam map (Figure 7.3.4-6). The table shows that the "other" land use category has the highest acreage within the selected census blocks, followed by commercial and residential uses.

Table 7.3.4-13
Land Use / Land Cover (in acres) for Selected Census Blocks Intersecting the 500-Foot-Wide Stream Buffer Downstream of New Street Reservoir Dam
(Source: NJDEP – Land Use Land Cover)

Map ID	Block Number	Commercial (Acres)	Other (Acres)	Residential (Acres)	Grand Total
1	1013	0.21	25.60	2.82	28.63
2	9004	11.96	32.25	13.05	57.26
3	1011	0.12	1.07	0.25	1.44
4	1012	1.61	0.27	2.26	4.14
5	1007	0.01	0.00	7.15	7.15
6	1008	1.16	0.00	0.07	1.23
7	1010	3.82	0.08	0.15	4.04
8	1009	7.62	8.33	0.00	15.95
9	1002	8.97	18.13	1.19	28.30
10	2010	0.00	11.52	0.39	11.91
11	2008	2.54	3.17	1.40	7.11
12	2009	0.09	0.00	1.65	1.75
13	2007	0.13	0.00	2.19	2.32
14	2000	0.34	0.57	3.85	4.75
15	3008	4.20	0.12	0.98	5.29
16	3007	2.31	2.14	6.59	11.04

Map ID	Block Number	Commercial (Acres)	Other (Acres)	Residential (Acres)	Grand Total
17	3006	0.09	0.00	4.97	5.06
18	3005	1.33	0.00	3.91	5.24
19	4002	0.50	0.00	2.42	2.91
20	3001	2.71	19.24	0.86	22.81
21	4001	0.70	0.00	1.29	1.99
22	4000	0.15	0.00	0.00	0.15
23	3004	1.78	0.00	2.12	3.91
24	2006	1.71	0.64	2.78	5.13
25	3002	0.72	0.00	0.00	0.72
26	3003	1.87	0.02	0.71	2.60
27	1010	0.01	1.50	1.36	2.87
28	1009	0.00	0.91	3.09	4.00
29	1008	0.00	0.78	2.06	2.84
30	1004	0.05	0.91	3.00	3.96
31	1005	0.08	0.72	2.61	3.40
32	1002	1.12	0.95	2.91	4.98
33	1000	17.80	21.37	1.22	40.38
34	3000	3.41	7.44	0.00	10.85
35	3999	0.00	6.35	0.00	6.35
36	3998	0.00	9.79	0.00	9.79
37	3008	0.00	11.46	0.42	11.88
38	3000	8.11	15.61	0.30	24.03
39	1003	1.85	3.59	0.13	5.58
40	1999	0.00	3.09	0.00	3.09
41	3999	0.00	1.12	0.00	1.12
42	6999	0.12	3.30	0.23	3.65
43	6000	0.92	1.35	1.76	4.03
44	6001	1.93	0.00	4.53	6.46
45	5004	0.92	0.06	1.77	2.75
46	5006	1.33	0.00	0.81	2.14
47	5007	0.18	0.00	0.01	0.19
48	5005	0.24	1.52	0.00	1.77
49	5999	0.00	1.55	0.00	1.55
50	1998	0.00	2.06	0.00	2.06
51	1001	15.23	12.25	0.02	**27.50**

7.3.5 Earthquake Risk in Passaic County

As noted in the Hazard Identification and Profiling section, earthquake risk in New Jersey is concentrated in the northern part of the state, including Passaic County. Although the northeastern part of the US is not particularly seismic compared to other areas such as California and Alaska, earthquake risk in New Jersey can be considered moderate because of the extensive built up environment and population density. As part of an ongoing effort to estimate seismic risk in the state, the New Jersey Geologic Survey is using the FEMA HAZUS software to calculate seismic risk for counties in the northern part of the state, including Passaic. The results of these calculations are described in detail in a paper entitled *Earthquake Loss Estimation Study for Passaic County, New Jersey: Geologic Component.*[5]

As described on page 8 (et seq.) of the report, New Jersey Geologic Survey (NJGS) obtained soils, liquefaction susceptibility and landslide susceptibility data through research and field work, and incorporated it into the HAZUS model. Passaic County seismic soil class map is shown in Figure 7.3.5-1, and soil liquefaction susceptibility map in Figure 7.3.5-2 below. In addition to the *Earthquake Loss Estimation Study for Passaic County*, earthquake loss estimates for Passaic County are also summarized from the *HAZUS Multi-Hazard (MH) Estimated Annualized Earthquake Losses for the United States*.

[5] New Jersey Geologic Survey, 2004

Figure 7.3.5-1
Passaic County, New Jersey Seismic Soil Class
(Source: Earthquake Loss Estimation Study for Passaic County, New Jersey: Geologic Component, NJGS, 2004)

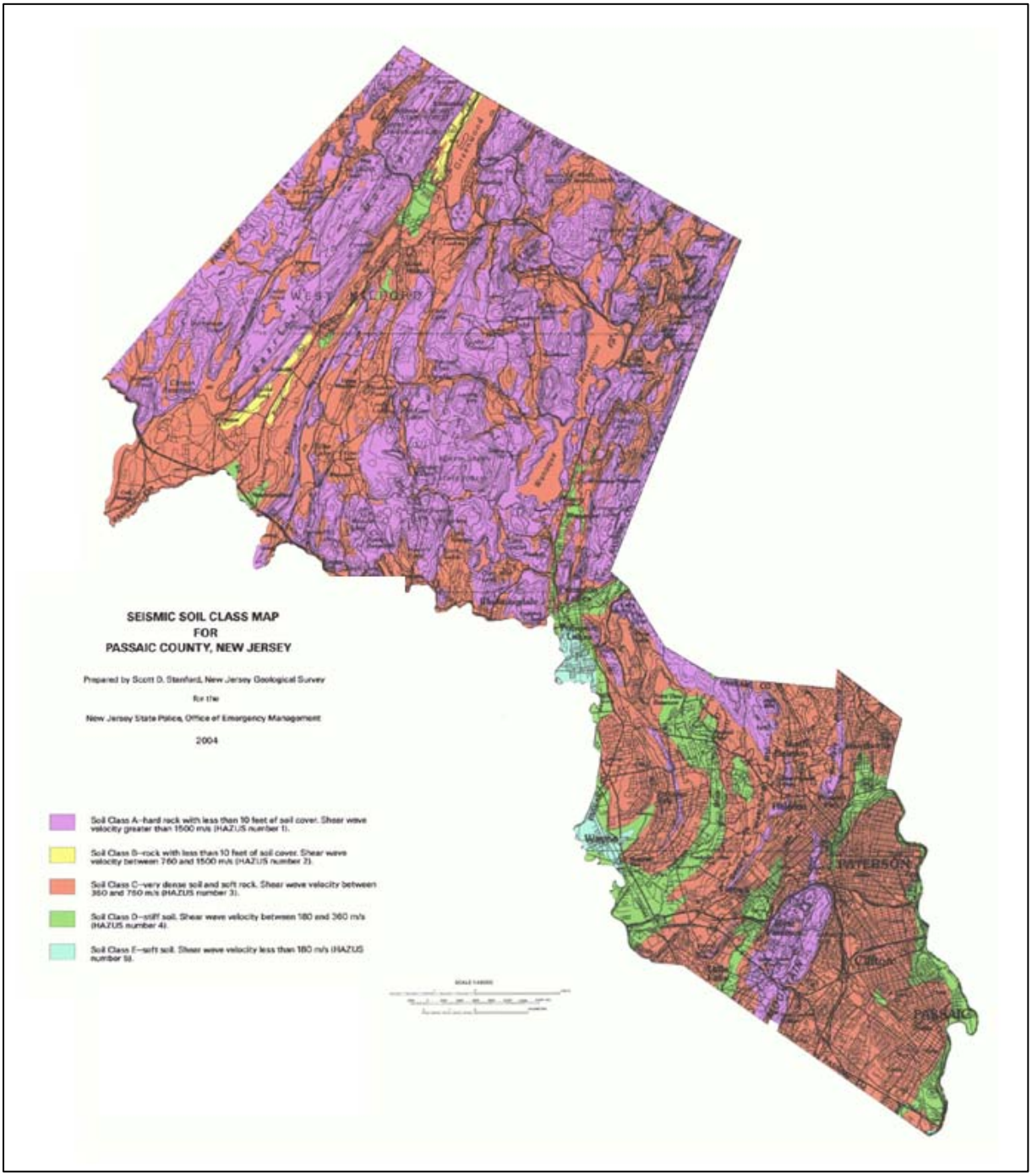
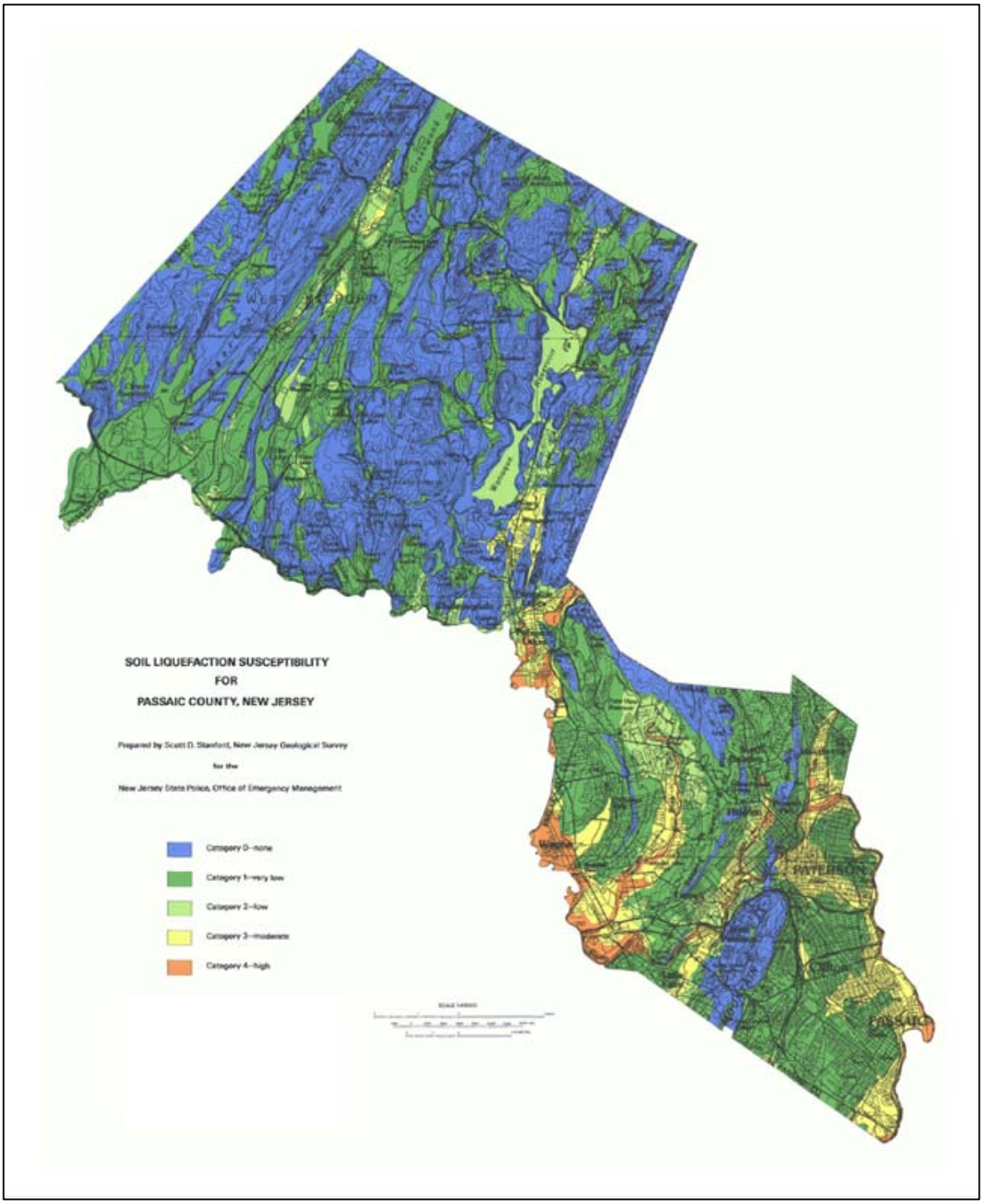


Figure 7.3.5-2
Passaic County, New Jersey Soil Liquefaction Susceptibility
(Source: Earthquake Loss Estimation Study for Passaic County, New Jersey: Geologic Component NJGS, 2004)



The agency completed a total of 12 HAZUS-based simulations, with variations in default and upgraded geology (meaning with and without incorporating data from the field borings and tests), and in liquefaction vs. non-liquefaction. Simulations were based on a range of earthquake magnitudes (Richter 5.0, 5.5, 6.0, 6.5 and 7.0), with resulting deterministic (single scenario) results.

The results of these calculations are shown in Tables 7.3.5-1 through 7.3.5-4, and are discussed in text below. The following table displays the building, contents, and business interruption damages to Passaic County assets (in billions of dollars) for Richter Magnitudes 5.0 through 7.0 with full upgrade geology. HAZUS does not include default data for utility system lifelines and therefore the infrastructure damages were not calculated for underground utilities.

Table 7.3.5-1
Deterministic Earthquake Scenario Damages to Passaic County Assets for Richter Magnitudes 5.0 through 7.0 (full upgrade geology); Range of Potential Monetary Values of Damages to Select Asset Classes (in $ billions)
(Source: Earthquake Loss Estimation Study for Passaic County, New Jersey: Geologic Component, NJGS, 2004)

Damage Type	5.0	5.5	6.0	6.5	7.0
Building Damages	$0.2 – 0.80	$0.6 - 2.40	$1.4 - 5.40	$2.5 - 9.80	$3.9 - 15.60
Contents Damages	$0.0 -0.10	$0.1 - 0.20	$0.1 - 0.40	$0.2 – 0.70	$0.3 - 1.10
Business Interruption	$0.0 - 0.10	$0.1 - 0.30	$0.2 - 0.80	$0.4 - 1.50	$.60 - 2.40
Infrastructure: Lifeline Damage	------	------	------	------	------

The following table displays the potential residential and commercial structures in Passaic County with minor and major damages (in thousands of buildings) for Richter Magnitudes 5.0 through 7.0.

Table 7.3.5-2
Deterministic Earthquake Scenario Damages to Passaic County Assets for Richter Magnitudes 5.0 through 7.0 (full upgrade geology); Potential Numbers of Residential and Commercial Structures with Minor and Major Damages (in thousands of buildings)
(Source: Earthquake Loss Estimation Study for Passaic County, New Jersey: Geologic Component, NJGS, 2004)

Damage Type	5.0	5.5	6.0	6.5	7.0
Residential (minor)	1 - 7	10 - 40	20 - 80	30 - 110	30 -120
Residential (major)	0 - 1	1 - 6	4 - 16	8 - 30	15 - 60
Commercial (minor)	< 1	< 1	0 - 1	0 - 1	0 - 1
Commercial (major)	< 1	< 1	< 1	0 - 1	0 - 1

The following table displays the potential number of casualties in Passaic County by level of severity, for Richter Magnitudes 5.0 through 7.0.

Table 7.3.5-3
Deterministic Earthquake Casualty Estimate for Passaic County for Richter Magnitudes 5.0 through 7.0 (full upgrade geology); Potential Numbers of Casualties by Level of Severity
(Source: Earthquake Loss Estimation Study for Passaic County, New Jersey: Geologic Component, NJGS, 2004)

Casualty Type	5.0	5.5	6.0	6.5	7.0
Level 1 – Medical Aid	130 - 500	400 - 1,700	1,000 - 4,000	2,000 - 8,000	4,000 - 14,000
Level 2 – Hospital Care	40 - 160	120 -500	300 - 1,100	600 - 2,000	1,000 - 4,000
Level 3 – Life Threatening	< 20	20 - 70	40 - 160	80 - 300	160 - 600
Level 4 - Fatalities	10 - 50	30 - 140	80 -300	160 - 600	300 - 1,200

The following table displays the potential displaced households and public shelter requirements (in number of persons) in Passaic County, for Richter Magnitudes 5.0 through 7.0.

Table 7.3.5-4
Deterministic Earthquake Shelter Need Estimates for Passaic County for Richter Magnitudes 5.0 through 7.0 (full upgrade geology); Potential Displaced Households and Public Shelter Requirements, in Numbers of Persons
(Source: Earthquake Loss Estimation Study for Passaic County, New Jersey: Geologic Component, NJGS, 2004)

Shelter Need Category	5.0	5.5	6.0	6.5	7.0
Displaced Households	600 - 2,000	2,000 - 9,000	2,000 - 9,000	11,000 - 45,000	19,000 - 76,000
Public Shelters	130 - 500	600 - 2,000	600 - 2,000	3,000 - 12,000	5,000 - 20,000

Table 7.3.5-5 displays the HAZUS loss estimation results for building damages in Passaic County, for Richter Magnitudes 5.0 through 7.0 with full upgrade geology (see NJGS report). For each earthquake scenario, the table displays the number of buildings with moderate or greater damages, and the percentage of buildings in these damage categories vs. the number of buildings of those specific types in the county. Following this table is a series of maps that display the percent of buildings with moderate or greater damage for each scenario.

Table 7.3.5-5
Moderate or Greater Building Damage Estimates (Count and Percentage) in Passaic County for Richter Magnitudes 5.0 through 7.0 (full upgrade geology)
(Source: Earthquake Loss Estimation Study for Passaic County, New Jersey: Geologic Component, NJGS, 2004)

Building Category	Total Buildings	Scenario 5.0 (Count)	Scenario 5.0 (%)	Scenario 5.5 (Count)	Scenario 5.5 (%)	Scenario 6.0 (Count)	Scenario 6.0 (%)	Scenario 6.5 (Count)	Scenario 6.5 (%)	Scenario 7.0 (Count)	Scenario 7.0 (%)
Agriculture	3	0	0.00%	0	0.00%	1	33.33%	3	100.00%	3	100.00%
Commercial	1,571	54	3.44%	212	13.49%	612	38.96%	1,033	65.75%	1,329	84.60%
Education	4	0	0.00%	0	0.00%	1	25.00%	3	75.00%	4	100.00%
Government	87	1	1.15%	10	11.49%	33	37.93%	58	66.67%	75	86.21%
Industrial	419	14	3.34%	57	13.60%	168	40.10%	283	67.54%	361	86.16%
Religious	77	2	2.60%	11	14.29%	28	36.36%	47	61.04%	60	77.92%
Single Family (Residential)	73,339	1,337	1.82%	6,088	8.30%	17,595	23.99%	33,319	45.43%	47,811	65.19%
Other Residential	24,611	375	1.52%	2,103	8.54%	6,057	24.61%	11,560	46.97%	16,615	67.51%
Total	**100,111**	**1,783**	**1.78%**	**8,481**	**8.47%**	**24,495**	**24.47%**	**46,306**	**46.25%**	**66,258**	**66.18%**

The following is a series of maps that displays the percentage of building damages (moderate or greater) in Passaic County for Richter Scale Magnitudes 5.0 through 7.0.

Figure 7.3.5-3
Passaic County: Richter Magnitude 5.0 Full Geology Upgrade Scenario:
Percent of Buildings with Moderate or Greater Damage
(Source: Earthquake Loss Estimation Study for Passaic County, New Jersey: Geologic Component, NJGS, 2004)

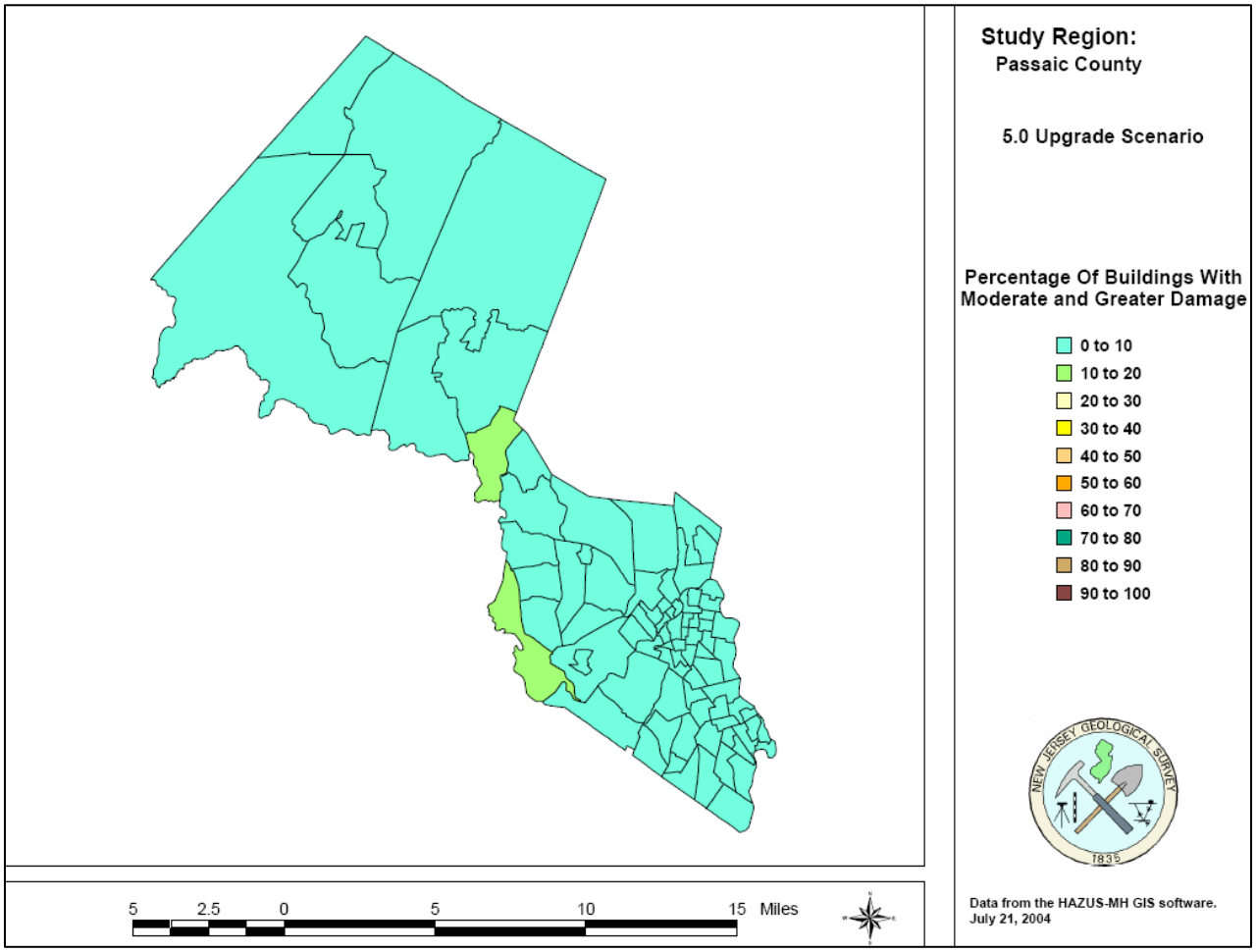


Figure 7.3.5-4
Passaic County: Richter Magnitude 5.5 Full Geology Upgrade Scenario:
Percent of Buildings with Moderate or Greater Damage
(Source: Earthquake Loss Estimation Study for Passaic County, New Jersey: Geologic Component NJGS, 2004)

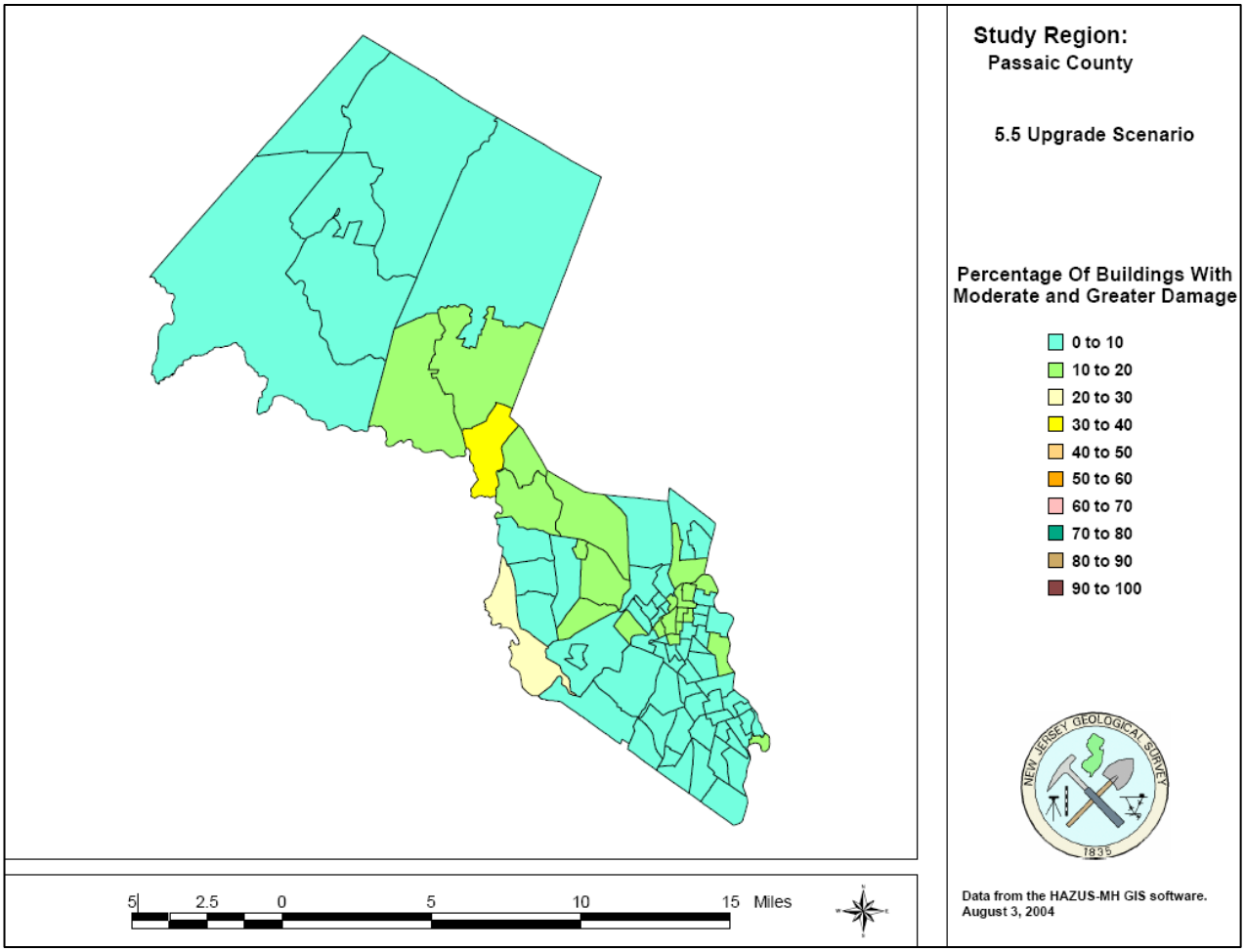


Figure 7.3.5-5
Passaic County: Richter Magnitude 6.0 Full Geology Upgrade Scenario:
Percent of Buildings with Moderate or Greater Damage
(Source: Earthquake Loss Estimation Study for Passaic County, New Jersey: Geologic Component, NJGS, 2004)

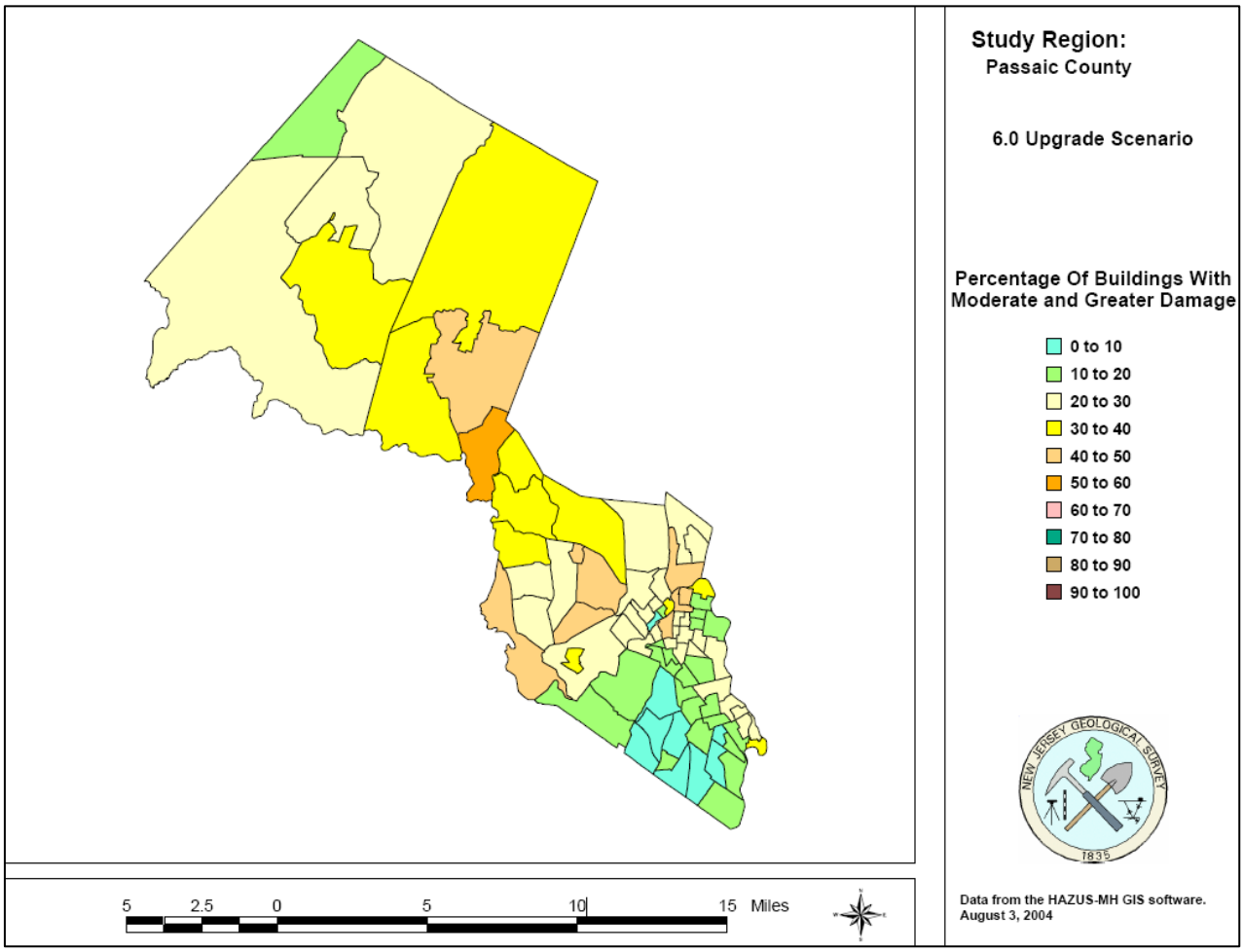


Figure 7.3.5-6
Passaic County: Richter Magnitude 6.5 Full Geology Upgrade Scenario:
Percent of Buildings with Moderate or Greater Damage
(Source: Earthquake Loss Estimation Study for Passaic County, New Jersey: Geologic Component, NJGS, 2004)

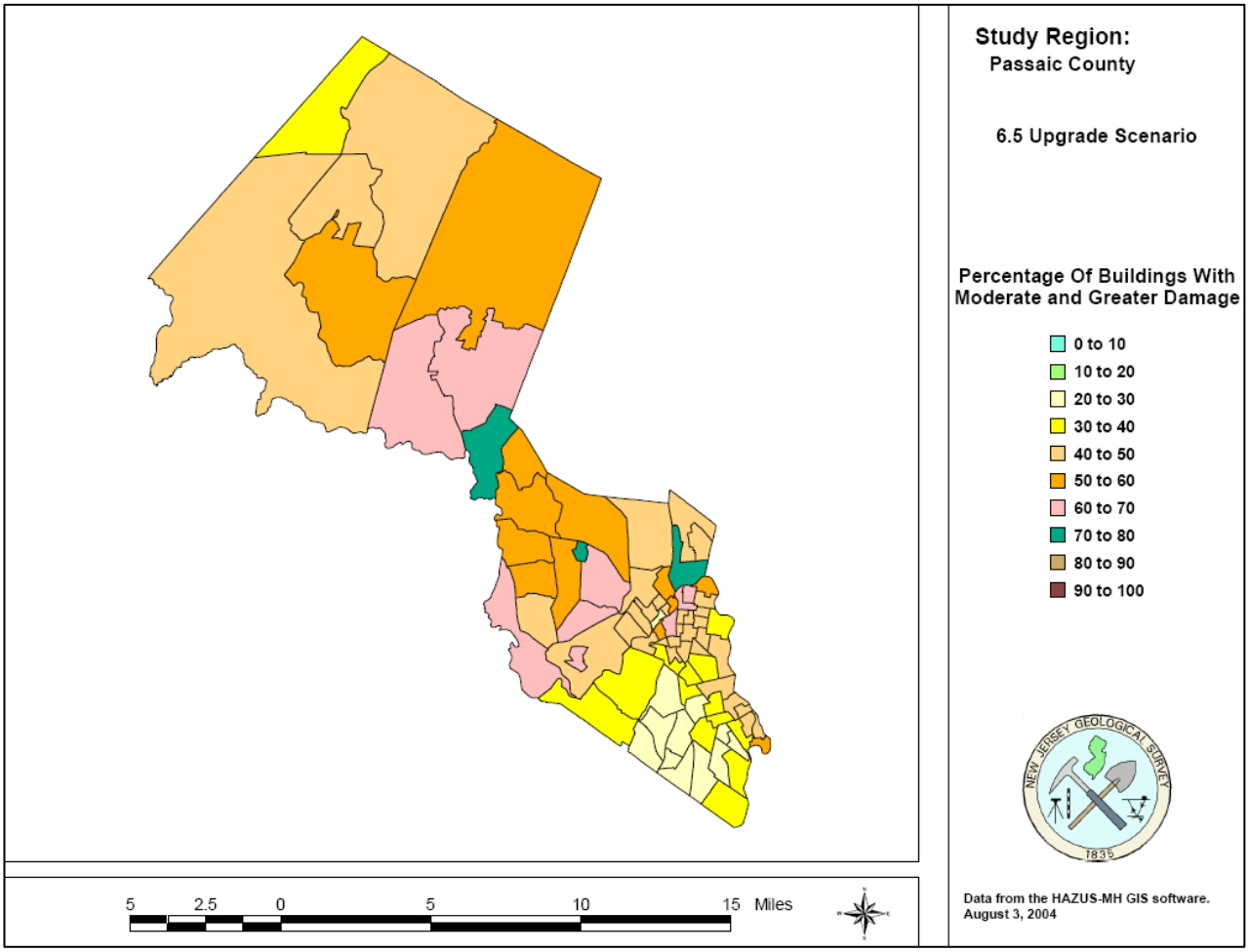
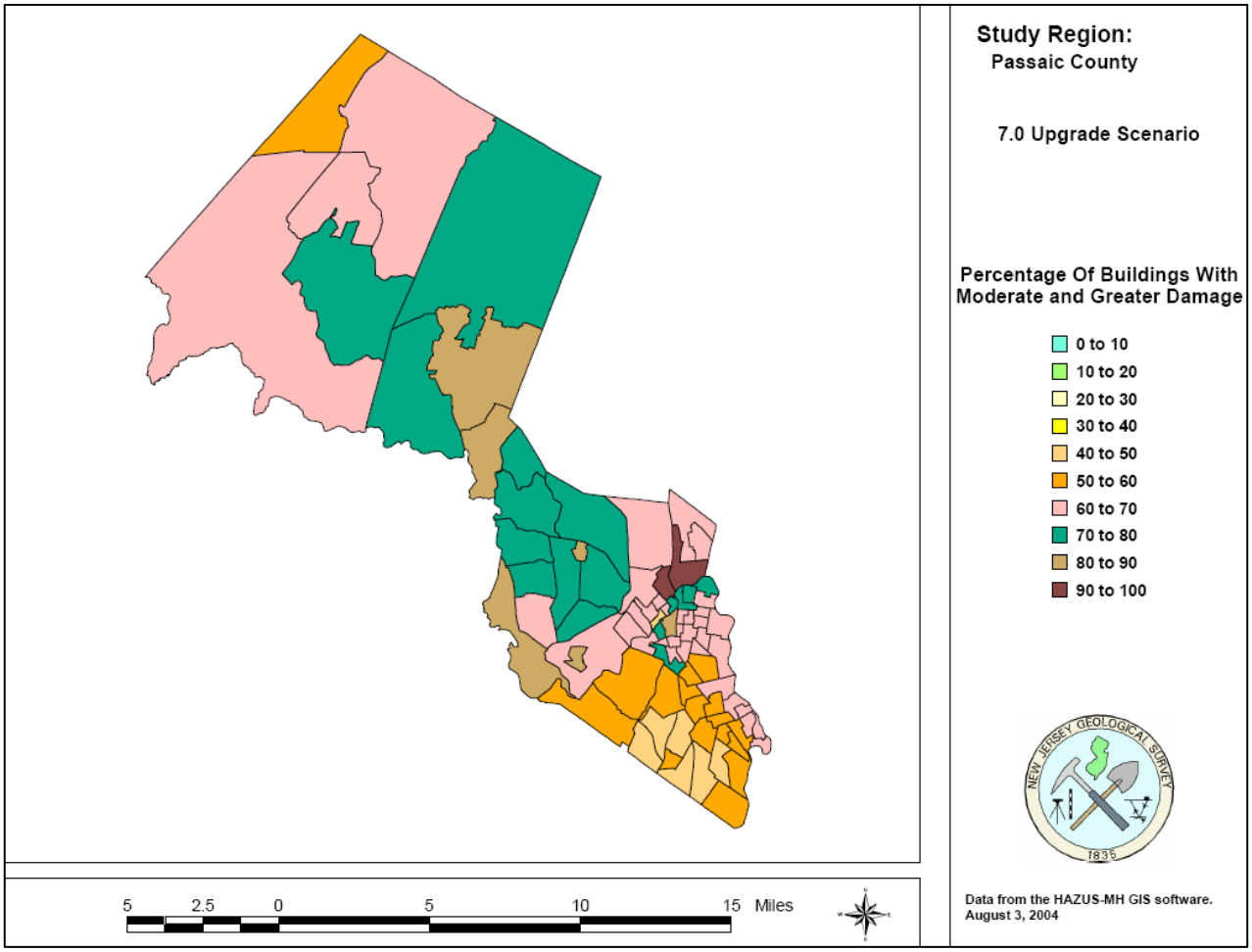


Figure 7.3.5-7
Passaic County: Richter Magnitude 7.0 Full Geology Upgrade Scenario:
Percent of Buildings with Moderate or Greater Damage
(Source: Earthquake Loss Estimation Study for Passaic County, New Jersey: Geologic Component, NJGS, 2004)



Probabilistic Earthquake Risk Estimates

In addition to the deterministic earthquake risk assessments described above, which do not incorporate the probabilities of occurrence for the various scenarios, this section also includes probability-based risk estimates that were performed using the FEMA Full-Data Earthquake Benefit-Cost Analysis Module. Calculations were performed for two general asset classes: residential and non-residential. The non-residential class includes industrial, commercial, government, education and religious assets. As was the case with the hurricane wind risk calculations in a previous section, data regarding the square footage of these various assets was obtained through the HAZUS software. Note that the non-residential asset class of agriculture was not included in these calculations because of the assumed relatively low occupancy of such assets, and the difficulty of assigning a specific structural type to buildings.

Methodology

The FEMA Earthquake BCA software includes default shake data based on ZIP code. ZIP code 07442 was used for this analysis, as it was with the wind calculations, because of its fairly central location in the county. Table 7.3.5-6 shows the default annual probabilities for various levels of ground shaking, expressed as percent ground acceleration (PGA, a percentage of G [gravity]).

Table 7.3.5-6
Earthquake Shake Probabilities for Central Point in Passaic County, New Jersey
(Source: FEMA Full Data Earthquake BCA software default)

Level One Data

Seismic Hazard Wizard

Data Source	The user performed a hazard data look up with the provided USGS hazard data set. The user provided zipcode (07442). The geographic center for that zipcode has coordinates (lon \ lat) -74.29 \ 41.00. Data was found for those coordinates. Identifying data for coordinates returned include: Post Office Name: RIVERDALE
Site Soil Type	Class D: Stiff soil V(30) 180 - 360 m/sec

Seismic Hazard Curve

PGA (%g)	4 - 8	8 - 16	16 - 32	32 - 55	55 - 80	80 - 100	> 100
Annual Probability	0.029743196	0.003619	0.00081202	0.000289685	5.66814E-05	8.50924E-06	2.62297E-06

Risk to Residential Assets and People

The shake data is used in combination with information about the value, occupancy and seismic performance of the asset, to calculate annual and long-term risk. Specific residential building and occupancy parameters are summarized in Table 7.3.5-7 below.

Table 7.3.5-7
Select Data Parameters for Passaic County Earthquake Risk Estimate (Residential Assets)
(Source: FEMA Full Data Earthquake BCA software, HAZUS)

Data Type	Value	Note
Residential building type	Wood, light frame	FEMA BCA default W1
Residential structure replacement value	$125/s.f.	Estimated
Residential contents replacement value	$41.66/s.f.	FEMA default %
Displacement monthly rental cost	$1.00/s.f.	FEMA default
One time displacement cost	$1.00/s.f.	Estimated
Occupancy load	2.5 per 1,000/s.f.	Derived from census/HAZUS

These data are used in the FEMA BCA software module to calculate risk for residential assets. The following two figures show scenario damages to buildings and contents, and displacement costs, by level of shaking. The level of shaking is expressed in percent ground acceleration. The figures do not yet incorporate probabilities.

Table 7.3.5-8
Scenario Building and Contents Damages, and Displacement Costs, by Level of Shaking (pga),
Residential Assets
(Source: FEMA Full Data Earthquake BCA software)

SCENARIO DAMAGES BEFORE-MITIGATION ($ per event)							
PGA (% g)	Building Damages	Contents Damages	Displacement Costs	Business Losses	Rental Losses	Public/ Nonprofit	Total
4 - 8	$11,250	$0	$0	$0	$0	$0	$11,250
8 - 16	$133,750	$0	$0	$0	$0	$0	$133,750
16 - 32	$745,000	$2	$0	$0	$0	$0	$745,002
32 - 55	$2,178,750	$7	$400,003	$0	$0	$0	$2,578,760
55 - 80	$4,105,000	$14	$900,008	$0	$0	$0	$5,005,022
80 - 100	$5,772,500	$19	$1,200,011	$0	$0	$0	$6,972,530
> 100	$12,500,000	$25	$1,400,013	$0	$0	$0	$13,900,038

(1) Note: Figures are per 100,000 square feet of building area

Table 7.3.5-9 shows similar data related to casualties by level of shaking. The group of columns labeled *Scenario* shows the numbers of expected casualties by magnitude, as related to level of shaking (pga). The group of columns labeled *Expected Annual* shows the annual numbers of expected casualties by magnitude, as related to level of shaking (pga).

Table 7.3.5-9
Scenario Injuries and Deaths by Level of Shaking (pga), *Residential Assets*
(Source: FEMA Full Data Earthquake BCA software)

CASUALTIES BEFORE-MITIGATION (number)							
PGA	Building	SCENARIO			EXPECTED ANNUAL		
(%g)	SDF (%)	Minor	Major	Deaths	Minor	Major	Deaths
4 - 8	0.09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
8 - 16	1.07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
16 - 32	5.96	1.25E+00	5.00E-01	2.50E-01	1.02E-03	4.06E-04	2.03E-04
32 - 55	17.43	6.75E+00	4.25E+00	2.00E+00	1.96E-03	1.23E-03	5.79E-04
55 - 80	32.84	1.88E+01	1.48E+01	7.25E+00	1.06E-03	8.36E-04	4.11E-04
80 - 100	46.18	3.20E+01	2.75E+01	1.35E+01	2.72E-04	2.34E-04	1.15E-04
> 100	60.75	4.83E+01	4.38E+01	2.18E+01	1.27E-04	1.15E-04	5.70E-05
				Totals:	4.43E-03	2.82E-03	1.37E-03

(1)Figures are per 100,000 square feet of building area

Risk to Non-Residential Assets, Operations and People

This subsection addresses estimated earthquake risk to non-residential assets, operations and people. As noted earlier, non-residential assets were combined into a single category in order to simplify the analysis. Basic data parameters are provided in the table below.

Table 7.3.5-10
Select Data Parameters for Passaic County Earthquake Risk Estimate *(Non-residential Assets)*
(Source: FEMA Full Data Earthquake BCA software, HAZUS)

Data Type	Value	Note
Non-residential building type	Steel frame/unreinforced masonry	Average of types
Non-residential structure replacement value	$140/s.f.	Estimated
Non-residential contents replacement value	$140/s.f.	Estimated
Displacement monthly rental cost	$1.00/s.f.	FEMA default
One time displacement cost	$1.00/s.f.	Estimated
Occupancy load	10 per 1,000/s.f.	Derived from census/HAZUS

These data are used in the FEMA BCA software module to calculate risk for non-residential assets. The following two figures show scenario damages to buildings and contents, displacement costs and operational business losses, by level of shaking. The level of shaking is expressed in percent ground acceleration (pga). The figures do not yet incorporate probabilities. Note that in order to streamline the analysis, public and non-profit losses were not separately calculated; when facility-specific calculations are required, the FEMA BCA software requires inputs for annual budgets of public and non-profit operations, which must be determined on an individual basis.

Table 7.3.5-11
Scenario Building and Contents Damages, and Displacement Costs, by Level of Shaking (pga),
Non-Residential Assets
(Source: FEMA Full Data Earthquake BCA software)

	SCENARIO DAMAGES BEFORE-MITIGATION ($ per event)						
PGA (% g)	Building Damages	Contents Damages	Displacement Costs	Business Losses	Rental Losses	Public/ Nonprofit	Total
4 - 8	$228,200	$228,200	$0	$5,556	$0	$0	$461,956
8 - 16	$1,456,000	$1,456,000	$300,002	$27,778	$0	$0	$3,239,780
16 - 32	$4,902,800	$4,902,800	$900,008	$83,333	$0	$0	$10,788,941
32 - 55	$14,000,000	$9,150,400	$1,400,013	$83,333	$0	$0	$24,633,746
55 - 80	$14,000,000	$11,765,600	$1,400,013	$83,333	$0	$0	$27,248,946
80 - 100	$14,000,000	$12,870,200	$1,400,013	$83,333	$0	$0	$28,353,546
> 100	$14,000,000	$13,510,000	$1,400,013	$83,333	$0	$0	$28,993,346

(1) Figures are per 100,000 square feet of building area

Table 7.3.5-12 shows similar data related to casualties by level of shaking. The group of columns labeled *Scenario* shows the numbers of expected casualties by magnitude, as related to level of shaking (pga). The group of columns labeled *Expected Annual* shows the annual numbers of expected casualties by magnitude, as related to level of shaking (pga).

Table 7.3.5-12
Scenario Injuries and Deaths by Level of Shaking (pga), *Non-residential Assets*
(Source: FEMA Full Data Earthquake BCA software)

CASUALTIES BEFORE-MITIGATION (number)							
PGA	Building	SCENARIO			EXPECTED ANNUAL		
(%g)	SDF (%)	Minor	Major	Deaths	Minor	Major	Deaths
4 - 8	1.63	4.33E-01	0.00E+00	0.00E+00	1.29E-02	0.00E+00	0.00E+00
8 - 16	10.40	6.93E+00	3.90E+00	1.73E+00	2.51E-02	1.41E-02	6.27E-03
16 - 32	35.02	3.73E+01	2.95E+01	1.43E+01	3.03E-02	2.39E-02	1.16E-02
32 - 55	65.36	9.23E+01	8.41E+01	4.16E+01	2.67E-02	2.44E-02	1.21E-02
55 - 80	84.04	1.33E+02	1.28E+02	6.41E+01	7.57E-03	7.27E-03	3.64E-03
80 - 100	91.93	1.53E+02	1.50E+02	7.45E+01	1.30E-03	1.27E-03	6.34E-04
> 100	96.50	1.64E+02	1.63E+02	8.15E+01	4.31E-04	4.26E-04	2.14E-04
				Totals:	1.04E-01	7.14E-02	3.44E-02

(1) Figures are per 100,000 square feet of building area

Earthquake Risk Estimates to Residential and Non-Residential Assets

Tables 7.3.5-13 and 7.3.5-14 summarize earthquake risk to Passaic County assets, operations and people. It must be noted that these calculations are based on broad estimates of building types, occupancies and soil characteristics. Northern New Jersey has a moderate degree of known earthquake risk that is related to both the presence of faults and the amounts of built environment and people. In many cases, particularly where critical facilities are involved, jurisdictions should initiate limited studies of these facilities in order to identify on a site-specific basis where there are significant risks from earthquakes. The information in this section should be used for planning purposes only, i.e. as the basis for additional steps in risk assessment, and eventually (where warranted) targeted mitigation actions to reduce the risk.

Table 7.3.5-13
Summary of Estimated Earthquake Risk to Passaic County Assets and Operations
(Source: FEMA Full Data Earthquake BCA software)

Asset Category	Building	Contents	Displacement	Business Loss	Total
Residential	$58,215,182	$0	$4,440,739	$0	$62,655,921
Non-residential	$121,622,338	$112,707,593	$13,391,763	$2,099,374	$249,821,068
Total	**$179,837,520**	**$112,707,593**	**$17,832,502**	**$2,099,374**	**$312,476,989**

Table 7.3.5-14
Estimated Casualty-Related Earthquake Risk in Passaic County
(Source: FEMA Full Data Earthquake BCA software)

Asset Type	Residential			Non-Residential		
Magnitude	**Minor**	**Major**	**Death**	**Minor**	**Major**	**Death**
Rate per 100K s.f.	0.00443	0.00282	0.00137	0.104	0.0714	0.0344
Passaic	$91,535	$97,114	$7,076,944	$505,502	$578,411	$41,801,160

HAZUS Earthquake Loss Estimates in Passaic County

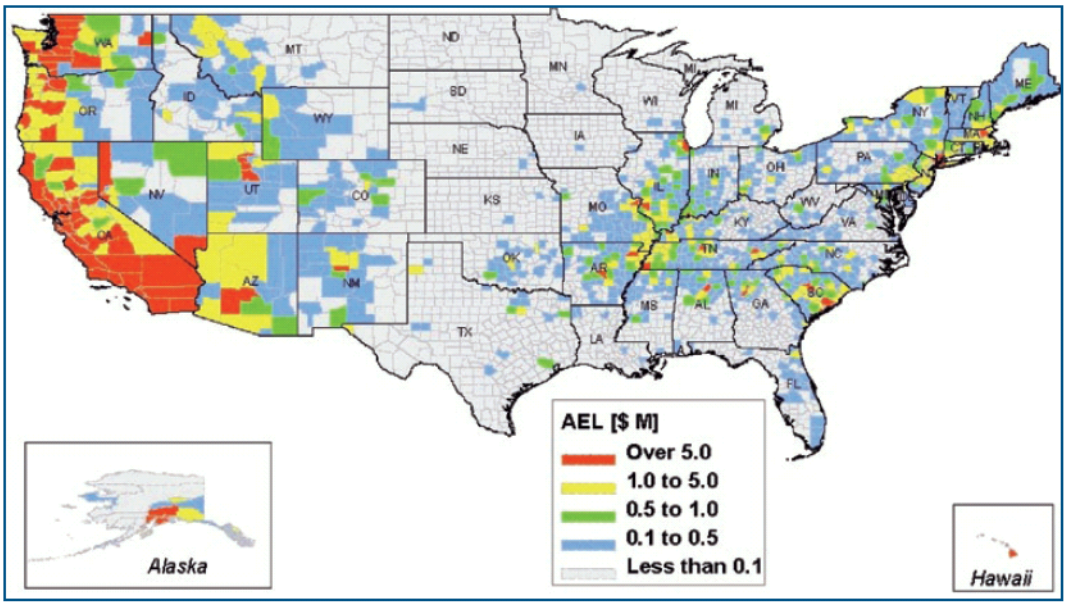
In addition to analyzing the *Earthquake Loss Estimation Study for Passaic County*, earthquake loss estimates for the County were also estimated from the FEMA document titled, *HAZUS Multi-Hazard (MH) Estimated Annualized Earthquake Losses for the United States.* This document, produced in April 2008, provides annualized earthquake loss estimates at the national, regional, State, and County levels. The study highlights the impacts of both high risk and high exposure on losses caused by earthquakes. It is based on loss estimates generated by HAZUS-MH, a geographic information system (GIS)-based earthquake loss estimation tool developed by FEMA in cooperation with the National Institute of Building Sciences (NIBS). The HAZUS tool provides a method for quantifying future earthquake losses[6].

To calculate the earthquake loss estimates the building replacement value of the building inventory was estimated. The estimated replacement value was based on the structural building value only and did not include the land or building contents. The study estimated that the building inventory replacement value for most Counties in New Jersey, including Passaic, was between $10 and $50 billion.

The results of the study indicated that New Jersey has a relatively low hazard risk with a high building inventory in comparison to the rest of the nation. The study results shows that New Jersey ranks 14th nationally in estimated annual earthquake losses with $39.7 million in annual losses. As shown in Figure 7.3.5-8, the annual estimated earthquake losses for counties in northern New Jersey, including Passaic County, were estimated from $1 to $5 million.

[6] FEMA *HAZUS Multi-Hazard (MH) Estimated Annualized Earthquake Losses for the United States*

Figure 7.3.5-8
Annual Earthquake Losses (AEL)
(Source: HAZUS Multi-Hazard (MH)
Estimated Annualized Earthquake Losses for the United States, April, 2008)



7.4 Passaic County Critical Facilities Risk Assessment

Although not a specific requirement for mitigation plans, risk assessments for critical facilities are an important element in developing and prioritizing mitigation actions. At the time this Plan was drafted and approved by the State of New Jersey and FEMA, there was only a limited amount of information available to complete risk assessments for critical facilities in Passaic County. This subsection describes the information required to complete risk assessments.

FEMA does not prescribe a definition of critical facilities. Generally speaking, critical facilities are those assets and operations that are essential to a jurisdiction maintaining functionality, especially during and after emergencies or significant natural hazard events. There is a range of facilities that can be categorized as critical, including

- Police and fire facilities
- Emergency operations centers
- Water and wastewater treatment plants
- Shelters
- Hospitals (in particular, trauma centers)
- Communications facilities and infrastructure
- Key infrastructure, such as bridges and roads
- Lifelines, in particular utility lines (water, electricity, gas)

Risk assessments typically contemplate three general categories of potential losses: (1) direct damage to structure and contents; (2) loss of function; and, (3) injuries and deaths. There are well-established procedures for calculating these types of risks as they relate to critical facilities. All of these procedures require information about the facilities to facilitate a vulnerability calculation, and then a risk assessment that quantifies potential future losses. Although it is not necessary to have all of the data points listed below, it is highly recommended that jurisdictions attempt to secure as much of the information as possible so that the risk assessment will fully capture all potential risks. Note that all of this information is used in conjunction with data about natural hazards (probability and severity) to calculate risk; this subsection deals only with information related to the facilities. This is a general list of information that should be gathered – note that not all of these data points apply to all critical facilities. For example, it is not necessary to gather the square footage of a bridge or water line.

- Use of the facility
- Location, in particular with respect to natural hazards, and preferably with latitude/longitude
- Size of the facility (for buildings, in square feet)
- Replacement value of the asset (can usually be obtained through open sources)
- Description and replacement value of contents (can usually be obtained through open sources)
- Structure type (for buildings, preferably in conformance with FEMA HAZUS descriptors)
- Elevation (above mean sea level)
- Occupancy (i.e. number of people, preferably by time of day)
- Annual budget of the operation
- Cost of securing similar alternative facilities (not critical information)
- Volume of service provided (applies to lifelines and transportation infrastructure)
- Number in community served by the facility or operation
- Any history of losses related to natural hazards (direct damages, loss of function)
- Any existing engineering or vulnerability studies
- Photographs of the facilities and surrounding area

The present subsection is not intended to provide an explanation of how to complete a vulnerability or risk assessment. The information listed here is the basic data required to complete a risk assessment. FEMA has an extensive suite of software and guidance that can be used for this purpose, including the 386-series of mitigation planning guides, in particular publication 386-2 *Understanding Your Risks: Identifying Hazards and Estimating Losses* (fema.gov/library, then use search engine). All of the benefit-cost analysis software and technical manuals are also available through FEMA.

The risk assessment is an essential first step in the process of identifying sites where additional study may be warranted and/or where efforts should be focused on developing mitigation actions. After developing a risk profile for a critical facility (i.e., a calculation of expected future losses from various hazards), potential losses can be readily compared to provide a picture of which combinations of vulnerability and hazards appear to be the most significant. Once this is known, there are several potential next steps:

- No action: If risks are relatively small in an absolute sense, or in comparison to other facilities, the results of the assessment can be used as a way to assign low priority to any mitigation actions, including additional study and specific projects.
- Further study: The risk assessment will show the source of potential future damages and losses, although in some cases not in enough detail to identify specific vulnerabilities. The risk calculation will inform decisions about the need for additional study, which will in turn lead to the development of mitigation actions. Such studies are nearly always completed by engineers or architects, with experience and technical knowledge related to the performance of building and infrastructure components. It is also important to understand the expected performance of any mitigation projects in reducing risk–this should be a part of any vulnerability study. It is also important to understand the costs of any mitigation projects that may be indicated, so that (if a particular project is part of a grant application) its costs can be compared to the risks (and effectiveness–as above) to determine if it merits funding.
- Develop mitigation alternatives: In cases in which vulnerabilities are obvious based on the risk assessment and other empirical knowledge of an asset or site (including existing local knowledge or engineering studies), it may be possible for a jurisdiction to bypass any additional vulnerability studies, and proceed to the process of developing mitigation alternatives for high-priority sites. These can partially be identified through the risk assessment process, which quantifies potential damages and allows comparisons. In cases where specific vulnerabilities are well understood, it is possible to develop basic specifications for mitigation projects, then to compare their effectiveness and costs to the results of the risk assessment. This is the most important use of the risk assessment data, outside the process of selecting sites for study.

It is not possible in the context of a hazard mitigation plan to discuss all potential mitigation projects, because there is a very large number of them, and because they have widely varying effectiveness and costs. The risk assessment process is an essential first step in identifying sites that merit additional study, and in making valid comparisons of cost savings among different assets and mitigation projects.

It is important to note that the participating municipalities in Passaic County have made substantial progress in identifying and gathering information about their critical facilities. Appendix E contains an excerpt of the information that has already been gathered as part of the development of this Plan. This information was important in helping some of the participating municipalities identify candidate mitigation projects in this Plan and it is expected that improving the quality and quantity of data regarding these facilities will result in the identification of additional viable projects as part of subsequent plan updates.

7.5 Passaic County Future Development Trends

This subsection of the Passaic County HMP identifies areas in the county that may have potential for development, particularly in floodplains. Areas of potential development have been identified by compiling spatial data from several statewide planning-related documents, then using a GIS-based (Geographic Information System) process to remove areas that are either already developed, or are unlikely to be developed because of land use restrictions, especially statewide policies.

The main sources of data for this process were the New Jersey State Development and Redevelopment Plan (NJDRP), the New Jersey Department of Environmental Protection, and the New Jersey Department of Community Affairs - Office of Smart Growth. The planning team secured GIS-based data sets from each of these sources, with the purpose of identifying areas that are appropriate and inappropriate for development, according to various land planning and environmental protection standards.

The NJDRP establishes five *Planning Areas* that are used to apply statewide policies to both natural and built resources. In order to ensure consistency with statewide land planning designations (and because there is presently no statewide land use or zoning database), the Passaic County HMPC determined that these Planning Areas should be used as a general basis for describing existing land uses and identifying areas with potential for development.

There are five Planning Area designations. These five Planning Areas are large masses of land (more than one square mile in extent) that share a common set of conditions such as population density, infrastructure systems, level of development or natural systems. The Planning Areas reflect distinct geographic and economic units within the State and serve as an organizing framework for application of the statewide Policies of the State Plan.

- Metropolitan Planning Area (Planning Area 1) Provides for much of the State's future redevelopment. Revitalize cities and towns; promote growth in compact forms; stabilize older suburbs; redesign areas of sprawl; and protect the character of existing stable communities.
- Suburban Planning Area (Planning Area 2) Provides for much of the State's future development. Promote growth in Centers and other compact forms; protect the character of existing stable communities; protect natural resources; redesign areas of sprawl; reverse the current trend toward further sprawl; and revitalize cities and towns.
- Fringe Planning Area (Planning Area 3) Accommodate growth in Centers; protect the environs primarily as open lands; revitalize cities and towns; protect the character of existing stable communities; protect natural resources; provide a buffer between more developed Metropolitan and Suburban Planning Areas and less developed Rural and Environmentally Sensitive Planning Areas; and confine programmed sewers and public water services to Centers.
- Rural Planning Area and Rural/Environmentally Sensitive Planning Area (Planning Area 4) Maintain the environs as large contiguous areas of farmland and other lands; revitalize cities and towns; accommodate growth in Centers; promote a viable agricultural industry; protect the character of existing stable communities; and confine programmed sewers and public water services to Centers.
- Environmentally Sensitive Planning Area and Environmentally Sensitive/Barrier Islands Planning Area (Planning Area 5) Protect environmental resources through the protection of large contiguous areas of land; accommodate growth in Centers; protect the character of existing stable communities; confine programmed sewers and public water services to Centers; and revitalize cities and towns.[7]

[7] 2001 State Development and Redevelopment Plan

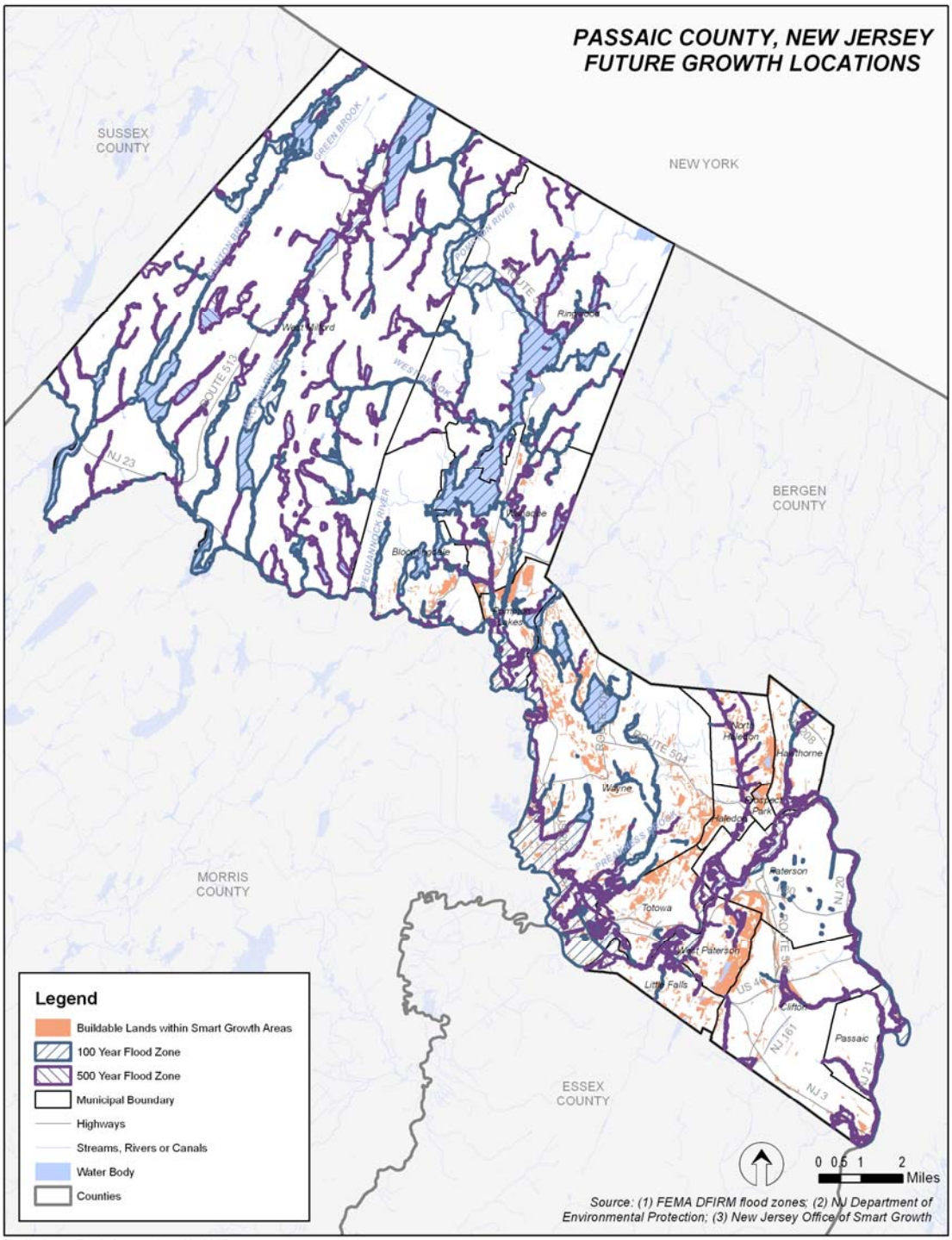
The State Development and Redevelopment Plan (NJDRP) indicates that Planning Area designations 1 and 2 are most appropriate for development, although in some limited circumstances the other areas may also be considered appropriate. This section of the county hazard mitigation plan does not include a detailed discussion of the criteria used in the NJDRP, but planners and local officials can review the latter Plan on the web at http://www.state.nj.us/dca/osg/plan/.

The NJDRP is supported by the identification of Smart Growth areas. Smart Growth is the term used to describe well-planned, well-managed growth that adds new homes and creates new jobs, while preserving open space, farmland, and environmental resources. Smart Growth supports livable neighborhoods with a variety of housing types, price ranges and multi-modal forms of transportation. The Smart Growth Areas were created to help implement the goals of the New Jersey State Plan (Source: NJ Department of Community Affairs - Office of Smart Growth).

The boundaries of the smart growth areas in New Jersey were developed by the Office Smart Growth. The Smart Growth areas supporting the NJDRP are predominately located within the Metropolitan Planning Area and Suburban Planning Area, but also include land within the growth areas of the NJ Pinelands Management Areas as well as some areas of the Meadowlands.

Figure 7.5-1 highlights in tan the remaining buildable land within the Smart Growth areas for Passaic County. Also identified on the map are the FEMA designated 100-year and 500-year floodplains. The five Planning Areas from the NJDRP and the Smart Growth areas described above were used to isolate the buildable lands. To identify the remaining buildable lands in Passaic County, the areas designated as non-Smart Growth and the Planning Areas not suitable for development were eliminated as buildable land. In addition, areas already considered urban were also eliminated. The area remaining is considered the buildable land area identified on the Passaic County Future Growth Map.

Figure 7.5-1
Passaic County Future Growth Locations
(Sources: 2001 New Jersey State Development and Redevelopment Plan, FEMA, NJDEP)



Preliminary Draft September 19, 2008

Table 7.5-1 identifies the acres of remaining buildable land areas in Passaic County that are displayed above on the Future Growth Locations map. The data is ranked by the total number of buildable acres in each municipality and is broken out by FEMA flood zones (100 and 500-year floodplain). The table reveals the majority of buildable land area in Passaic County is located outside of the 100-year and 500-year floodplains. Within Passaic County, the largest area of buildable land is located in Wayne Township.

Table 7.5-1
Passaic County Buildable Land (in acres) by Flood Zone, Ranked by Municipality
(Sources: 2001 New Jersey State Development and Redevelopment Plan, FEMA)

Municipality Name	Acres within 100-year Floodplain	Acres within 500-year Floodplain	Acres Outside 500-year Floodplain	Grand Total
Wayne Township	366	52	1,324	1,742
Woodland Park Borough	31	5	609	645
Totowa Borough	36	23	434	492
Clifton City	46	38	392	476
North Haledon Borough	14	6	343	363
Pompton Lakes Borough	35	2	280	317
Paterson City	49	11	192	252
Hawthorne Borough	29	11	195	235
Little Falls Township	8	7	195	209
Wanaque Borough	15	3	170	188
Haledon Borough	4	2	155	161
Bloomingdale Borough	1	0	145	146
Prospect Park Borough	2	0	105	107
Passaic City	17	12	26	55
Ringwood Borough	0	0	0	0
West Milford Township	0	0	0	0
Total	**652**	**170**	**4,565**	**5,387**

Passaic County contains urban, suburban and rural settings, ranging from the developed urban centers of the cities of Paterson and Passaic to the sparsely developed region of the Highlands located in the Townships of West Milford and Ringwood.[8] As Passaic County participates in regional growth initiatives and implements the State policies of Highlands Preservation and metropolitan revitalization, the Passaic County Planning Department is currently completing a study that addresses the performance of its transportation system. Phase 1 of the *Passaic County Transportation and Smart Growth Strategy Evaluation Model* was completed in July 2005. Smart growth strategies were discussed as part of assessing the transportation system in Passaic County.

[8] Passaic County Fast Facts

The Study indicates that in the northern part of the County, where most development has focused over the past two decades, there are major pressures to develop vacant land. The majority of the northern portion of the County currently consists of parklands and environmentally sensitive areas that are outside of the identified smart growth areas (area mainly consists of the Highlands Special Resource Area). In the southern part of the County, future development will be driven by the forces of redevelopment and revitalization.[9] As the County's southern portion is largely developed and the majority of the northern portion is located within the Highlands Special Resource Area, it is anticipated that future development will consist predominantly of infill development in the South and Highlands-permissible land uses in the North.[10]

7.6 Summary of Risk Assessment

Mitigation planning is intended to provide a rational method for communities to decide what actions to take to reduce their risks from natural hazards. Aside from actually determining and implementing specific actions, perhaps the most important part of a mitigation plan is the risk assessment, which establishes an objective basis for prioritizing mitigation efforts. The risk assessment in this Plan was used to develop a sense of where the most significant risks are in Passaic County, to identify the hazards that present the most potential damage to the county, municipalities and their assets, to ascertain where additional study may be warranted, and to begin the process of identifying and prioritizing mitigation actions.

Section 6 of this Plan describes the location, extent and effects of past events, and discusses the probabilities of the various hazards affecting the county in the future. For some hazards there is a large body of information available to support detailed examinations, while some others are less potentially significant, and therefore not studied as much. Table 7.6-1 summarizes the risk (future loss) estimates for the hazards flood, high winds, severe storm–winter weather, dam failure and earthquake/geological. The figures are based on calculations of direct damages, losses of functions and casualties. Passaic County shows a fairly typical pattern, i.e. that flood is by far the most significant threat when analyzed on a site-specific basis (see right-hand columns of Table 7.6-1), although the data shows lower total risk from floods than from the other hazards when considered across the entire county and over a long planning horizon. The reason for this is that the flood hazard is relatively concentrated in a geographic sense, while the entire county is uniformly exposed to the effects of wind, winter storms and earthquakes (although there are some variations from place to place, based on topography, soils, etc., which are discussed in the present section, as well as in Section 6 of this Plan).

[9] *Passaic County Transportation and Smart Growth Strategy Evaluation Model,* July, 2005
[10] Passaic County Farmland Preservation Plan, September 2008

Table 7.6-1
Summary of Passaic County Natural Hazard Risks
by Asset and Hazard Type (100-Year Horizon)
(Sources: 2000 US Census, HAZUS)

Hazard	Asset	Risk (100-Year Horizon)	Risk Per SF (1)	Risk Per Capita (2)
Flood	Repetitive loss properties (residential)	$32,287,476	$16.21	$12,966
Flood	Severe repetitive loss properties	$18,306,811	$45.99	$36,760
Flood	Deaths and Injuries	Not Determined	NA	NA
High Wind–Straight-Line Winds	All assets	$200,053,412	$0.93	$409
High Wind–Straight-Line Winds	Deaths and injuries	Not Determined	NA	NA
Severe Storm–Winter Weather	All assets, direct damages (3)	$4,024,497	NA	$14
Severe Storm–Winter Weather	Deaths (monetized) (4)	$1,027,440	NA	NA
Severe Storm–Winter Weather	Injuries (monetized)	$45,664	NA	NA
Dam Failure	All assets, direct damages	See Section 7.3.4	NA	NA
Earthquake/Geological	All assets	$312,476,989	$1.46	$639
Earthquake/Geological	Deaths (monetized)	$1,272,563	NA	NA
Earthquake/Geological	Injuries (monetized)	$48,878,104	NA	NA

Notes: (1) Risk per square foot (SF) estimate for the flood hazard based on average building size of 2,000 SF. Risk per SF for the high wind–straight-line wind and earthquake/Geological hazards based on HAZUS estimate of total square footage for the county (See Table 7.3.2-6). (2) Risk Per Capita column based on Passaic County 2000 population from the US Census Bureau. Flood risk per capita based on household occupancy of 2.5 people per dwelling. (3) Winter storm risks are assumed to be primarily related to damages to public assets and infrastructure, to interrupted services, or to response requirements. (4) Standard FEMA practice is to express deaths and injuries in terms of dollars (monetized) in order that the risks can be compared to other categories that are not related to life safety. For further information see FEMA Guidance titled *What is a Benefit*? (included on BCA Toolkit version 3.0).

As noted earlier, the purpose of risk assessment is to identify and quantify future losses from natural hazards, with the goal of using this information to determine what actions should be taken to reduce damages. Although Passaic County as a whole has more risk from wind, winter storms, and earthquakes than it does from floods, there are several factors that must be considered and understood in this context. First, as noted, wind, winter storm and earthquake hazards are far less site-specific than floods and most other natural hazards, so the risk is by definition greater because the whole county is exposed. However, it must also be understood that there are no large-scale mitigation measures that will reduce risks to all properties simultaneously, so site-specific risks are a more significant consideration than countywide ones in most cases. It is necessary to calculate risks on a site-specific basis as a first step in developing meaningful mitigation actions. The paragraphs below describe initial steps that the county and municipalities can take to begin a more detailed risk assessment process that will assist with developing mitigation actions.

Flood

There is already a range of more specific information in this section related to the flood hazard in Passaic County, and this has been used to identify sites to study in more detail. Specific sites have also been identified for further study, based in part on the estimates in this section. Tables 7.3.1-4 through 7.3.1-6 provide key flood risk metrics that have been used to prioritize these areas. For example, Table 7.3.1-4 shows the various municipalities in the county with repetitive flood insurance claims. In some municipalities (such as Wayne and Little Falls Townships and Pompton Lakes Borough) there are a relatively high average number of claims per policy, and a high average claim value. This suggests that there is significant flood risk in these areas. Although this is not definitive, it does offer some insight to where planners and engineers should focus efforts to more fully determine flood risk. Similarly, Table 7.3.1-5 shows the municipalities that include non-residential flood insurance claims. In Passaic County, the Borough of Hawthorne and the Township of Wayne have the highest number of claims in the data set. The Township of Little Falls also has the highest average claims values. Table 7.3.1-6 shows individual streets in the various municipalities, with numbers of claims and average amounts of claims. The data can be used in the same manner as described above. For example, in this table Poplar Avenue, Riveredge Road, and Louis Street have relatively high numbers of claims (and high average numbers of claims per property), and high average claims amounts. It is also important to recognize that in some cases (particularly for flood mitigation), it may be possible to develop mitigation measures that address risks to multiple properties. Because of this it is important to develop an understanding of the proximity of floodprone structures to each other, and of the local topography and hydrologic conditions that may influence risk.

High Wind—Straight-line Wind

Straight-line wind risk is addressed in detail in Subsection 7.3.2. As noted, the wind risk can be considered fairly uniform across Passaic County, although topography and vegetation can influence the effects of the hazard to some degree. Subsection 7.3.2 addresses a range of building types, based on best available asset inventory information from open sources. While this is a reasonable approach to large-scale assessments such as this, there are many characteristics of individual buildings that must be considered in a site-specific risk assessment. These include the amount of exterior glazing (and structural characteristics of the glazing), roof configuration, ground-to-roof structural characteristics (load path), and the strength and configuration of doors. Although some site characteristics can influence the severity of the wind hazard (by increasing or reducing velocity, or by the presence of potential windborne missiles), most wind risk is related to built assets. Because of this, the process of identifying and prioritizing sites for further study is simpler than it is for earthquakes. This Plan recommends that Passaic County undertake more detailed wind risk assessments, based on identifying the most critical facilities and compiling specific structural data about them. In 2006 FEMA, developed a wind hazard database that is used in conjunction with its benefit-cost analysis software. The database includes a list of several dozen structural types, and associated wind damage functions. This list of structure types can be used as the basis for field work to collect information about critical facilities and other buildings. It should be noted that most of New Jersey (including Passaic County), has a relatively low level of wind hazard, so the county should probably start with a fairly small list of its most critical facilities and operations, and estimate the risks for those, before continuing with any additional work on assets that are less important.

Earthquake/Geological

As described in Subsection 7.3.5, there is a moderate degree of earthquake risk in Passaic County. However, the risk study done in support of this Plan is not highly detailed, especially as regards site-specific elements such as soil characteristics and building structural types. As described in Section 9 (Mitigation Strategy), it will be desirable for Passaic County to identify and prioritize specific areas or facilities where there is a high density of built assets and populations. In these areas (and potentially others), this Plan also recommends that the county undertake a more detailed examination of proximity to faults and soil characteristics, to further identify areas that may be at higher risk because of the hazard (as opposed to the nature of the built environment or presence of populations). The purpose of these exercises is to identify combinations of hazard, population and building characteristics that suggest elevated risk. Some building types–specifically unreinforced masonry, which is common in New Jersey - are particularly prone to damage and collapse when subjected to shaking forces, and should be studied from an engineering perspective when they are in areas subject to soil liquefaction, particularly when the facilities house critical operations or have large occupancies.

Other Countywide Hazards

With regard to the other hazards shown in the table above (severe storm–winter weather, dam failure), there is presently not enough open-source information to support specific conclusions about risks, or to make meaningful comparisons to other hazards.

In the case of severe storms–winter weather, the risk is presumably widespread, and related to vulnerabilities in buildings (and infrastructure) as well as to deaths and injuries, and the costs of snow and ice mitigation. There are several specific actions that the county or individual jurisdictions can undertake to better understand winter weather risks. A typical approach is to identify and prioritize critical facilities, then undertake engineering studies of the facilities to identify any hazard-specific vulnerabilities such as weak structural systems, or exterior infrastructure (such as electrical feeds or antennae) that may be subject to damage from snow/ice loads or high winds.

In the State of New Jersey, the NJDEP maintains an inventory of dams, including hazard rankings, as discussed in detail in the subsection above. Although the rankings offer a good initial indication of which dams may create risks (particularly in conjunction with the downstream buffer methodology used in this section), there are numerous risk variables that should be studied if a comprehensive, engineering-based assessment is needed. As noted, these variables include the condition of the dam(s), the amount of water impounded behind them, local topography, and downstream populations and infrastructure. As is the case with other hazards discussed here, if a more detailed risk assessment is needed, the county could prioritize the dams based on the variables noted above, then identify a means to complete an engineering study, perhaps in cooperation with NJDEP.

Relative Risks in the Municipalities

Table 7.6-2 provides a general comparison of hazard vulnerabilities among Passaic County jurisdictions. All hazards included in the present risk assessment section of the plan are included in the matrix. For the flood, high wind, winter storm and dam failure hazards, the risk in each jurisdiction is ranked high, medium or low. These relative rankings are based on a composite review of the risk data presented earlier in this section, and are intended *only* as a relative indication of potential risks. It should be understood that even where overall risks are ranked medium or low, in many cases specific sites, populations and operations in communities may still be at elevated risk from certain hazards. The matrix is intended only as a general indication of where County of local planners may wish to focus their initial attention in further understanding risks and the potential for mitigation actions if resources are limited.

The flood rankings were generally based on (1) the numbers of National Flood Insurance Program claims in the various communities (and the amounts of the claims, and (2) the percentage of the jurisdiction in the floodplain. The high wind and winter storm rankings are based on the potential dollar losses described in Subsections 7.3.2 and 7.3.3, respectively. Note that the dam failure entries are based on NJDEP hazard rankings, the County's selection of the six dams it considers the most hazardous, and the proximity of jurisdictions to these dams. Neither the buffer zone mapping nor this ranking should not be interpreted as a definitive indication of risk. The County and jurisdictions should use this information as a starting point in a process to determine if additional risk studies may be warranted.

Table 7.6-2
Passaic County Municipality-Level Risk Matrix

Municipality Name	Flood	High Wind	Earthquake/ Geological	Dam Failure	Winter Storm
Bloomingdale Borough	Medium	Low	Note 1	Low	Low
Clifton City	Medium	High	Note 1	Low	High
Haledon Borough	Medium	Low	Note 1	Low	Low
Hawthorne Borough	High	Medium	Note 1	Low	Medium
Little Falls Township	High	Medium	Note 1	Low	Low
North Haledon Borough	Low	Low	Note 1	Low	Low
Passaic City	Medium	High	Note 1	Low	Medium
Paterson City	High	High	Note 1	Medium	High
Pompton Lakes Borough	High	Medium	Note 1	Medium	Medium
Prospect Park Borough	Low	Low	Note 1	Low	Low
Ringwood Borough	Low	Medium	Note 1	Low	Medium
Totowa Borough	High	High	Note 1	Low	Low
Wanaque Borough	High	Low	Note 1	Low	Medium
Wayne Township	High	High	Note 1	Medium	Medium
West Milford Township	Medium	High	Note 1	Medium	Medium
Woodland Park Borough	High	Medium	Note 1	Low	Medium

Note 1 – In some cases there may be moderate earthquake or landslide risk in certain jurisdictions, but the availability of technical data does not support such determinations on a local level at this time. As noted earlier in Subsection 7.3.5, earthquake risk in particular is a function of both the seismic hazard and the nature of the built environment (specifically, the tendency of structures to fail under shaking loads). Earthquake (and landslide) risk assessments must be conducted on a highly site-specific basis.

Recommendations to Enhance the Risk Assessment

Section 9 of this Plan outlines a series of general recommendations that can be implemented on a countywide basis as well as a wide range of specific, prioritized actions that individual municipalities are committing to as part of the planning process. The HMPC used the present risk assessment section as the basis for these actions and priorities. However, it has been generally acknowledged that additional information would be helpful in refining and updating this Plan in the years to come. Section 9 also includes actions to aid in this process that include the following general steps:

- Continue to identify and prioritize critical facilities, facilities with high occupancies, or operations with high value
- Study hazard vulnerabilities based on specific conditions and hazards at sites for the highest priority sites and facilities
- Undertake detailed risk assessments for critical facilities in hazard areas, and with known vulnerabilities
- Develop appropriate, cost-effective mitigation measures for the facilities

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Section 8
Capability Assessment

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8.1 Overview and Purpose of Capability Assessment

Although not required by Disaster Mitigation Act of 2000 or the Interim Final Rule, a capability assessment adds context to a mitigation plan by providing an inventory of a municipality's programs and policies, and an analysis of its capacity to carry them out. These are essential for developing mitigation strategies and actions.

The capability assessment is a review of Passaic County's resources in order to identify, review, and analyze what the county is currently doing to reduce losses, and to identify the framework that is in place for the implementation of new mitigation activities. This section of the Plan also facilitates efforts with the New Jersey State Office of Emergency Management (NJOEM) and with federal agencies and resources. In addition, this assessment will be useful in gauging whether the current local organizational structures and inter-jurisdictional or county coordination mechanisms for hazard mitigation could be improved, and how.

This local capability is extremely important, because the municipal officials know their own landscape best. Additionally, many of the most critical and effective hazard mitigation strategies and programs, including enforcement of floodplain management, building codes, and land-use planning, require a strong local role to achieve effective implementation.

New Jersey follows a strong *home rule* legal philosophy. That philosophy dictates that all land in the state not directly belonging to a government entity is incorporated into a municipality.

State statutes require each municipality to assign an individual to be responsible for its local emergency management duties. The municipal emergency management coordinator is responsible for coordinating municipal emergency response and recovery operations with county, state, and federal officials.

8.2 Methodology

This capability assessment results from research, interviews, and surveys. Relevant documents were reviewed related to hazard mitigation, including especially the New Jersey State Hazard Mitigation Plan Update (2008), as well as state and federal sources related to funding, planning, and regulatory capability. Extensive summary information from these sources can be found in Appendices F.1-F.3.

For the county capability assessment, a series of in-depth one-on-one interviews provided key insights and information. In Passaic County, these interviews were conducted during the period of October 2008 until February 2009 with the following individuals:

- Maryann Trommelen, Deputy Emergency Management Coordinator, County Office of Emergency Management
- Michael LaPlace, Director, County Planning Department
- Michael Lysicatos, Senior Planner / GIS, County Planning Department
- Renee Alessio, Right-to-Know Coordinator, County Department of Health

For the municipal capability assessment, a web-based survey tool was designed and administered. The questions were vetted by the Passaic County Office of Emergency Management (PCOEM), and the survey was live from October 2008 until December 2008. The survey was targeted to the primary municipal contacts for this planning process. For the most part, these are municipal Office of Emergency Management (OEM) coordinators. Other municipal staff with relevant expertise–including those in the departments of planning, public works, and buildings–were also encouraged to take the survey.

The survey generally covered the following topics:

- Staff, personnel, and technical capability
- Knowledge of Federal Emergency Management Agency (FEMA) mitigation programs
- Current/ongoing mitigation efforts
- Intra- and inter-governmental coordination
- Land use and regulation
- Floodplain management
- Building code inspection
- Capital improvement
- Land conservation programs

The text of this survey, as well as tabular results can be found in Appendix F.4.

Additionally, a separate survey was created to assess the knowledge of the general public in matters related to hazard mitigation. This is a key capability issue, as many of the most crucial mitigation decisions are made by members of the public. The questions were vetted by the Passaic County Hazard Mitigation Planning Committee (HMPC), and the survey went live in October 2008. To date, the survey has been started by 132 individuals, 119 of whom completed the survey. This is not enough representation of the Passaic County population to warrant an in depth analysis at this time. The text of this survey and a summary of the results collected thus far can be found in Appendix F.5.

8.3 Federal and State Regulations, Plans, and Funding Sources

8.3.1 Inventory of Regulations, Plans, and Funding Sources

This section, including Table 8.3.1-1, provides summary information regarding selected federal and state regulations, plans, and sources of funding that are relevant to mitigation projects and activities. For additional information regarding funding availability and eligibility, and other details about and evaluations of these regulations, plans, and funding sources, see Appendices F.1-F.3.

Also, see Table 8.5.1-1 for further discussion and evaluation of key regulations and minimum standards that are implemented at the municipal level.

Table 8.3.1-1
Summary of Selected State and Federal Regulations, Plans, and Funding Sources Relevant to Natural Hazard Mitigation

Title	Program Type	Administered by/ Eligible recipient		
		State	County	Municipality
Farm Bill Cons. Program/ Farm and Ranch Lands Protection Program	Funding (Fed.)	New Jersey Department of Agriculture (NJDOA)/Div. of Agriculture and Natural Resources	X	X
FEMA Public Assistance (PA) grants	Funding (Fed.)	NJOEM	X	X
FEMA Hazard Mitigation Grant Program (HMGP)	Funding (Fed.)	NJOEM	X	X
FEMA Pre-Disaster Mitigation (PDM) grants	Funding (Fed.)	NJOEM	X	X
FEMA/NFIP Repetitive Flood Claims (RFC) grants	Funding (Fed.)	NJOEM	X	X
FEMA/NFIP Severe Repetitive Loss (SRL) grants	Funding (Fed.)	NJOEM	X	X
FEMA/NFIP Flood Mitigation Assistance (FMA) grants	Funding (Fed.)	NJOEM	X	X
National Dam Safety Program/ Water Resources Devt. Act (WRDA)	Funding (Fed.)	New Jersey Department of Environmental Protection (NJDEP)/Dam Safety Section		(specific waterways explicitly identified in WRDA)
HUD Community Development Block Grants (CDBG)	Funding (Fed.)	New Jersey Department of Community Affairs (NJDCA)/Division of Community Resources	X	X
Land and Water Conservation Fund	Funding (Fed.)	NJDEP/Green Acres Program	X	X
USDA Forest Legacy Program	Funding (Fed.)	NJDEP/Green Acres Program		(available to private landowners)
NJ Open Space Program	Funding (local)	NJDEP/Green Acres Program	X	X

Title	Program Type	Administered by/ Eligible recipient		
		State	County	Municipality
Community Wildfire Hazard Mitigation Assistance Program	Funding (NJ)	NJDEP/Forest Fire Service	X	X
Shore Protection Program	Funding (NJ)	NJDEP/Off. of Engineering and Construction	X	X
Green Acres	Funding (NJ)	NJDEP/Green Acres Program	X	X
Coastal Blue Acres	Funding (NJ)	NJDEP	X	X
Farmland Preservation Program	Funding (NJ)	NJDOA/State Agriculture Devt. Committee	X	X
Flood Control Plan grants (1)	Funding (NJ)	NJ Meadowlands Commission		X
Municipal Assistance Program (1)	Funding (NJ)	NJ Meadowlands Commission		X
Freshwater Wetland Protection Act/ Wetland Mitigation Fund	Funding (NJ)	NJDEP	X	
Dam Restoration and Inland Water Projects Loan Program	Funding (NJ)	NJDEP	X	X
Sewerage Infrastructure Improvement Act Grants	Funding (NJ)	NJDEP	X	X
NJ Small Communities CDBG	Funding (NJ)	NJDCA/ Division of Community Resources	X	X
Environmental Infrastructure Financing Program	Funding (NJ)	NJDEP		Any public, private, or non-profit owned water system
Transportation Trust Fund Municipal Aid	Funding (NJ)	New Jersey Department of Transportation (NJDOT)/Division of Local Aid	X	X
Transportation Trust Fund	Funding (NJ)	NJDOT	X	
New Jersey Conservation Foundation (NJCF)	Funding (private)			(private program)
NJ Devt. and Redevt. Plan	Plan	NJDCA/Office of Smarty Growth (OSG)	X	X
Highlands Preservation Area	Regulation	NJDEP/Division of Land Use Regulation (DLUR)		X
Watershed Permitting	Regulation	NJDEP/Municipal Storm water Regulation Water Quality Div.		X
NJ Flood Hazard Area Control Act	Regulation	NJDEP/Flood Control Section		X
Uniform Construction Code	Regulation	NJDCA/Division of Codes		X
Uniform Fire Code	Regulation	NJDCA/Fire Safety Division		X
Flood Hazard Area Control Act	Regulation	NJDEP	X	X
Safe Dam Act	Regulation	NJDEP	X	X
Waterfront Devt. Statute and Coastal Permit Program	Regulation	NJDEP/DLUR		X
Coastal Area Facility Review Act (CAFRA)	Regulation	NJDEP/DLUR		X

Title	Program Type	Administered by/ Eligible recipient		
		State	County	Municipality
Wetlands Act/ Coastal Zone Mgt. (CZM)	Regulation	NJDEP/DLUR		X
Storm water Mgt. Rules	Regulation	NJDEP		X
Tidelands Act	Regulation	NJDEP		X
Municipal Land Use Law	Regulation	NJDEP/B. of Land Use Compliance	X	

Notes:
(1) Available/applicable in Meadowlands areas only.

For many federal grants, the non-federal share can be borne by the state as *grantee*, the recipient community as *sub-grantee* or in some cases, the property owner who benefits from the project. In the case of property acquisitions intended to remove properties that experience repetitive flood losses, the non-federal share is typically covered by the property owner, who accepts the federal share of 75% and documents the lost equity as the non-federal share. This can serve as a disincentive to participation.

It is also important to note in this discussion of federal plans that on March 19, 2009, during the development of this Plan, FEMA approved a multi-year initiative called "Risk Mapping, Assessment and Planning" or "Risk MAP". The plan implementation spans FY10-FY14 and builds on the success of FEMA's Map Modernization program that will soon be concluding the work to provide reliable digital flood mapping for the majority of the Nation's population.

Per FEMA's website[1], the "vision for Risk MAP is to deliver quality data that increases public awareness and leads to action that reduces risk to life and property". One objective of the initiative is to "[r]educe losses of life and property through continuous improvement of mitigation plans", which is consistent with the goals and specific action items in this Plan. The Mitigation Action Plan for Middlesex County (see Section 9) includes an action item that specifically includes ensuring that Middlesex County takes full advantage of any opportunities that the Risk MAP program will provide.

[1] http://www.fema.gov/plan/ffmm.shtm

8.3.2 Implications of NJOEM Capabilities on Local Hazard Mitigation Efforts

State capabilities for hazard mitigation have an impact on the efficacy of local planning and implementation. In accordance with the State Hazard Mitigation Plan Update (SHMPU), the focus of New Jersey's statewide hazard mitigation effort is centered in the NJOEM, located in the Division of State Police.

NJOEM is represented on the State Hazard Mitigation Team (SHMT), which is chaired by a representative of the Governor's Office. Other state agencies represented on the SHMT and actively involved in hazard mitigation include the NJDEP, NJDCA, the NJDOT, and the Department of Banking and Insurance.

The SHMT has responsibility for the following, at a minimum:

- Identifying hazards, monitoring changes in hazard vulnerability, and implementing measures for reducing potential damage by providing a mechanism for follow-up activities crucial to the successful implementation of team recommendations.
- Developing and maintaining a comprehensive state hazard mitigation plan for the reduction of natural hazards.
- Promoting public awareness of risks associated with known hazards and preparedness among residents of the state.
- Serving as an advisory group to the Governor's Advisory Council on Emergency Services (GACES) and preparing post-disaster hazard mitigation recommendations for all applications.
- Investigating and recommending cost-effective hazard mitigation opportunities to the NJOEM and GACES as part of any disaster recovery effort.

Historically, NJOEM has had limited staffing to address the hazard mitigation needs of the state. Additional staff is needed to expand the ability of the state to support local and county mitigation planning needs. NJOEM needs to employ adequate staffing with the necessary expertise for the timely development of hazard mitigation plans and to facilitate the implementation of risk reduction projects statewide.

In the past, NJOEM has employed planning professionals and program administrators who conducted community outreach, mitigation workshops, and training opportunities to promote development of hazard mitigation plans, assist with developing alternative funding sources, and promote a statewide risk reduction strategy. Recent staffing loss and the inability to hire has left the State Hazard Mitigation program understaffed to meet the needs of county and local emergency management programs. As stated in the SHMPU, the state would benefit from hiring professional staff for the State Mitigation Unit to fulfill its responsibilities and manage its increased workload resulting from recent disasters; the addition of several FEMA funded mitigation programs, and commitments in the SHMPU. Increased NJOEM staffing is needed in the areas of planning, engineering, and project management.

In addition to the employment of professional staff, there is a need to develop a cadre to supplement disaster recovery operations and mitigation staff to assist NJOEM with education of affected communities, project assessment, and development of mitigation projects that have been recommended but not initiated. Such a cadre could be used to supplement state staffing during disaster recovery operations.

8.4 Capability Assessment for Passaic County

In accordance with New Jersey's home rule structure, authority over the three key tools for proactive hazard mitigation–land use planning, floodplain management, and building code enforcement–reside at the municipal level. For more on this, see Section 8.5. Counties play a coordinating role in these matters.

8.4.1 Relevant Ordinances and Policies

This section, as illustrated in Table 8.4.1-1, provides a list of Passaic County ordinances and policies that have the potential to affect and/or promote mitigation within the county. Understanding which ordinances and policies affect mitigation in the county is a helpful component to mitigation activities. Many of the ordinances and policies that most directly affect development in relation to hazards reside at the municipal level. These include zoning, floodplain management, and building code enforcement.

Table 8.4.1-1: Passaic County Ordinances and Policies Relevant to Hazard Mitigation
(Source: Interviews with Passaic County Staff, 2009)

Ordinance/Policy	Description	Enforcement / Implementation
Municipal Land Use Law	Encourages appropriate development in municipalities that promotes public health, safety, morals, and general welfare.	Municipal planning and zoning offices.
Cross-Acceptance Report	Encourages consistency between municipal, county, regional, and state plans for development and redevelopment.	Passaic County Planning Department
Passaic County Corridor Enhancement Plan and Smart Growth Transportation Plan	Encourages sound planning for growth and economic development.	Passaic County Planning Department
Passaic County Open Space, and Farmland Preservation Trust Fund, Open Space Master Plan, Farmland Preservation Plan and Highlands Preservation Area	Trust fund to preserve agricultural lands or open space and protect sensitive areas.	Passaic County Planning Department

Ordinance/Policy	Description	Enforcement / Implementation
Emergency Operations Plan	The county is required by state Statute to update its Emergency Operations Plan every four years. The current Plan is dated January 2008.	Passaic County Office of Emergency Management
Passaic County Planning Act	To make and adopt a master plan for the physical development of the county. Provide for the review of all subdivision and site plans for land development along county roads or affecting county drainage facilities.	Passaic County Planning Board

8.4.2 Fiscal Capacity

This section, as illustrated in Table 8.4.2-1, provides a list of local funding sources within Passaic County and determines if that funding source can be used to affect or promote mitigation within the county. Understanding where potential funding sources are available to the county is a helpful component to mitigation activities.

Table 8.4.2-1
Passaic County Funding/Financing Sources Relevant to Hazard Mitigation
(Source: Interviews with Passaic County Staff, 2009)

Financial Resources	Accessible or Eligible to Use
General Fund	No
Development Fees	N/A
Community Development Block Grant (CDBG) (see Note 1)	Yes
Capital Improvements Project Funding	No
Authority to levy taxes for specific purposes	No
Fees for water, sewer, gas or electric service	N/A
Green Acres Fund (see Note 2)	Yes
Impact Fees for Homebuyers or Developers for New Developments/Homes	N/A
County Match Fund	Yes
Transportation Grant Funds	No
Federal Hazard Mitigation Grants (see Note 3)	Yes

Notes:
1. Projects must address a low income population that qualifies under US Department HUD rules or Americans with Disabilities Act (ADA) compliance. Interested parties should refer to the submittal rules under Passaic County's CDBG program for conditions.
2. The Green Acres Fund is a state program that would similarly is subject to specific submittal rules that should be reviewed in detail.
3. These grants include HMGP, PDM, RFC, SRL, and FMA programs identified in Table 8.3-1.

Generally, the following conditions must be met in order for a project to be considered for county funding:

- Fall under Passaic County's jurisdiction
- Have a benefit to Passaic County and affected municipalities within the county

Additionally, counties may participate in projects that affect county infrastructure, including roads and drainage infrastructure.

8.4.3 Technical, Administrative, and Regulatory Capacity

This section provides a review of the administrative and technical resources within the county's departments to determine if all of the necessary resources are available to Passaic County to engage in mitigation planning processes. Table 8.4.3-1 indicates potential resource needs, and indicates whether the county currently has staff with that expertise or available outside contractors.

Table 8.4.3-1: Passaic County Administrative and Technical Capacity
(http://www.passaiccountynj.org/Departments/Planning/PDF/Farmland_Preservation_Trust_Fund/OSTF_Rules_&_Regs.pdf)
(Source: Interviews with Passaic County Staff, 2009)

Staff/Personnel Resources	On Staff	Department/Agency
Planner(s) or engineer with knowledge of land development and Land management practices	Yes	Planning
Engineer(s) or professional(s) trained in construction practices related to buildings and/or infrastructure	Yes	Engineering
Planners or engineer(s) with an understanding of natural and/or human-caused hazards	Yes	Planning
Floodplain Manager	No	
Surveyors	Yes	Engineering
Staff with education or expertise to assess the community's Vulnerability to hazards	Yes	OEM
Personnel skilled in GIS and/or HAZUS	Yes	Planning and Health Departments
Emergency Manager	Yes	PCEOM

Additionally, although most land-use related regulatory powers in New Jersey reside at the municipal level, counties have the ability to influence and guide development in important ways. These are discussed below.

Intra- and Inter-Jurisdictional Coordination

The Passaic County staff works with state partners on implementing state funded programs. The Passaic County OEM staff has significant contact with the NJOEM Regional Staff on a regular basis implementing training and Emergency Management Performance Grants (EMPG) Emergency Management Agency (EMA) initiatives as required. Passaic County OEM and other county departments interact and are an integral part of the New Jersey Urban Area Security Initiative (UASI) group, which includes seven counties and two core cities. Passaic County and representatives from local municipalities also interact and work with representatives from the state on the implementation of the state Homeland Security Grants. When an emergency has been declared and a Declaration Disaster has been received, Passaic County OEM as well as other county agencies and local municipalities work very closely with FEMA representatives. During the declaration process, meetings are hosted with FEMA representatives. Additionally, teams of FEMA workers have been deployed and have worked side by side with Passaic County OEM staff for several months at the county OEM office.

Regionalization

Municipalities in New Jersey are currently being encouraged to consolidate ("regionalize") services and functions. These may include police, fire, EMS, limited emergency operations functions, and other items. In Passaic County, the county freeholders have taken the following steps regarding shared services:

Two areas showing regionalization are communications and in the detection, deterring, response to and recovery from threats and incidents of terrorism. Passaic County has a regionalized 9-1-1 Communications Center which is located at the Passaic County Sheriff's Department and they are the public safety answering point for six out of the 16 municipalities in Passaic County. UASI provides resources to state, county, and municipal governments to develop plans for terrorism events on a regional level. While this initiative focuses primary on operations and is still relatively a new concept, the coordination and cooperation being established will strengthen the process of regionalizing other services in the county. The county also shares purchasing commodities with other municipalities within Passaic County.

In terms of regionalizing hazard mitigation efforts, the county currently feels that this would not work and that the municipal OEMs should continue to remain responsible for their mitigation programs. Reasons for this revolve mainly around limited staffing at the county level, which would not allow the close coordination needed to effectively manage a program of this type.

Land Use Planning and Regulation

The Passaic County Planning Board is granted the authority to review site plans and subdivision applications as permitted under the New Jersey County Planning Act. The county planning board may provide for the review of site plans for land development along county roads or affecting county drainage facilities and for the approval of such development as hereinafter set forth and limited for the purpose of assuring a safe and efficient county road system. Such review and approval shall be in conformance with procedures and standards adopted by resolution or ordinance as appropriate of the governing body. In addition, the county planning board shall provides for the review of all subdivisions of land within the county by said county planning board and for the approval of those subdivisions affecting county road or drainage facilities. Such review or approval shall be in accordance with procedures and engineering and planning standards adopted by resolution of the board of chosen freeholders. This gives the county some control and provides a mechanism for coordinated development. The Planning Department manages drainage issues/projects along county roads and holds meetings in which the municipalities are encouraged to participate and bring forth current issues.

The Planning Department also carries out a wide range of planning functions and programs relating to land use, environmental and infrastructure issues in Passaic County. The Department is responsible for serving on the Regional Technical Advisory Committee (RTAC) of the North Jersey Transportation Planning Authority (NJTPA). This committee reviews all transportation projects that are funded by federal transportation dollars as well as advises the NJTPA on technical studies and other transportation planning matters that may affect the County. The Planning Department also carries out other general planning functions such as technical studies, facilities planning, open space preservation, and transportation planning. Another important function of the Planning Department is coordination with other state and local planning bodies such as the Highlands Commission, NJ Office of Smart Growth, NJ County Planners Association, NJ Chapter of the American Planning Association, and local planning departments.

Floodplain Management

Floodplain management in Passaic County is a function strictly handled at the municipal level of government. The county is not responsible for adopting or enforcing a minimum floodplain ordinance. At the municipal level, all 16 municipalities have adopted some type of ordinance that restricts or controls development or construction in flood prone areas. For more information on floodplain management and NFIP participation at the municipal level, see Section 8.5 and Appendix F.1-F.2 and F.4.

The county is required to follow all applicable national and state restrictions pertaining to floodplains and wetlands when acquiring land for parks and recreation through programs such as Green Acres or Farmland Preservation. Such lands are then owned by the county.

Building Code Enforcement

Building code enforcement in Passaic County takes place at the municipal level of government. All municipalities are required by New Jersey law to enforce the New Jersey Uniform Construction Code. Building codes are either enforced by local inspectors or third party contractors. Passaic County manages the Construction Board of Appeals, which provides a mechanism to solve disputes over construction practices at the municipal level. For more on building code enforcement at the municipal level, see Section 8.5 and Appendix F.1-F.2 and F.4

Economic Development Planning

The Passaic County Economic Development Department is responsible for promoting and developing the economic growth of the county. The Director of Economic Development is fully responsible for the implementation and coordination of all economic development plans and programs including matters affecting workforce investment, community development, quality of housing and preservation of historic sites and programs. The Department works to strengthen Passaic County's economy and positioning the county to compete in a global marketplace by stimulating and creating new jobs, retaining existing businesses, and facilitating economic growth and development.

Capital Improvements Planning

The County Treasurer, by law, is the custodian of all county funds and is responsible for meeting the county's long- and short-term capital fund requirements. Drainage projects and improvements to roads, bridges, and county facilities receive annual appropriations in the budget which are important projects in terms of hazard mitigation.

Land Conservation

Acknowledging the need to preserve open space and farmland and to improve the park system/facilities in Passaic County, two referenda were added to the November 1996 Election Ballot concurrently as non-binding Ballots. The citizens approved an Open Space and Farmland Preservation Trust Fund referendum and an Open Space and Parks Improvement Fund referendum that were ultimately consolidated as a result of legislative initiative.

Any of Passaic County's sixteen municipalities and qualified charitable conservancies is eligible to submit applications to the Open Space Trust Fund Advisory Committee.

Qualified nonprofit land trusts and charitable conservancies are defined as a "corporation or trust whose purposes include the acquisition and preservation of land or water areas or of a particular land or water area, or either thereof, in a natural, scenic or open condition, no part of the net earnings of which insures to the benefit of any private shareholder or individual, and which has received tax exemption under section 501(c) of the 1954 Internal Revenue Code." (N.J.S.A 13:83-2)

The Passaic County Open Space Master Plan (2001) and the County Farmland Preservation Plan (2008) provides direction for the future preservation of County open space, County farmland and County participation in State Agriculture Development Committee (SADC)-funded programs.

8.5 Capability Assessment for Municipalities within Passaic County

8.5.1 Overview of Relevant Statewide Mandatory Minimum Standards Related to Local Ordinances and Policies

New Jersey is a home rule state, under which each municipality is directly responsible for local enforcement of building codes, floodplain management, emergency management, and zoning ordinances.

In order to ensure a minimum set of standards, the state has passed laws and regulations mandating each municipality adopt local ordinances with the same basic criteria, so that jurisdictions may add additional requirements, but cannot have fewer/weaker requirements than the state standard. Having each municipality with a core set of policies, programs, and capabilities at its disposal allows for more effective mitigation against hazards, regardless of a municipality's relative size, population, or wealth.

New Jersey mandates compliance with the Municipal Land Use Law, Uniform Construction Codes, floodplain management, and growth management, and strongly encourages land and water preservation through incentive programs. These mandates translate into local ordinances, policies, or programs that regulate and enforce how zoning, building, and open space are managed by the municipalities. Table 8.5.1-1 highlights the State Laws that drive the state's policies to support local municipalities' ability to impact hazard mitigation.

Table 8.5.1-1: New Jersey Policies that Impact Municipal Hazard Mitigation Efforts
(Source: New Jersey State Hazard Mitigation Plan Update, 2008)

Policy	Land Use Planning
Description	State of New Jersey Municipal Land Use Law (MLUL) L.1975, c. 291, s. 1, effective August 1, 1976, is the legislative foundation of the land use process, including decisions by Planning Boards and Zoning Boards of Adjustment, in the State of New Jersey. It defines the powers and responsibilities of boards and is essential to their functions and decisions. It also provides the required components of a municipal Master Plan.
Applicability	Every municipal agency shall adopt and may amend reasonable rules and regulations, not inconsistent with this act or with any applicable ordinance, for the administration of its functions, powers, and duties.
Effectiveness	The MLUL requires that each municipality prepare a comprehensive plan and update that plan every six years. These plans help jurisdictions review their land use plans and policies with public participation.
Policy	**Floodplain Management**
Description	New Jersey State Law Flood Hazard Area Control Act (NJSA 58:16A-52). The National Flood Insurance Act of 1968 is a federal program establishing the NFIP, which enables property owners in participating communities to purchase insurance as protection against flood losses, in exchange for state and community floodplain management regulations that reduce future flood damages. As further incentive for communities to surpass the NFIP basic requirements, the Community Rating System (CRS) recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements.

Applicability	The Act and regulations attempts to minimize damage to life and property from flooding caused by development within fluvial and tidal flood hazard areas, to preserve the quality of surface waters, and to protect the wildlife and vegetation that exist within and depend upon such areas for sustenance and habitat. While it does not require local adoption, as it is enforced by the NJDEP. The floodplain ordinances of each municipality need to be reviewed to be in compliance with revised regulations (2007). NFIP: Municipality participation is voluntary; however, members of the National Flood Insurance Program must have the required aspects of the NFIP codified within their zoning, floodplain, and land development ordinances and CRS additional aspects if the municipality is a member of CRS.
Effectiveness	Flood Hazard Control Act: Regulations for the Flood Hazard Control Act were adopted in November 2007; it is therefore difficult to quantify the effectiveness at this time. See below for discussion of floodplain management activity at the county and municipal levels in Passaic County. The New Jersey Dam Safety program, new state storm water management requirements, and the development of all hazard mitigation plans, are among some of the efforts that can provide CRS credits for New Jersey municipalities.
Policy	**Building Codes**
Description	Uniform Construction Code (UCC) Act of 1975 requires all jurisdictions to have current land use master plans (reexamined every six years), zoning, and other land development ordinances. The UCC contains sub-codes for residential and other buildings, as well as requirements that address construction in both A and V flood zones. All new construction is required to comply with the UCC for flood zone construction. In the affected areas, older at-grade structures have been routinely razed and replaced with new and often larger structures, all now conforming to the NFIP's requirements for A-zone and V-zone construction. Thus, through the building boom of the 1990's and 2000's, there have been thousands of structures modified to FEMA's more stringent requirements, especially with respect to homes built on piling at or above the base flood elevation for that zone. This in itself is a form of mitigation. However, there are still thousands of older homes still at grade that remain vulnerable to flood from storm surge and other sources.
Applicability	New Jersey State Law requires that all municipalities adopt ordinances that follow the UCC.
Effectiveness	Considered among the most effective elements in a mitigation program because building codes mandate best practices and technology, much of which is designed to reduce or prevent damage from occurring when structures are under stress.
Policy	**Growth Management**
Description	The State Plan was prepared and adopted by the State Planning Commission according to the requirements of the State Planning Act of 1985 as amended (NJSA 52:18A-196 et seq.) to serve as an instrument of state policy to guide state agencies and local government in the exercise of governmental powers regarding planning, infrastructure investment, and other public actions and initiatives that affect and support economic growth and development in the state.
Applicability	Through the Green Acres Program, Open Space Tax Program, State Development and Redevelopment Plan, and the State Planning Act, New Jersey has enhanced the traditionally limited role of county land use planning and control. The state also provides tools for municipalities when preparing their master plans and better opportunity for a comprehensive approach to planning so not to harm or be in conflict with neighboring municipalities' plans.
Effectiveness	See below for discussion of land use planning and regulation as it applies to hazard mitigation in Passaic County.

Policy	Critical Area Protection
Description	Green Acres Program; Blue Acres Program; Historical Preservation Program; Farmland Preservation
Applicability	These programs provide the funding necessary for municipalities and counties to purchase land for open space preservation and recreation.
Effectiveness	The state has made a $3.3 billion public investment in open space preservation and recreation since 1961. New Jersey residents have consistently voted for open space and recreation referendums at the state and local levels. In 2007, all 21 counties and 231 municipalities assessed a special tax for land preservation and recreation purposes. See below for further discussion of land conservation as it relates to hazard mitigation in Passaic County.

8.5.2 Technical, Administrative, and Regulatory Capacity

As described above, capability at the municipal level was assessed through the use of an online survey, augmented by research into other state sources and interviews with county officials. The survey was targeted to the primary contacts for this Hazard Mitigation Plan in each municipality (those who comprise the HMPC). Typically, these were municipal OEM coordinators. Others with relevant knowledge were solicited to participate as well, including those in the departments of planning, public works, and buildings. In Passaic County, 14 out of 16 primary contacts participated to some degree.

The full text of the survey questions, as well as full data reporting for Passaic County, is contained in Appendix F.4.

Staffing and Personnel Capability for Hazard Mitigation

Municipal primary contacts in Passaic County typically have relatively strong experience and training. Just over 8% of the respondents had three to five years experience and 15 to 20 years of training. Approximately 33% of the respondents had worked in their positions for 20-plus years and only one individual had less than six months experience in their current role.

However, municipal staffing levels were often minimal. Approximately 33% of respondents reported having zero staff, while approximately 42% had only two to three staff members. Most respondents (33%) reported having no staff that works in a hazard mitigation capacity. Municipalities reported using contractors, however their work did not relate to hazard mitigation. Additionally, several offices reported the use of volunteers and/or students to assist current staff for hazard mitigation related projects.

Approximately 71% of offices reported having staff trained in grant writing or grant administration, with a large majority (71%) stating that their staff could spend a total of zero-to-five hours per week on mitigation-related management duties. However, most (57%) of respondents said no other office would be a preferable location for hazard mitigation grant and project oversight.

Respondents reported no use of GIS –this question was skipped by all respondents.

More than half of the respondents had some familiarity with FEMA mitigation programs. Overall, at least 50% of respondents reported a moderate or higher familiarity with one or more of programs such as Public Assistance (PA), Hazard Mitigation Grant Program (HMGP), Pre-Disaster Mitigation Program (PDM), and Flood Mitigation Assistance (FMA), among others. Figure 8.5.2-1 and Figure 8.5.2-2 further details responders understanding of these programs and Passaic County's participation in FEMA grant programs.

Figure 8.5.2-1: Respondent Familiarity with FEMA Mitigation Funding Sources
Answering 7 of 14
(Source: New Jersey Passaic County Municipal Capability Assessment Survey, 2008)

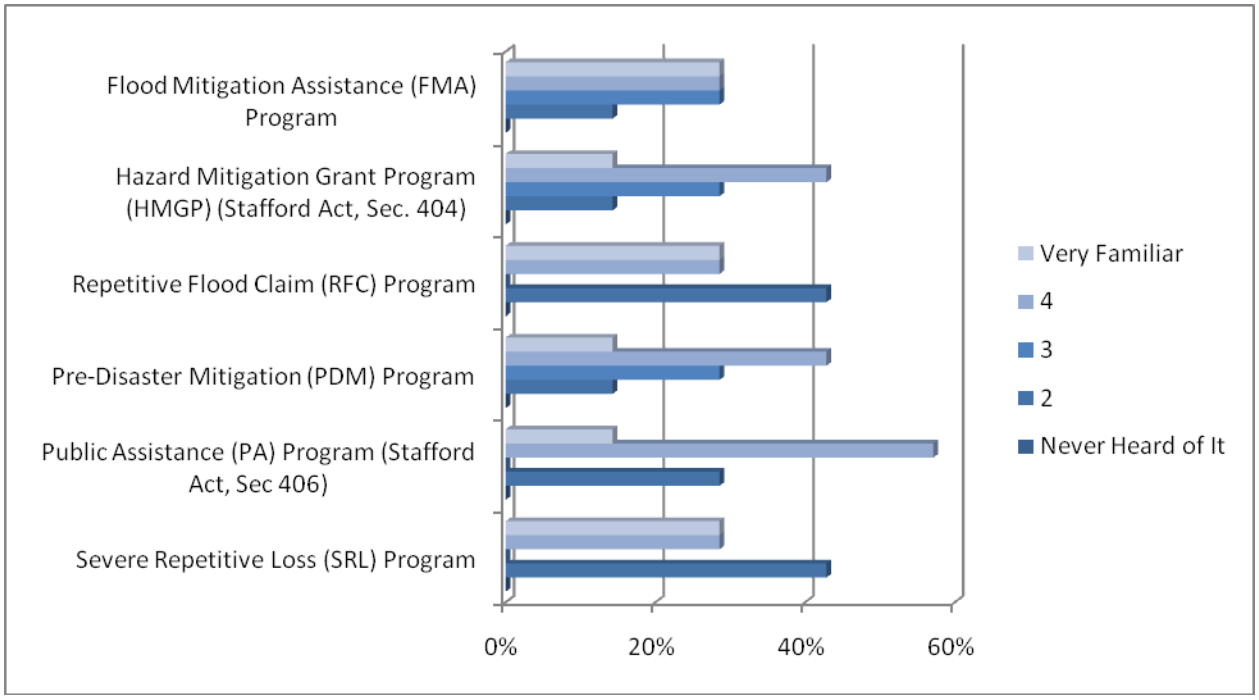
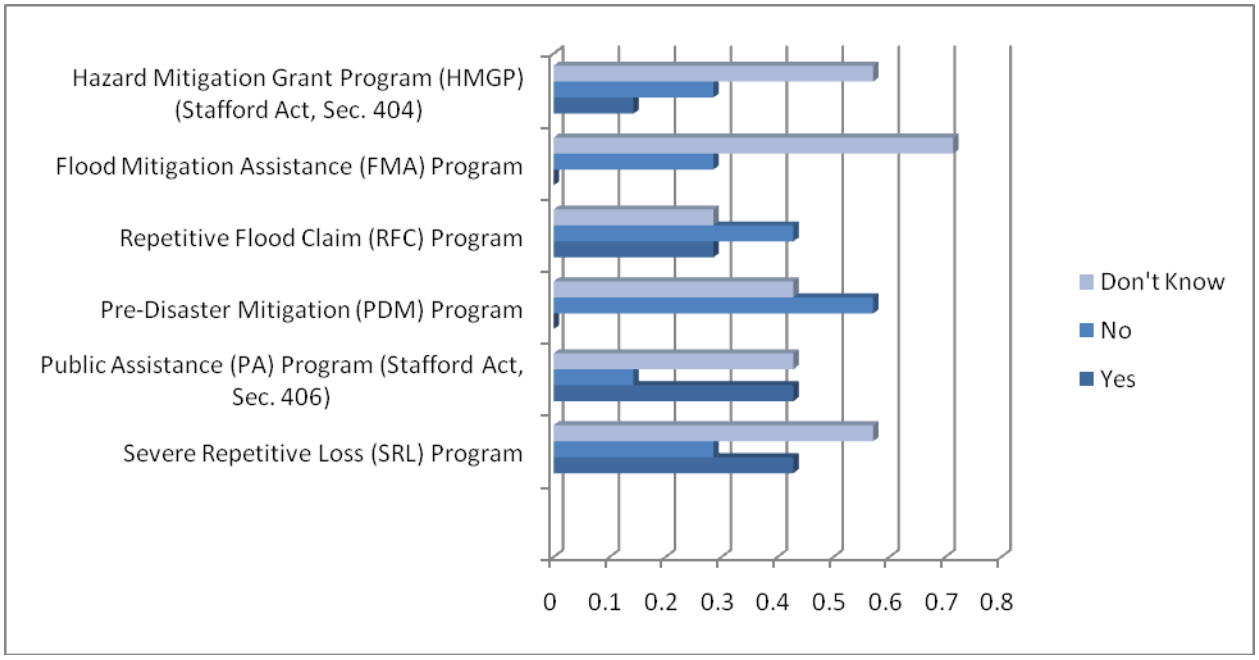


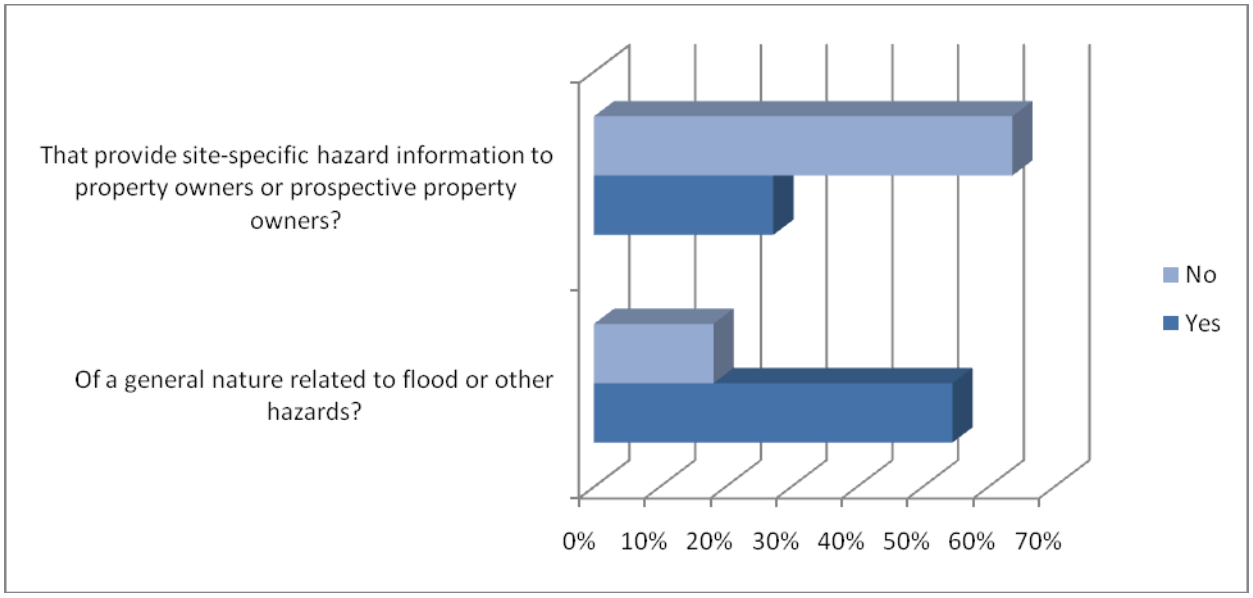
Figure 8.5.2-2: Municipal Participation in FEMA Mitigation Programs
Answering 7 of 14
(Source: New Jersey Passaic County Municipal Capability Assessment Survey, 2008)



Very few respondents provided any insight into the effectiveness of mitigation programs in their municipalities. Challenges attributed to executing mitigation projects included limited funding and planning reviews. Proposed mitigation programs that would be useful in their municipality include acquisition.

As Figure 8.5.2-3 shows, over 50% of respondents reported that their municipalities maintain public information programs related to hazard mitigation, but few are able to provide site-specific hazard information for property owners or prospective property owners.

Figure 8.5.2-3: Existence of Municipal Public Education Programs Related to Hazard Mitigation
Answering 11 of 14
(Source: New Jersey Passaic County Municipal Capability Assessment Survey, 2008)



Intra- and Inter-Jurisdictional Coordination

Many municipal primary contacts coordinate their mitigation activities with other agencies, both within the same municipality and beyond. Approximately 64% of the respondents reported that other municipal offices also carry out mitigation-related work, typically in the Department of Public Works (100%), the Planning Department (57%), the Building Department (100%), and the OEM (86%).

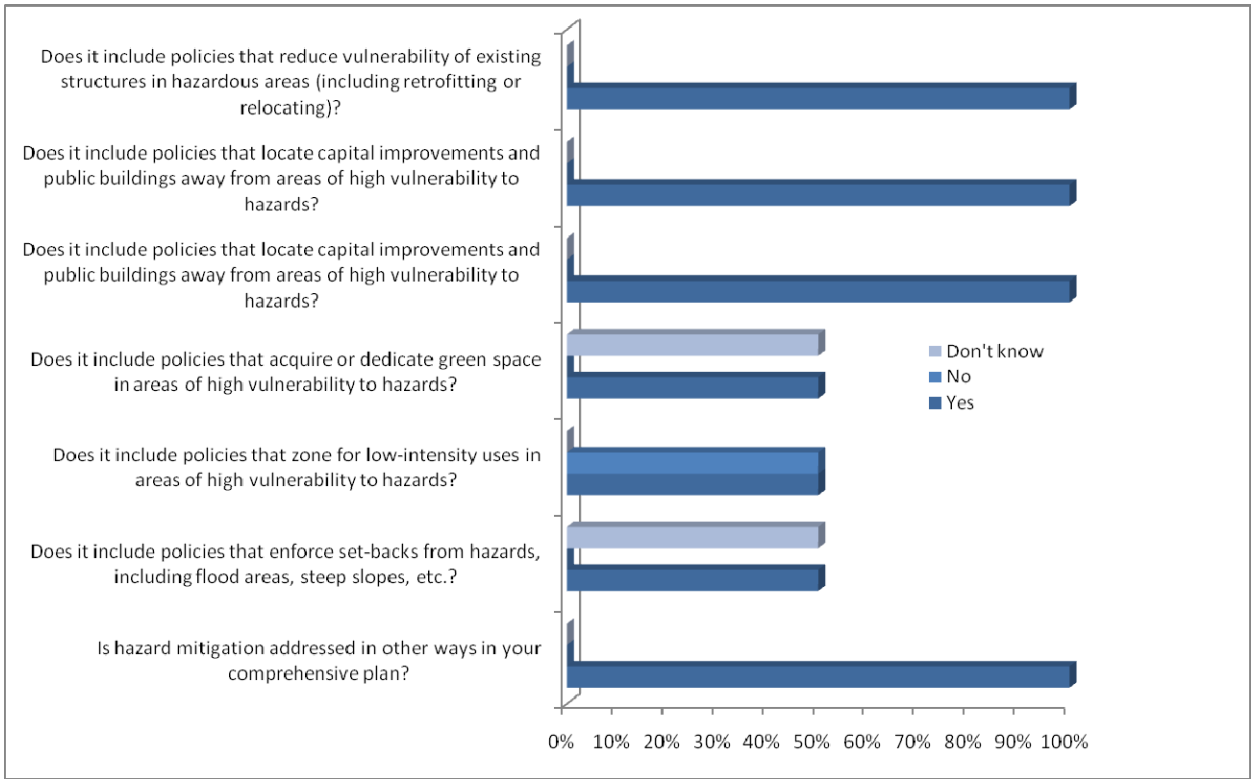
All of the respondents reported working with the county on mitigation efforts, while over 16% reported working with a regional planning entity, 50% reported working with state agencies, and 33% reported working with federal partners. Of all of these, the county OEM was rated the most valuable partner for most of the respondents.

Land Use Planning and Regulation

Of the respondents, approximately half of the primary contacts were familiar with land-use planning and regulation tools as they relate to hazard mitigation.

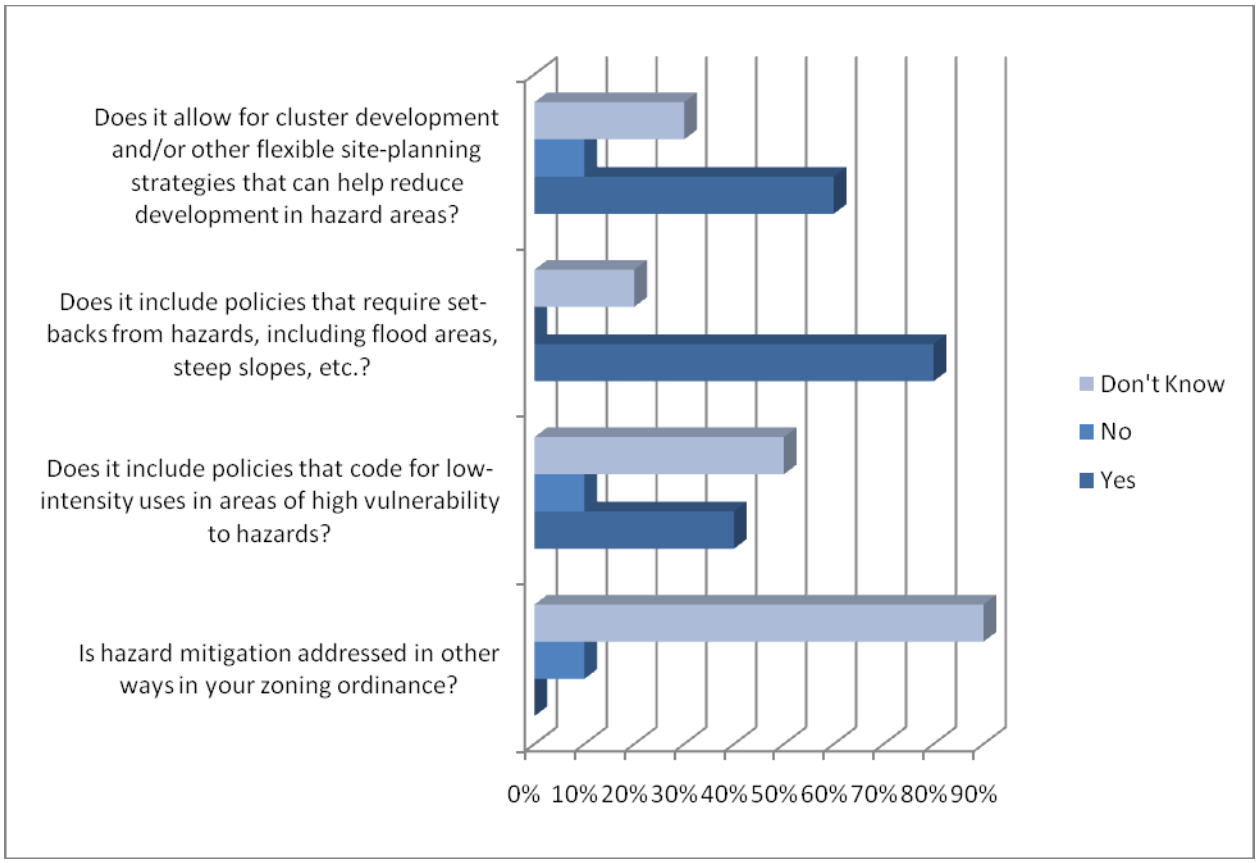
Those who were familiar rated their plans high for prioritizing mitigation, as shown in Figure 8.5.2-4. Comprehensive Plans were generally understood to call for limiting development in hazard-prone areas and establishing policies related to set-backs and other mitigation measures near flood areas, steep slopes, etc.

Figure 8.5.2-4: Hazard Mitigation Addressed in Municipal Comprehensive Plans
Answering 2 of 14
(Source: New Jersey Passaic County Municipal Capability Assessment Survey, 2008)



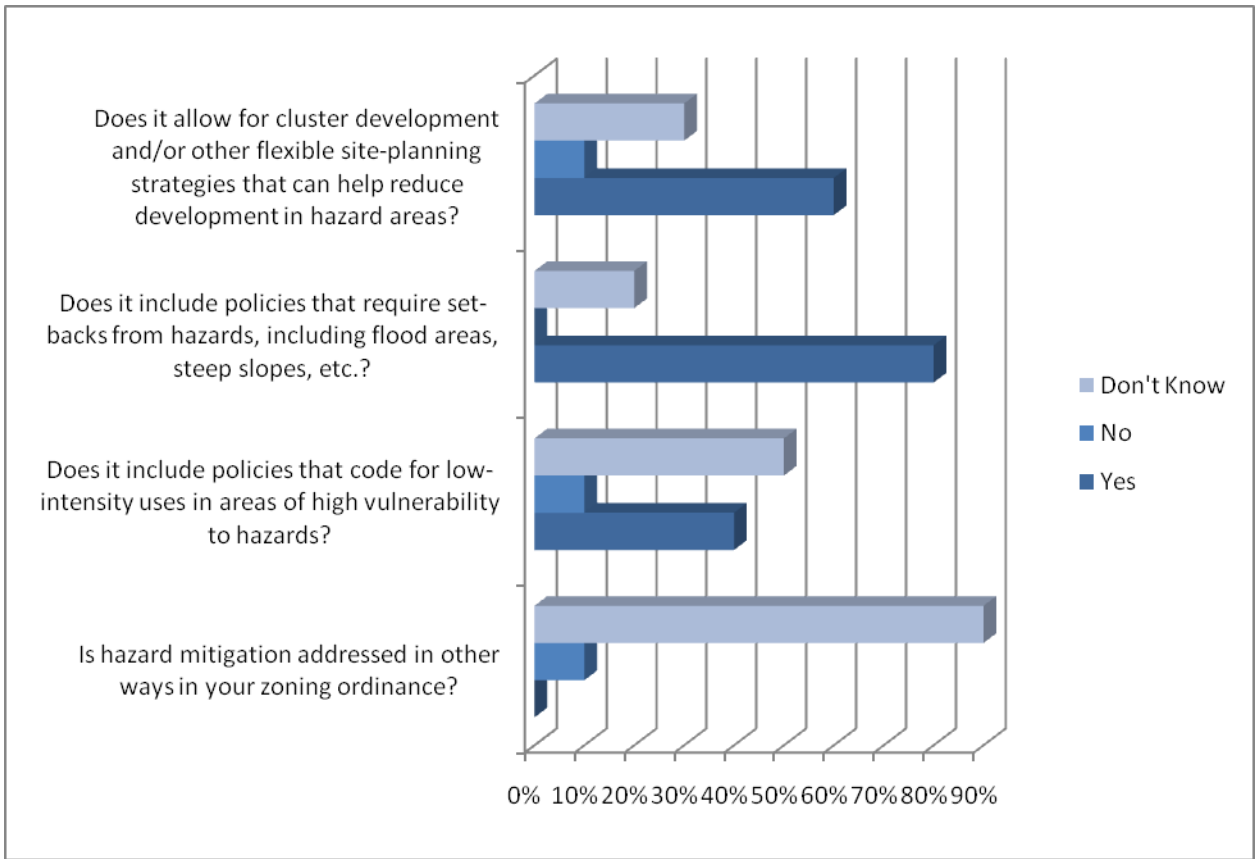
A large majority of respondents (90%) were familiar with their municipality's zoning, as shown in Figure 8.5.2-5. Zoning codes were generally understood to call for limiting development in hazard-prone areas and establishing policies related to set-backs and other mitigation measures near flood areas, steep slopes, etc. Codes were also understood to allow for compliance with floodplain management ordinances that can help mitigate hazards.

Figure 8.5.2-5: Hazard Mitigation Addressed in Municipal Zoning
Answering 10 of 14
(Source: New Jersey Passaic County Municipal Capability Assessment Survey, 2008)



Just over two-thirds of respondents were familiar with their municipality's subdivision ordinance. Subdivision ordinances were generally understood to call for limiting development in hazard-prone areas and establishing policies related to set-backs and other mitigation measures near flood areas, steep slopes, etc.

Figure 8.5.2-6: Hazard Mitigation Addressed in Subdivision Ordinance
Answering 5 of 12
(Source: New Jersey Passaic County Municipal Capability Assessment Survey, 2008)



Floodplain Management

Approximately 27% of respondents reported a familiarity with floodplain management program. As Table 8.5.2-1 shows, 16 of 16 municipalities in Passaic County participate in the NFIP, meaning that they are required under state and federal law to have adopted a model floodplain management ordinance and have a designated floodplain manager. However, the degree of on-the-ground effectiveness of floodplain managers varies widely. Only a few are estimated to be actively engaged in mitigating risk. In some cases, the individual who is formally tasked with the responsibility for floodplain management may not be aware of the assignment.[2]

Of the respondents, over 50% knew which department or agency within their municipality administers the floodplain program.

Table 8.5.2-1: NFIP and CRS Participation in Passaic County
(Source: FEMA)

Municipality	Participating in the National Flood Program as of December, 2008]	CRS Rating
Bloomingdale, Borough of	Yes	10
Clifton, City of	Yes	10
Haledon, Borough of	Yes	10
Hawthorne, Borough of	Yes	10
Little Falls, Township of	Yes	10
North Haledon, Borough of	Yes	10
Passaic, City of	Yes	10
Paterson, City of	Yes	10
Pompton Lakes, Borough of	Yes	10
Prospect Park, Borough of	Yes	10
Ringwood, Borough of	Yes	10
Totowa, Borough of	Yes	10
Wanaque, Borough of	Yes	10
Wayne, Township of	Yes	8
West Milford, Township of	Yes	10
[West Paterson / Woodland Park], Borough of	Yes	10

[2] In the past, municipal building code enforcement/inspectors were often automatically assigned the duties of a floodplain manager. This practice is now being discouraged by the state Division of Codes and Standards (DCA), which is part of the Office of Community Affairs. This agency supervises building inspection programs in New Jersey.

Building Code Enforcement

Respondents reported that building code enforcement is most often (91%) the responsibility of a Building Department. Twenty-seven percent of code enforcement officers have 2 staff working directly with building code enforcement.

Capital Improvement Planning

The primary responders reported that the executive leadership such as the City Council and Mayors office, as well as other departments such as the engineering department and planning boards of their municipalities oversee the capital improvement program. Of the responders, approximately 18% reported that hazard mitigation projects are generally considered as part of the capital improvements program, while 36% reported that capital improvement projects themselves are assessed for hazard or hazard mitigation implications.

Land Conservation

Just over half of the respondents (54%), stated that their municipalities participate in land conservation programs such as Green Acres and Blue Acres. One respondent specified the Department of Environmental Protection as the administrator of these programs.

8.6 Current and Completed Hazard Mitigation Programs and Projects

This section provides a review of the completed hazard mitigation projects or programs and provides a description of potential or in-process projects or programs and the agency or agencies that the county worked with or is working with to complete the projects.

Table 8.6-1: Current and Completed Hazard Mitigation Programs and Projects
(Source: New Jersey Passaic County Municipal Capability Assessment Survey, 2008)

Program or Project	Description	Agency
Hazard Mitigation Plan	The county and its municipalities are currently in the process of developing a Multi-Hazard, Multi-Jurisdictional Hazard Mitigation Plan.	Passaic County OEM
HMGP	Acquisition/Demolition of flood prone property	Little Falls, Township of
HMGP	Acquisition/Demolition of flood prone property	Wayne, Township of
HMGP	Acquisition/Demolition of flood prone property	Wayne, Township of
HMGP	Acquisition/Demolition of flood prone property	Wayne, Township of
HMGP	Acquisition/ Demolition of flood prone property	Wayne, Township of
HMGP	Acquisition/ Demolition of flood prone property	Wayne, Township of
HMGP	Acquisition/ Demolition of flood prone property	Wayne, Township of
HMGP	Acquisition/ Demolition of flood prone property	Wayne, Township of

8.7 Summary and Conclusions

In conclusion, there are several areas which may be investigated further to determine the relevance of developing hazard mitigation strategies to fill gaps or shortcomings. Particularly these areas include: staffing, resources, and coordination.

As noted, there is often little to no staffing available at the local level to devote to hazard mitigation related activities. This includes project identification, data gathering, and overall knowledge about FEMA grants. Furthermore, additional education and training for current staff regarding hazard mitigation, the resources available, and methods of using specified grant funding could assist Passaic County in reducing future risk. This knowledge would also assist in preparing better project applications that may be selected based on a competitive selection process. Increasing staff and resources would subsequently allow for greater coordination among all levels of government.

Section 9
Mitigation Action Plan

Contents of this Section

9.1 Interim Final Rule Requirement for the Mitigation Action Plan
9.2 Mitigation Goals, Objectives, and Actions
9.3 Identification and Analysis of Mitigation Actions
9.4 Flood Mitigation Projects
9.5 Prioritization and Implementation of Mitigation Actions

9.1 Interim Final Rule Requirement for the Mitigation Action Plan

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, an 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.*

9.2 Mitigation Goals, Objectives, and Actions

This section contains goals, objectives, and action items for the Passaic County New Jersey Multi-Jurisdictional 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.
- Objectives (or strategies) describe strategies to attain an identified goal. Objectives are more specific statements than goals; objectives are also usually measurable and can have a defined completion date.
- 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 6 and 7 consisted of identifying the hazards that affect Passaic County and the potential for damage to community assets that are vulnerable to the hazards. Section 8 identified the strengths and weaknesses of state and local capabilities. The goals and objectives described below were established and validated by the Passaic County Hazard Mitigation Planning Committee (HMPC) 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 Passaic County Hazard Mitigation Plan are as follows:

- Goal 1: Improve EDUCATION AND OUTREACH efforts regarding potential impacts of hazards and the identification of specific measures that can be taken to reduce their impact
- Goal 2: Improve DATA COLLECTION, USE, AND SHARING to reduce the impact of hazards
- Goal 3: Improve CAPABILITIES, COORDINATION, AND OPPORTUNITIES at municipal and county levels to plan and implement hazard mitigation projects, programs, and activities
- Goal 4: Pursue OPPORTUNITIES TO IMPLEMENT PROJECTS, including mitigation of repetitive and severe repetitive loss properties and other appropriate hazard mitigation programs, and activities

Specific objectives and actions to support these goals are described below in Table 9.3.2-1. In addition, municipality-specific actions are described in Table 9.3.3-1

For additional information related to state and federal programs and funding sources to support the below actions, please refer to Appendix F.1-F.3; in particular, for detail regarding limitations related to FEMA mitigation grant programs, see Appendix F-3, Table F.3-2.

9.3 Identification and Analysis of Mitigation Actions

9.3.1 Potential Mitigation Actions

Passaic County has identified several hazard mitigation actions that would benefit the county. These were identified in the HMPC 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 Passaic 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 chose to ignore the information available. Public education serves to assist the communities with problems experienced from flood, high wind–straight-line winds, severe storm–winter weather, dam failure, and earthquake/geological, 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 Goal 1.

Projects identified by the HMPC are as follows:

- Develop *All Hazards* public education and outreach program for hazard mitigation and preparedness
- Initiate a public awareness program on local TV for hazard safety
- Conduct evacuation exercises with and for local Office of Emergency Management (OEM) personnel and private citizens
- Conduct yearly workshops related to FEMA hazard mitigation grant programs, including 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 (coordinated with Action 1.B.1, below)
- Educate the public through New Jersey Office of Emergency Management (NJOEM) and New Jersey Forest Fire Service outreach programs and hazard mitigation workshops

National Flood Insurance Program, Floodplain Management, and Building Codes

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 Goal 3. The use of the National Flood Insurance Program (NFIP) is critical to the reduction of future flood damage costs to the taxpayer.

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 BFEs are available.

See Table 9.3.1-1 for the dates on which the communities of Passaic County joined the NFIP.

Table 9.3.1-1
National Flood Insurance Program
(Source: http://www.fema.gov/cis/NJ.pdf)

Name of Community	Date Joined NFIP
Bloomingdale Borough	March 10, 1972
Clifton City	June 15, 1982
Haledon Borough	March 16, 1981
Hawthorne Borough	September 17, 1980
Little Falls Township	August 17, 1981
North Haledon Borough	July 2, 1981
Passaic City	August 28, 1979
Paterson City	February 16, 1977
Pompton Lakes Borough	September 4, 1970
Prospect Park Borough	April 3, 1978

Name of Community	Date Joined NFIP
Ringwood Borough	February 3, 1982
Totowa Borough	August 5, 1985
Wanaque Borough	January 16, 1981
Wayne Township	February 16, 1972
West Milford Township	January 16, 1981
Woodland Park Borough	December 15, 1981

Each municipality within Passaic 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 New Jersey Department of Environmental Protection (NJDEP).

Established through the NFIP, the Community Rating System (CRS) is a program that counties and municipalities can elect to join. Depending on the level of commitment to floodplain management, participants receive a discount on their flood insurance premiums.

Within floodplain management as a whole, the education process must play an important role. As noted above, 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.

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 county and consists of three main components. The first is to advise the homeowners that they live in a repetitive loss area and could be subject to flooding. The second 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 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 community in Passaic County is a participating community in the NFIP Program and 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 Passaic County should encourage additional training opportunities for all code enforcement personnel, to include its municipal floodplain manager.

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

Additionally, floodplain management and land use planning serve to assist the communities with problems experienced from floods, high winds, severe storms, and earthquakes as well as other lower priority hazards.

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

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

Flood Mitigation Actions

Retrofitting structures prone to periodic flooding is an effective mitigation technique to reduce the flood loss of property and is consistent with Goal 4. Techniques include the elevation of structures, acquisition, mitigation reconstruction, dry floodproofing, wet floodproofing, drainage improvements, and installation of generators.

Elevation: involves raising a structure on a new foundation so that the lowest floor is above the BFE. Almost any type and size of structure can be elevated.

Acquisition of Structures: the *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 community 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 SRL grant program that allows demolition and reconstruction of structures when the elevation option 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 Floodproofing: techniques include those that prevent water from entering a structure. It includes the building of floodwalls adjacent to existing walls, the installation of special doors to seal out floodwaters, and special backflow valves for water and sewer lines. Dry floodproofing includes low-cost mitigation measures such as raising air conditioners, heat pumps, and hot water heaters on platforms above the BFE.

Wet Floodproofing: 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,protection of mechanical and utility equipment, and use of openings or breakaway walls. Application of wet floodproofing 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 community.

Drainage: Improving the drainage capacity around roads and low-lying areas is a time-tested technique to mitigate flood damage. Maintenance of drainage canals and laterals is essential to maximize their efficiency and continued long term effectiveness. General actions to reduce the effects of flooding include: widening and deepening the earthen canals, cleaning of existing ditches, replacing existing culverts, upgrading pumps, installing check valves and inverts in certain culverts. Maintaining and improving drainage serves to assist the communities with problems experienced from floods, high winds, and severe storms.

Generators: Another cost-effective retrofitting technique includes the installation of generators. By providing power with generators during and after severe storms, many critical facilities may continue to provide necessary services to the community. The installation of generators serves to assist the communities with problems experienced from floods, high winds, severe storms, earthquakes, and dam failure.

Early Warning Systems

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 community'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 the communities with problems experienced from floods, high winds, severe storms, earthquakes, dam failure, wildfire, and storm surge.

Wind Retrofitting Mitigation Actions

Structures can be retrofitted to withstand high winds by installing hurricane shutters, roof tie-downs and other storm protection features. The exterior integrity is maintained by protecting the interior of the structure and providing stability against wind hazards associated with hurricanes. 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 from 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.

Earthquakes

Significant seismic events, while not common to the region, do pose a potentially significant threat to Passaic County and the surrounding area. The most practical preventative action to be considered, concerns appropriate building code enforcement. While this is not necessarily practical for existing structures except for renovations or reconstruction, there are activities that can be taken to mitigate further exposure to risk.

Building Retrofit: the use of reinforced concrete materials in combination with cross ties is a proven technique to provide current structures with additional stabilization. The addition of seismic stabilizer platforms for important of critical mechanicals within buildings will significantly reduce adverse impacts.

Dam Failure

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

Educational Outreach: develop and conduct educational outreach programs on the associated risks that close proximity to dams presents.

Building Codes: adopt building codes using a flood protection elevation which is based on dam water levels.

Warning Systems: install warning systems to prevent loss of life in the event of a dam failure.

Land Use: avoid construction in areas located within a dam high velocity inundation zone.

Inundation Studies: conduct detailed studies to identify the inundation areas including potential water velocity and height.

Severe Storms–Winter Weather

Heavy snowfall and extreme cold can immobilize the entire region. Winter storms can result in flooding, storm surge, closed highways, blocked roads, downed power lines and hypothermia. Winter storm hazards that affect Passaic County include:

Freezing Rain: Rain that freezes when it hits the ground, creating a coating of ice on roads, walkways, trees, and power lines.

Sleet: Rain that turns to ice pellets before reaching the ground. Sleet also causes moisture on roads to freeze and become slippery.

Blizzard: Sustained winds or frequent gusts to 35 miles per hour or greater and considerable amounts of falling or blowing snow (reducing visibility to less than a quarter mile) are expected to prevail for a period of three hours or longer.

Educational Outreach: develop and conduct educational outreach programs on the associated risks from living and working in areas susceptible to severe winter storm events. Outreach materials can include educating the community on winterization activities, including: caulking and weather-stripping doors and windows, installing storm windows or covering windows, clearing rain gutters, repairing roof leaks, cutting away tree branches that could fall during storms, as well as other possible mitigation activities.

Tornados

Tornadoes are one of nature's most violent storms. They generally originate within powerful thunderstorms and can also accompany tropical storms and hurricanes as they move onto land. Tornados strike quickly, with little or no warning, and are most frequently seen during the spring and summer months.

Educational Outreach: develop and conduct educational outreach programs to teach residents about the threat from high winds and tornados and potential action steps such as designating safe areas within a home as a home shelter.

Building Codes: enforce state building codes designed to mitigate the impact of high winds including tornados, such as building with wind-resistant designs, and strengthening unreinforced masonry.

9.3.2 Countywide Mitigation Actions

The HMPC developed the following program of mitigation actions in response to the risk and capability assessments (see Sections 7 and 8) that will be implemented on a countywide basis. These general actions are presented in Table 9.3.2-1. This program will be implemented under the auspices of Passaic County Office of Emergency Management (PCOEM).

Table 9.3.2-1
Passaic County Hazard Mitigation Goals, Objectives, and General Actions

GOAL 1: Improve **EDUCATION AND OUTREACH** efforts regarding potential impacts of hazards and the identification of specific measures that can be taken to reduce their impact

Objective	Action	Priority (1)	Responsible Entity (2)	Projected Timeline	Projected Resources	Rationale for Action and Priority
Objective 1.A: Increase awareness of risks and understanding of the advantages of mitigation by the general public and local government officials (see also municipal actions in Table 9.3.2-1).	1.A.1: Develop *All Hazards* public education and outreach program for hazard mitigation and preparedness. See additional description regarding Action 1.A.1 on page 9-11.	High	Passaic County and municipal OEMs	One year	Passaic County and municipal OEM personnel	Better informed population creates a greater willingness and expectation to participate in mitigation actions.
	1.A.2: Support development of a public awareness program on local TV channel for hazard safety to be implemented by municipalities where appropriate and consistent with specific municipal action items.	Medium	Passaic County and municipal OEMs	Six months to one year	Passaic County and municipal OEM personnel, local public TV	Better informed and involved population reduces risk and loss.
	1.A.3: Conduct evacuation exercises with and for local OEM personnel and private citizens.	Medium	PCOEM	One year	Passaic County and municipal OEM personnel, local business and citizen groups	Public participation leads to more active emergency and preparedness response.
	1.A.4: Conduct yearly workshops related to FEMA hazard mitigation grant programs, including FMA, HMGP, PDM, SRL, and RFC, with a focus on those aspects available to private firms and property owners (coordinated with Action 1.B.1, below).	High	PCOEM, NJOEM	Ongoing	Existing state assets and federal grants	Makes local officials and the public aware of federal grants thereby increasing participation.

GOAL 1: Improve **EDUCATION AND OUTREACH** efforts regarding potential impacts of hazards and the identification of specific measures that can be taken to reduce their impact						
Objective	**Action**	**Priority (1)**	**Responsible Entity (2)**	**Projected Timeline**	**Projected Resources**	**Rationale for Action and Priority**
	1.A.5: Educate the public through NJOEM and New Jersey Forest Fire Service outreach programs and hazard mitigation workshops.	High	PCOEM, NJOEM, New Jersey Forest Fire Service	Ongoing	Existing state resources	Encourages the development of Pre-Disaster Mitigation plans and participation in mitigation grant programs.
Objective 1.B: Increase local government official awareness regarding funding opportunities for mitigation.	1.B.1: Conduct yearly workshops related to FEMA hazard mitigation grant programs, including FMA, HMGP, PDM, SRL, and RFC (coordinated with Action 1.A.4, above).	High	PCOEM, NJOEM	Ongoing	Existing state assets and federal grants	Makes local officials aware of federal grants thereby increases participation.
Objective 1.C: Increase local government official awareness regarding opportunities for participation in and contributing to future Plan updates.	1.C.1: Reach out to municipal Floodplain Administrators, depts. of planning, public works, engineering, etc. regarding the importance of hazard mitigation planning and provision of municipal plans and data for planning purposes	High	PCOEM, municipal coordinators	Ongoing	Existing county and municipal resources	Makes local officials aware of benefits of plan participation.

County Action 1.A.1: Develop All Hazards public education and outreach program for hazard mitigation and preparedness.

Responsible Agency: County and municipal OEMs.

PCOEM will implement a county-wide committee with local municipalities to develop an "All Hazards" Public Education and Outreach Campaign. The Hazard Mitigation Awareness and Education Campaign will include ***all natural hazards*** identified as applicable to Passaic County.

To foster a more hazard-resilient community, PCOEM will work closely with external stakeholders – especially organizations that can provide technical information and/or assistance in the areas of hazard identification and risk assessment. Tapping into local resources, the County will institute a robust, multi-pronged campaign. Participating jurisdictions will work closely with PCOEM to ensure that the targeted outreach meets its intended audience.

County Tasks:

1. PCOEM will host Hazard Mitigation Awareness and Education Website on the Passaic County website.
2. PCOEM and the Passaic County Planning Department will be responsible for conducting outreach to other relevant stakeholders – e.g., FEMA, NJOEM, colleges and universities, Regional Planning Commissions, river and watershed-based non-profits (e.g., Great Swamp Watershed Association, Rockaway River Watershed Cabinet, etc.), the NJ American Planning Association — and internal stakeholders— Passaic County Departments of Planning, Health, Parks, and GIS. PCOEM and the Passaic County Planning Department will create flyers for dissemination via the Passaic County Fair and other Passaic County events as well as for local distribution via municipal offices, libraries, schools, etc.
3. PCOEM and the Passaic County Planning Department will each be identified as a local resource.

Participating Jurisdiction Tasks:

1. Jurisdiction will provide a direct link to the Passaic County website from the jurisdiction website.
2. Jurisdiction OEMs (with/or Planning Department) will be responsible for identifying and engaging any local agencies or nonprofits that could serve as hazard and/or mitigation subject matter experts and providing contact information (and regular updates) to PCOEM for inclusion on the website.
3. Jurisdiction OEMs (with/or Planning Department) will publicize the website via in-person methods. In-person methods may and should be tailored to the community. Examples include the jurisdiction representative speaking at local fairs, May Day, little league games, and public meetings.
4. Jurisdiction OEMs (with/or Planning Department) will publicize the website via posting/distribution of the Passaic County promotional flyer at high-visibility locations, e.g., municipal offices, libraries, schools, etc.

GOAL 2: Improve **DATA COLLECTION, USE, AND SHARING** to reduce the impact of hazards						
Objective	**Action**	**Priority (1)**	**Responsible Entity (2)**	**Projected Timeline**	**Projected Resources**	**Rationale for Action and Priority**
Objective 2.A: Improve availability to the county and participating municipalities of data related to all relevant hazards for use in future planning efforts. .	2.A.1: Develop and maintain relationships with organizations that can provide technical information and/or assistance in the areas of hazard identification and risk assessment, e.g., incorporate information re: implementation of Risk MAP initiative as source of improved information re: flood risk in participating municipalities.	Medium	PCOEM, Rutgers University, New Jersey Geological Survey (NJGS), National Oceanic and Atmospheric Administration (NOAA) and United States Army Corp of Engineers (USACE)	Ongoing	Existing county staff, FEMA, NJOEM, Rutgers University, NJGS, other federal agencies including NOAA and USACE	Provides the basis for making decisions about where to focus mitigation activities, including further study, and eventually mitigation projects.
	2.A.2: Coordinate with state efforts to undertake detailed vulnerability assessments and develop mitigation options for critical facilities in A and AE zones.	High	Passaic County and municipal OEMs	To be determined based on funding	Existing staff	Step in process of securing grant funds to mitigate risks to these sites.
	2.A.3: Encourage municipal OEMs to continuously update and verify status of repetitive loss and severe repetitive loss lists from the NFIP.	High	Passaic County and municipal OEMs	Ongoing	Existing staff	Essential to continuing the county's efforts to reduce flood losses. Enables the county to appropriately prioritize its actions to mitigate repetitive loss and severe repetitive loss properties, in accordance with FEMA requirements (and contributes to qualifying the county and local jurisdictions for the 90:10 federal-local match under the SRL program).

GOAL 2: Improve **DATA COLLECTION, USE, AND SHARING** to reduce the impact of hazards						
Objective	**Action**	**Priority (1)**	**Responsible Entity (2)**	**Projected Timeline**	**Projected Resources**	**Rationale for Action and Priority**
Objective 2.A, cont.:	2.A.4: Coordinate with NJGS and other county, state and federal agencies to better identify specific sites in the county that may be exposed to the effects of geo-hazards such as landslides, sinkholes, and subsidence and compare results with locations of critical facilities.	Medium	PCOEM, Municipal OEM, NJDEP, NJGS	Ongoing	NJGS	Although risk does not appear to be particularly high from these hazards, there remains a need to better understand the hazards on a site-specific basis. Studies will be used as the basis for developing additional actions and strategies to mitigate risk, particularly when critical facilities are at risk.
	2.A.5: Coordinate with state effort to survey wind vulnerabilities, based on criteria such as age of the facility, value of operations, proximity to the coast, etc., using a prioritized list of state, county, and local facilities,	Low	PCOEM, NJOEM, with cooperation of other agencies that own and/or operate the facilities; New Jersey State Climatologist	Ongoing	NWS, NJ State Climatologist	Although wind is not as significant a risk to the county as some other hazards, there are likely some critical facilities that are quite vulnerable to wind hazards, and where these vulnerabilities may be relatively inexpensive to mitigate.

GOAL 2: Improve **DATA COLLECTION, USE, AND SHARING** to reduce the impact of hazards						
Objective	**Action**	**Priority (1)**	**Responsible Entity (2)**	**Projected Timeline**	**Projected Resources**	**Rationale for Action and Priority**
Objective 2.A, cont.:	2.A.6: Coordinate with state efforts to inventory or survey prioritized areas to determine if there is a need for additional study or data collection related to wildfire and/or urban-interface fires. Focus of inventory/study will be on identifying areas where there exist vulnerable populations or built environment and/or areas where fuel loads and other conditions suggest potential for wildfire risk.	Medium	PCOEM, New Jersey Forest Fire Service, NJOEM	Ongoing	Existing staff	Establishes basis for additional studies and eventually mitigation actions, if they are indicated.
	2.A.7: Coordinate with state efforts to conduct wildfire risk assessments for areas and assets that are determined to have the most hazard (fuel load, etc.) potential, and the most vulnerable structures, populations, or operations.	Medium	PCOEM, New Jersey Forest Fire Service, outside engineering consultants	Ongoing	Potential FEMA grants to conduct studies as indicated.	Quantifies which facilities are at most risk, and forms basis for determining where mitigation actions should be contemplated.
	2.A.8: Maintain effective coordination and information sharing related to hazardous material sites with NJOEM and the Right to Know (RTK) Network.	Medium	PCOEM, RTK Network, NJOEM, Passaic Co. Health	Ongoing	Existing staff	Provides a basis for prioritizing potential hazmat sites for further study and potential responses.
	2.A.9: Complete data collection for Geographic Information System (GIS) analysis and mapping of potential areas of impact related to hazardous material sites.	Medium	Passaic Co. Health and Planning depts.	Ongoing	Existing staff and grants if available	Provides a basis for prioritizing potential hazmat sites for further study and potential responses.

GOAL 2: Improve **DATA COLLECTION, USE, AND SHARING** to reduce the impact of hazards						
Objective	**Action**	**Priority (1)**	**Responsible Entity (2)**	**Projected Timeline**	**Projected Resources**	**Rationale for Action and Priority**
Objective 2.A, cont.:	2.A.10: Integrate data about hazardous materials with most current available information about other risk factors, e.g. population, climate, other site-specific characteristics.	Medium	PCOEM, RTK Network, NJDEP, USEPA, Passaic County Health Dept. and Passaic County PCSD Haz Mat	Ongoing	Existing staff	Potentially allows integration of hazardous materials information with data related to natural hazards.
	2.A.11: Undertake a survey of critical facilities to identify and prioritize those that may have structural characteristics that make them vulnerable to excessive snow and ice loads.	Medium	Passaic County and local agencies with critical facilities	Ongoing	Facility Managers (as time is available)	Provides a basis for prioritizing actions, including mitigation.
	2.A.12: Complete a detailed analysis of past losses related to nor'easters and other coastal storms to determine if additional study is indicated. Work with state and federal agencies to develop a detailed characterization of erosion history and risks in particular.	Medium	Passaic County and local agencies with critical facilities; New Jersey State Climatologist	Ongoing	Existing staff	Provides a basis for determining if any additional study is warranted; data can be used as part of next Plan update.
	2.A.13: Work with appropriate agencies to identify specific areas that are vulnerable to storm effects, then inventory assets and populations in these areas as the basis for a risk calculation.	Medium	PCOEM, municipal OEMs, NOAA, USACE, local officials, NJDEP	Ongoing	Existing staff	Provides a basis for determining if any further risk assessment action is warranted.
	2.A.14: Work with NJDEP to more fully understand the dam hazard rankings and methodology behind them, particular regarding high-hazard sites.	Medium	PCOEM, NJDEP	Ongoing	NJDEP	Provides a basis for further development and prioritization any future actions or strategies.

GOAL 2: Improve **DATA COLLECTION, USE, AND SHARING** to reduce the impact of hazards						
Objective	**Action**	**Priority (1)**	**Responsible Entity (2)**	**Projected Timeline**	**Projected Resources**	**Rationale for Action and Priority**
Objective 2.A, cont.:	2.A.15: Conduct detailed risk assessments for dams that appear to have vulnerabilities, and where there is potential for significant damage or loss of life.	High	PCOEM, NJDEP, engineering consultants	Ongoing	NJDEP, USACE	Quantifies potential losses from dam failures where vulnerabilities have been identified.
	2.A.16: Use best possible flood data, including DFIRM and Map Mod data, if available, in next plan update	High	PCOEM, and municipal OEMs	Ongoing	Existing staff	This is essential data for establishing flood risk.
	2.A.17: Consolidate and incorporate relevant local data related to hazards, extent, probability, exposure, risk, history, etc.	High	PCOEM, and municipal OEMs	Ongoing	Existing resources	Basis for hazard identification, risk assessment, and mitigation strategies
Objective 2.B: Provide government officials and local practitioners with educational opportunities and information regarding best practices for hazard mitigation planning, project identification, and implementation	2.B.1: Participate in the Emergency Preparedness Conference and workshops.	High	Passaic County and municipal OEMs, NJOEM, New Jersey Forest Fire Service	Ongoing	Existing state resources	The Emergency Preparedness Conference is an important venue to promote and increase participation in hazard mitigation programs and reaches a wide variety of people and interests.

GOAL 2: Improve **DATA COLLECTION, USE, AND SHARING** to reduce the impact of hazards						
Objective	**Action**	**Priority (1)**	**Responsible Entity (2)**	**Projected Timeline**	**Projected Resources**	**Rationale for Action and Priority**
Objective 2.C: Acquire and maintain detailed data regarding critical facilities such that these sites can be prioritized and risk-assessed for possible mitigation actions	2.C.1: Develop a database inventory of critical facilities countywide (county-, local-, and privately-owned), including fire and police stations, medical facilities, major public buildings important for emergency response and recovery, and critical lifeline transportation and utility nodes such as bridges, water treatment plants, wastewater treatment plants, high voltage electric substations, and hazardous materials facilities.	High	PCOEM, and municipal OEMs	Ongoing	Existing staff, possibly consultants depending on funding availability	Developing basic information such as this will allow the state to meet federal requirements for prioritizing mitigation grant funds that will be directed to reducing losses to critical facilities.
	2.C.2: Prioritize critical facilities and complete Phase 1 site surveys to identify vulnerabilities.	High	PCOEM, and municipal OEMs	Commencing immediately, then ongoing	Existing staff	This is an essential first step in understanding risks and developing mitigation actions.

GOAL 3: Improve **CAPABILITIES, COORDINATION, AND OPPORTUNITIES** at municipal and county levels to plan and implement hazard mitigation projects, programs, and activities

Objective	Action	Priority (1)	Responsible Entity (2)	Projected Timeline	Projected Resources	Rationale for Action and Priority
Objective 3.A: Continue support of hazard mitigation planning, project identification, and implementation at the municipal and county level.	3.A.1: Continue working with the state, as well as local jurisdictions, to encourage local cooperation in making Repetitive Loss (RL) (and SRL) property mitigation a high priority, and to offer municipalities technical support in carrying out the requirements of FEMA mitigation programs as well as current information related to RL and SRL properties.	High	PCOEM	Ongoing	Existing staff	Represents a basic requirement to initiate and sustain program momentum for RL and SRL mitigation.
	3.A.2: Provide grants information, planning tools, training, and technical assistance to increase the number of public and private sector hazard mitigation projects.	High	PCOEM, NJOEM, FEMA Region II	Ongoing	Existing Resources, Mitigation Grant	Expanding the number of hazard mitigation projects will improve the county's resistance to hazards and reduce the impact of hazard events on its municipalities.
	3.A.3: Conduct direct outreach and education to municipal OEMs and other potential participants in Plan maintenance and future Plan updates	High	PCOEM	Ongoing	Existing resources	Increases efficacy and participating in hazard mitigation planning.
	3.A.4: Work with NJOEM and FEMA to incorporate "recommended revisions" per NJOEM and FEMA Region II review of this Plan into future Plan updates.	High	PCOEM	Ongoing	Existing resources	Builds on successful completion of initial Plan and incorporates NJOEM and FEMA input.

GOAL 3: Improve **CAPABILITIES, COORDINATION, AND OPPORTUNITIES** at municipal and county levels to plan and implement hazard mitigation projects, programs, and activities

Objective	Action	Priority (1)	Responsible Entity (2)	Projected Timeline	Projected Resources	Rationale for Action and Priority
Objective 3.B: Support increased NFIP/CRS participation	3.B.1: Conduct community outreach, workshops, and training to increase NFIP and CRS participation including potentially setting up CRS site visits and/or workshops for interested jurisdictions (coordinate with outreach actions listed under Objectives 1.A and 1.B).	Medium	PCOEM, Municipal OEMs, NJOEM	Ongoing	Existing resources	Encourages participation in NFIP, so flood losses will be insured and covered, allows eligibility in the FMA, encourages participation in the CRS program so NFIP premiums can be reduced and floodplain management improved.
	3.B.2: Encourage municipalities to include identification and prioritization of actions related to future participation in and compliance with the NFIP	High	PCOEM. Municipal OEMs	Ongoing	Existing resources	Encourages participation in NFIP and CRS programs so NFIP premiums can be reduced and floodplain mgmt improved
Objective 3.C: Support increased integration of municipal/county hazard mitigation planning and floodplain management with effective municipal/ county zoning and, subdivision regulation, and comprehensive planning.	3.C.1: Encourage enforcement of floodplain management as it relates to new and existing construction by integrating hazard mitigation practices with zoning, subdivision ordinances, comprehensive planning, and other land use tools at the municipal level.	High	PCOEM, NJDEP, municipal officials	Ongoing	Existing resources and Federal grant funds (FEMA Community Assistance Program-State Support Services Element)	Guides communities in a more effective control and use of floodplains.

GOAL 3: Improve **CAPABILITIES, COORDINATION, AND OPPORTUNITIES** at municipal and county levels to plan and implement hazard mitigation projects, programs, and activities						
Objective	**Action**	**Priority (1)**	**Responsible Entity (2)**	**Projected Timeline**	**Projected Resources**	**Rationale for Action and Priority**
Objective 3.C: cont'd.	3.C.2: Coordinate with state efforts to encourage the New Jersey League of Municipalities to become more involved in mitigation activities, and in particular to support the activities described in Action 3.C.1 and 3.D.1.	Medium	PCOEM, NJOEM, New Jersey League of Municipalities	Ongoing	Existing staff	Advances all goals in the Plan by increasing preparedness and knowledge of citizens, and law and policymakers.
Objective 3.D: Elicit and support efforts by federal and state legislatures and agencies to address shortcomings in existing laws, programs, and administrative rules related to hazard mitigation.	3.D.1: Encourage enforcement of floodplain management as it relates to new and existing construction by integrating hazard mitigation practices with zoning, subdivision ordinances, comprehensive planning, other land use tools, and environmental and other regulatory mechanisms via state requirements, reviews, and regulations. Coordinate with the State Planning Commission to integrate the State Development and Redevelopment Plan and the State Hazard Mitigation Plan Update.	High	PCOEM, NJDCA, NJDEP, State Planning Commission, municipal building inspectors, municipal floodplain managers, local planning/zoning boards	Ongoing	Existing resources	Guides communities in a more effective control and use of floodplains.
Objective 3.E: Provide for user-friendly hazard-data accessibility for mitigation and other planning efforts and for private citizens	3.E.1: Develop a simple GIS platform, or build upon an existing platform, to maintain and analyze critical facilities inventories and information about hazards.	Low	Passaic Co. Planning Dept. and Health Dept.	Ongoing	Existing staff	Provides a basis for understanding risks and maintaining most current information; provides a good means of maintaining data needed for period updates to the Hazard Mitigation Plan; and (potentially) helps to identify promising sites, mitigation actions, and grant proposals.

GOAL 3: Improve **CAPABILITIES, COORDINATION, AND OPPORTUNITIES** at municipal and county levels to plan and implement hazard mitigation projects, programs, and activities						
Objective	**Action**	**Priority (1)**	**Responsible Entity (2)**	**Projected Timeline**	**Projected Resources**	**Rationale for Action and Priority**
Objective 3.F: Provide direct support, where possible, to municipal mitigation programs.	3.F.1: Explore potential for possible regionalization or consolidation of hazard mitigation planning, administration, and/or implementation at the county level.	High	PCOEM	Ongoing	Existing staff	This could help support, coordinate, and consolidate hazard mitigation capabilities.

GOAL 4: Pursue **OPPORTUNITIES TO MITIGATE** repetitive and severe repetitive loss properties and other appropriate hazard mitigation projects, programs, and activities						
Objective	**Action**	**Priority (1)**	**Responsible Entity (2)**	**Projected Timeline**	**Projected Resources**	**Rationale for Action and Priority**
Objective 4.A: Facilitate development and timely submittal of project applications meeting state and federal guidelines for funding (1) for RL and SRL properties and (2) for hardening/retrofitting infrastructure and critical facilities with highest vulnerability ratings.	4.A.1: Coordinate with state efforts to develop and implement a detailed severe repetitive loss mitigation strategy that will qualify the county and municipalities for 90:10 cost share under the FEMA SRL program.	High	PCOEM, NJOEM	Immediate and ongoing	Existing local, state, and federal funding programs	Protects people, property, and response assets while removing high cost structures from the NFIP.
	4.A.2: Continue working with local and regional jurisdictions to encourage and support their efforts to mitigate RL and SRL properties, either individually through the use of cluster solutions and/or basin projects, as appropriate, and offer technical support in carrying out the requirements of FEMA mitigation programs. (see Table 9.3.3-1 for further detail).	High	PCOEM, NJOEM	Ongoing	Federal grants, Green Acres, other open space funds	Initiates a long-term process to protect property from effects of repetitive flooding.
	4.A.3: Implement mitigation projects and programs intended to reduce risk to critical facilities (see Table 9.3.3-1 for further detail).	Low	PCOEM, municipal OEMs and local permitting and planning offices	Ongoing	Federal grants, other state and local sources	Reduces exposure and risk to critical facilities.
	4.A.4: Implement other mitigation projects and programs as appropriate at the municipal level (see Table 9.3.3-1 for further detail).	Low	PCOEM, municipal OEMs and local permitting and planning offices	Ongoing	Federal grants, other state and local sources	Varied

GOAL 4: Pursue **OPPORTUNITIES TO MITIGATE** repetitive and severe repetitive loss properties and other appropriate hazard mitigation projects, programs, and activities						
Objective	**Action**	**Priority (1)**	**Responsible Entity (2)**	**Projected Timeline**	**Projected Resources**	**Rationale for Action and Priority**
Objective 4.B: Maintain and enhance local regulatory standards.	4.B.1: Ensure including full and effective building code enforcement, floodplain management, and implementation of other vulnerability-reducing regulations.	High	PCOEM, municipal OEMs and municipal building inspectors, municipal floodplain managers, local planning/zoning boards	Ongoing	Existing state and local Resources	Advances all goals in the Plan by increasing efficacy of existing local mitigation programs and regulations.
Objective 4.B, cont	4.B.2: Integrate hazard mitigation Plan and priorities into floodplain management, zoning, subdivision regulation, and other local regulations as appropriate.	High	PCOEM, municipal OEMs and local permitting and planning offices	Ongoing	Existing county and local Resources	Implements all goals by mitigating risk to new construction on a jurisdiction-wide basis
	4.B.3: Integrate hazard mitigation priorities into Capital Improvement Plans, transportation planning, and other capital planning	High	PCOEM, municipal OEMs and local planning and engineering offices	Ongoing	Existing county and local Resources	Advances all goals in the plan by ensuring consistency of major investments with mitigation priorities.

Notes:

(1) Priority rankings were developed by PCOEM. See Appendix G and Table G-1 for details of STAPLEE analysis of these mitigation actions.
(2) In all of the action items in Table 9.3.2-1, PCOEM is indicated as one of the responsible agencies. In addition, there are several references to local agencies as responsible parties as well. One of the main roles of PCOEM in these actions - and in general regarding hazard mitigation planning and implementation - is support and facilitation of efforts to be encouraged at the local level. In some cases, municipalities have identified parallel action items (for example, County Action 1.A.1). In those situations, a specific relationship can be described and pursued as joint efforts. However, for most of these actions, the working relationships and specific responsibilities of PCOEM and the participating jurisdictions will need to be developed over time as part of the implementation of each action. It is envisioned that during the five-year period, PCOEM will be able to define workable programs with the municipalities on an on-going basis to better define these implementation strategies and keep workloads within the limits of county and local capabilities.

9.3.3 Municipality-Specific Mitigation Actions

Within Passaic County, 16 municipalities signed letters-of-intent as participating municipalities.

Strategies for hazard mitigation within Passaic County and the municipalities were identified to reduce damage to those areas and conform to the requirements of the Interim Final Rule (IFR). The following 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 Passaic County identified mitigation actions and programs based upon the risk assessment (Section 7) and capabilities assessment (Section 8). These are detailed in Table 9.3.3-1, below. In all cases, these actions support Goal 4, i.e., pursue opportunities to mitigate repetitive and severe repetitive loss properties and other appropriate hazard mitigation projects, programs, and activities.

Table 9.3.3-1
Municipality Specific Mitigation Actions

Mitigation action, program, or project	Hazard(s) addressed	Applies to existing or new structures	Existing local planning/ implementation mechanism	Responsible Party	Target Date	Estimated Cost ($) (1)	Funding Source (2)	Priority (3)
BLOOMINGDALE BOROUGH								
Bloomingdale 1: Backup power for shelter at W.T. Bergen School on 225 Glenwild Avenue	Flood / Extreme weather	Existing	Floodplain Management	Local Emergency Planning Committee (LEPC) / Bloomingdale Office of Emergency Management (OEM)	2 years	$20,000-$30,000	HMGP 5% Initiative	High

Mitigation action, program, or project	Hazard(s) addressed	Applies to existing or new structures	Existing local planning/ implementation mechanism	Responsible Party	Target Date	Estimated Cost ($) (1)	Funding Source (2)	Priority (3)
Bloomingdale 2: Acquisition/Elevation of 20 flood prone properties located on the following roads: Vandam and Post Brooks: Vandam Avenue, Brandt Lane, Walnut Street, Tice Street, Poplar Street, Chestnut Street, and Park Avenue	Flood	Existing	Floodplain Management	Borough Administrator	2 years	$8 million *Note #1*	FMA, PDM-C and HMGP if available *Note #2*	Medium
Bloomingdale 3: Construct new and upgrade existing culverts and retention basin and flood ponds along Vandam Brook and Post Brook along Brandt Lane	Flood	Existing	Floodplain Management	Borough Administrator and (contracted) Engineer	2 years	$1 million	FMA, PDM-C, and HMGP if available Developer Contribution	Medium
Bloomingdale 4: Flood proofing two Repetitive Loss properties located on Charles Street and in Morris Lake development.	Flood	Existing	Floodplain Management	Municipal OEM	2 years	$650,000	FMA, PDM-C and HMGP if available *Note #2*	High
Bloomingdale 5: Install river gauge on Pequannock River (at boundary with Riverdale)	Flood	Existing	Floodplain Management	Municipal OEM	3 to 5 years	$50,000	NJDEP FMA, PDM-C and HMGP if available *Note #2*	High
Bloomingdale 6: Develop all hazards public education and outreach program for hazard mitigation and preparedness.	All Hazards	Existing and New	Emergency Management	OEM Coordinator, in coordination with PCOEM	1 year	Staff Time	Bloomington Borough, PDM-C and HMGP	High

Mitigation action, program, or project	Hazard(s) addressed	Applies to existing or new structures	Existing local planning/ implementation mechanism	Responsible Party	Target Date	Estimated Cost ($) (1)	Funding Source (2)	Priority (3)
CLIFTON CITY								
Clifton 1: Backup power for shelter / distribution center at the Woodrow Wilson Middle School on Van Houten Avenue	All Hazards	Existing	Capital Improvement Plan	City Engineer	6 months	$65,000-$60,000	HMGP 5% Initiative	High
Clifton 2: Backup power for shelter / distribution center at Clifton High School on 333 Colfax Avenue	All Hazards	Existing	Capital Improvement Plan	City Engineer	1 year	$50,000-$60,000	HMGP 5% Initiative	High
Clifton 3: Backup power for shelter / distribution center at Elementary School #17 on Lexington Avenue	All Hazards	Existing	Capital Improvement Plan	City Engineer	6 months	$50,000	HMGP 5% Initiative	High
Clifton 4: Installation of storm-water management culverts for the Department of Public Works building on East 7th Street	Flood	Existing	Floodplain Management	City Engineer	2 years	$350,000	FMA, PDM-C and HMGP if available *Note #2*	Medium
Clifton 5: Relocate Passaic Valley Sewage Pumping Station on Kingslin Road out of floodplain.	Flood	Existing	Floodplain Management	City Engineer	2 years	$5 million	PDM-C and HMGP if available *Note #2*	Medium
Clifton 6: Storm-water management system upgrade along Route 46 at Main Avenue overpass	Flood	Existing	Floodplain Management	City Engineer	2 years	$450,000	PDM-C and HMGP if available *Note #2*	Medium

Mitigation action, program, or project	Hazard(s) addressed	Applies to existing or new structures	Existing local planning/ implementation mechanism	Responsible Party	Target Date	Estimated Cost ($) (1)	Funding Source (2)	Priority (3)
Clifton 7: Storm-water management system upgrade along Route 3 and Hepburn Road	Flood	Existing	Floodplain Management	City Engineer	2 years	$450,000	PDM-C and HMGP if available *Note #2*	Medium
Clifton 8: Upgrade culvert on Sylvan Avenue and Main Avenue	Flood	Existing	Floodplain Management	City Engineer	1 year	$850,000	FMA, PDM-C and HMGP if available *Note #2*	High
Clifton 9: Develop all hazards public education and outreach program for hazard mitigation and preparedness.	All Hazards	Existing and New	Emergency Management	OEM Coordinator, in coordination with PCOEM	1 year	Staff Time	Clifton City, PDM-C and HMGP	High
HALEDON BOROUGH								
Haledon 1: Backup generator for shelter at Haledon Recreation Center	All hazards	Existing	Capital Improvement Plan	Office of Emergency Management (OEM)	2 to 3 years	< $100,000	HMGP 5% Initiative	High
Haledon 2: Backup generator for Haledon Fire Company 1 located on Pompton Road	All hazards	Existing	Capital Improvement Plan	OEM	1 year	< $100,000	HMGP 5% Initiative	High
Haledon 3: Backup generator for Haledon Fire Company 2 located on West Broadway	All hazards	Existing	Capital Improvement Plan	OEM	1 year	< $100,000	HMGP 5% Initiative	High
Haledon 4: Public Warning/Alert System throughout the Borough	All hazards	Existing	Capital Improvement Plan	OEM	1 year	$60,000	State EMPG fund HMGP	Medium

Mitigation action, program, or project	Hazard(s) addressed	Applies to existing or new structures	Existing local planning/ implementation mechanism	Responsible Party	Target Date	Estimated Cost ($) (1)	Funding Source (2)	Priority (3)
Haledon 5: Flood proof 8 flood prone properties located on Henry Street	Flood	Existing	Floodplain Management	Municipal OEM	1 year	$350,000	Existing budget	High
Haledon 6: Develop all hazards public education and outreach program for hazard mitigation and preparedness.	All Hazards	Existing and New	Emergency Management	OEM Coordinator, in coordination with PCOEM	1 year	Staff Time	Haledon Borough, PDM-C and HMGP	High
HAWTHORNE BOROUGH								
Hawthorne 1: Backup generator for shelter at Hawthorne High School	All hazards	Existing	Capital Improvement Plan	Hawthorne Office of Emergency Management (OEM)	1 to 3 years	$95,000	HMGP 5% Initiative	High
Hawthorne 2: Backup generator for shelter at Lincoln Middle School	All hazards	Existing	Capital Improvement Plan	Municipal OEM	1 to 3 years	$95,000	HMGP 5% Initiative	High
Hawthorne 3: Elevate above floodplain seven sewer and water pump stations along the Passaic River	Flood	Existing	Capital Improvement Plan	Municipal OEM	1 to 3 years	$1.5 million	PDM-C and HMGP if available *Note #2*	Medium
Hawthorne 4: Re-channel Goffle Brook into Passaic River	Flood	Existing	Floodplain Management	Municipal OEM, USACE, Passaic County Engineer	5 years	$8 million	NJ DEP	Low

Mitigation action, program, or project	Hazard(s) addressed	Applies to existing or new structures	Existing local planning/ implementation mechanism	Responsible Party	Target Date	Estimated Cost ($) (1)	Funding Source (2)	Priority (3)
Hawthorne 5: Stream bank stabilization and bank augmentation of the Goffle Brook to protect private residences on Brookside Avenue and First Avenue	Erosion	Existing	Capital Improvement Plan	OEM, Passaic County Engineer	1 to 3 years	$850,000	FMA, PDM-C and HMGP if available *Note #2*	Low
Hawthorne 6: Develop all hazards public education and outreach program for hazard mitigation and preparedness.	All Hazards	Existing and New	Emergency Management	OEM Coordinator, in coordination with PCOEM	1 year	Staff Time	Hawthorne Borough, PDM-C and HMGP	High
LITTLE FALLS TOWNSHIP								
Little Falls 1: Backup power for shelter/ back-up 911 center/ backup police, fire, EMS, and communications centers at the Civic Center on 15 Warren Street	All Hazards	Existing	Capital Improvement Plan	Little Falls Office of Emergency Management (OEM)	3 months	$50,000-$60,000	HMGP 5% Initiative State EMPG fund	High
Little Falls 2: Backup power for shelter at St. Agnes Church on 65 Union Avenue	All Hazards	Existing	Capital Improvement Plan	Municipal OEM	3 months	$30,000-$40,000	HMGP 5% Initiative	High
Little Falls 3: Backup power for Fire Company 4 on Long Hill Road	All Hazards	Existing	Capital Improvement Plan	Fire Department	3 months	$20,000-$25,000	HMGP 5% Initiative	High
Little Falls 4: Backup power for Eagle Rescue Squad Company Number 1/ EMS on Wilmore Road	All Hazards	Existing	Capital Improvement Plan	Fire Department	3 months	$20,000-$25,000	HMGP 5% Initiative	High

Mitigation action, program, or project	Hazard(s) addressed	Applies to existing or new structures	Existing local planning/ implementation mechanism	Responsible Party	Target Date	Estimated Cost ($) (1)	Funding Source (2)	Priority (3)
Little Falls 5: Stream bank stabilization to protect Department of Public Works building along the Peckman River on Sindle Avenue.	Flood	Existing	Capital Improvement Plan	Municipal Department of Public Works	1 to 2 years	$875,000	NJ DEP FMA, PDM-C and HMGP if available *Note #2*	Medium
Little Falls 6: Stream bank stabilization along Peckman River from Tulip Gardens and Passaic Valley High School to Route 46.	Flood	Existing	Capital Improvement Plan	OEM Coordinator	1 to 2 years	$950,000	PDM-C and HMGP if available *Note #2*	High
Little Falls 7: Upgrade and improvement of embankment wall located along Cedar Grove Road	Flood	Existing	Capital Improvement Plan	Municipal Department of Public Works	1 to 2 years	$900,000	NJ DEP FMA, PDM-C and HMGP if available *Note #2*	High
Little Falls 8: Backup power for the Municipal Building/ Town Clerk/ Data Storage Facility on 225 Main Street	All Hazards	Existing	Capital Improvement Plan	Municipal Department of Public Works	1 to 2 months	< $100,000	HMGP 5% Initiative State EMPG fund	High

Mitigation action, program, or project	Hazard(s) addressed	Applies to existing or new structures	Existing local planning/ implementation mechanism	Responsible Party	Target Date	Estimated Cost ($) (1)	Funding Source (2)	Priority (3)
Little Falls 9: Upgrade of storm-water pumping station facilitating water removal from the following locations: Garden Street, Roselle Street, Dairy Street, Lyttel Street, Barber Street, River View Circle, William Street, Louis Street, Bogart Place, Fairfield Avenue, Island Avenue, West End Avenue, Orchard Avenue, Grey Rock, Woodcliff Avenue, Micklejohn Avenue, Garrabrant Avenue, Stinson Place, Muller Place, Ryle Avenue, Madison Avenue, Jackson Avenue, Sindle Avenue, Hopson Avenue, Cedar Street and Hudson Street	Flood	Existing	Floodplain Management	Municipal OEM	1-2 years	$1.5 million	PDM-C and HMGP if available *Note #2*.	Medium
Little Falls 10: Elevation of properties on William Street, Louis Street, Garden Street, Roselle Street, Dairy Street, Lyttel Street, and Barber Street (related to Little Falls 7)	Flood	Existing	Floodplain Management	Municipal OEM	1-2 years	< $1 million	FMA, PDM-C and HMGP if available *Note #2*.	Medium
Little Falls 11: Early warning system (reverse 911) to warn residents of flash flooding	Flood	New	Capital Improvement Plan	Municipal OEM	July 1, 2009	< $5,000	Little Falls State EMPG fund	High

Mitigation action, program, or project	Hazard(s) addressed	Applies to existing or new structures	Existing local planning/ implementation mechanism	Responsible Party	Target Date	Estimated Cost ($) (1)	Funding Source (2)	Priority (3)
Little Falls 12: Develop all hazards public education and outreach program for hazard mitigation and preparedness.	All Hazards	Existing and New	Emergency Management	OEM Coordinator, in coordination with PCOEM	1 year	Staff Time	Little Falls Township, PDM-C and HMGP	High
NORTH HALEDON BOROUGH								
North Haledon 1: Backup power for shelter at Grace Bible Church on High Mountain Road	All Hazards	Existing	Capital Improvement Plan	Municipal OEM	3 months	$100,000	HMGP 5% Initiative	High
North Haledon 2: Elevation of utilities out of flood prone basement of the Municipal Building/Data Storage Facility/Police Building	Flood	Existing	Floodplain Management	Municipal OEM	2 years	$250,000	PDM-C and HMPG *Note #2* State EMPG fund	Medium
North Haledon 3: Stream bank stabilization and bank augmentation along the Molly Ann Brook	Flood	Existing	Floodplain Management	Municipal OEM	2 years	$1.5 million	PDM-C and HMPG *Note #2*	Medium
North Haledon 4: Inundation study for Yahn's Pond Dam	Dam Failure	Existing	Floodplain Management	Municipal OEM	2 years	$65,000	FMA, PDM-C and HMGP if available *Note #2*	Medium
North Haledon 5: Develop all hazards public education and outreach program for hazard mitigation and preparedness.	All Hazards	Existing and New	Emergency Management	OEM Coordinator, in coordination with PCOEM	1 year	Staff Time	North Haledon Borough, PDM-C and HMGP	High

Mitigation action, program, or project	Hazard(s) addressed	Applies to existing or new structures	Existing local planning/ implementation mechanism	Responsible Party	Target Date	Estimated Cost ($) (1)	Funding Source (2)	Priority (3)
PASSAIC CITY								
Passaic 1: Stream bank stabilization and augmentation along the Passaic River located at 8th, 9th, and 10th streets near Passaic Street and River Drive	Flood	Existing	Capital Improvement Plan	OEM	2 years	$1 million	PDM-C and HMPG *Note #2*	High
Passaic 2: Public awareness program on local TV channel for hazard safety	All hazards	New	Capital Improvement Plan	OEM	6 months	$5,000	Passaic	Medium
Passaic 3: Code Update	Earthquake / High Wind	New	Building Code Ordinance	Building Department	3 years	Staff time	Passaic	High
Passaic 4: Elevation/Flood-proofing of four repetitive loss properties located on Henry Street	Flood	Existing	Floodplain Management	Municipal OEM	1 year	$800,000	Existing budget	High
Passaic 5: Develop all hazards public education and outreach program for hazard mitigation and preparedness.	All Hazards	Existing and New	Emergency Management	OEM Coordinator, in coordination with PCOEM	1 year	Staff Time	Passaic City, PDM-C and HMGP	High
PATERSON CITY								
Paterson 1: Backup power for shelter at Riverside Vets Community Center, 165 5th Avenue	All Hazards	Existing	Capital Improvement Plan	Municipal OEM	3 to 6 months	$125,000	HMGP 5% Initiative	High

Mitigation action, program, or project	Hazard(s) addressed	Applies to existing or new structures	Existing local planning/ implementation mechanism	Responsible Party	Target Date	Estimated Cost ($) (1)	Funding Source (2)	Priority (3)
Paterson 2: Riverbank augmentation of the Passaic River Corridor along the River Street area	Flood	Existing	Floodplain Management	Municipal OEM	1 to 2 years	$2.2 million	PDM-C and HMGP if available *Note #2*	High
Paterson 3: Flood proof the Public Safety Building on 111 Broadway Street	Flood	Existing	Floodplain Management	Municipal OEM	1 to 2 years	$250,000	FMA, PDM-C and HMGP if available *Note #2*	High
Paterson 4: Acquisition of home on the following roads: East Main Street, Corridor Street, Hilman Street, Presidential Boulevard, Amity Street, North First Street, Percie Street, Stout Street, North Street, Watson Street, and Bergen Street	Flood	Existing	Floodplain Management	Municipal OEM	3 to 5 years	$250,000+	FMA, PDM-C and HMGP if available *Note #2*	Medium
Paterson 5: Develop all hazards public education and outreach program for hazard mitigation and preparedness.	All Hazards	Existing and New	Emergency Management	OEM Coordinator, in coordination with PCOEM	1 year	Staff Time	Paterson City, PDM-C and HMGP	High

Mitigation action, program, or project	Hazard(s) addressed	Applies to existing or new structures	Existing local planning/ implementation mechanism	Responsible Party	Target Date	Estimated Cost ($) (1)	Funding Source (2)	Priority (3)
POMPTON LAKES BOROUGH								
Pompton Lakes 1: Engineering study to determine mitigation actions for the following streets: Lower Ringwood Avenue, Haroldson Place, Washington Avenue, Madison Place, Lincoln Avenue, Central Avenue, Willow Avenue, Elm Street, Magnolia Avenue, Arcadia Road, Albany Avenue, Bedford Road, Cambridge Road, Lower Garden Road, Marion Court, Stiles Court, Hill Court, Henderson Court, West Lenox Court, Riverview Road, Van Ness Avenue, Pine Street, Beech Avenue, Olive Avenue, Dawes Highway, Ramapo Street, Woodlawn Avenue, and Washington Avenue	Flood	Existing	Capital Improvement Plan	Borough Administrator	1 to 5 years	< $250,000	FMA, PDM-C and HMGP if available *Note #2*	High
Pompton Lakes 2: Acquisition of properties on the following streets: River Edge Drive, Laurel Avenue, Walnut Avenue, and Poplar Avenue	Flood	Existing	Floodplain Management	Borough Administrator	3 years	> $1,000,000	Blue Acres FMA, PDM-C and HMGP if available *Note #2*	Medium

Mitigation action, program, or project	Hazard(s) addressed	Applies to existing or new structures	Existing local planning/ implementation mechanism	Responsible Party	Target Date	Estimated Cost ($) (1)	Funding Source (2)	Priority (3)
Pompton Lakes 3: Improved drainage along Sunset Road	Flood	Existing	Capital Improvement Plan	Borough Administrator	1 to 5 years	< $250,000	Pompton Lakes FMA, PDM-C and HMGP if available *Note #2*	Medium
Pompton Lakes 4: Diesel generator for Firehouse / Alternate EOC	All Hazards	Existing	Capital Improvement Plan	Emergency Management Coordinator	1 to 5 years	$150,000	Fire Act Grant Application	High
Pompton Lakes 5: Diesel generator for primary shelter: Lakeside School	All Hazards	Existing	Capital Improvement Plan	Emergency Management Coordinator	1 to 5 years	$150,000	Homeland Security Grants	High
Pompton Lakes 6: River silt and snag removal	Flood	Existing	Capital Improvement Plan	Borough Administrator	1 to 5 years	$250,000 to $500,000	NJ DEP	Low
Pompton Lakes 7: Install check valves on storm drains, total of 6	Flood	Existing	Floodplain Management	DPW	1 to 5 years	$60,000	FMA, PDM-C, and HMGP if available *Note #2*	High
Pompton Lakes 8: Purchase Vac-Truck for storm drain cleaning and related projects	Flood	Existing	Capital Improvement Plan	Borough Administrator	1 to 3 years	$170,000	Pompton Lakes	High
Pompton Lakes 9: Riverbank restoration on Wanaque, Pequannock and Ramapo Rivers	Flood	Existing	Floodplain Management	Borough Administrator	1 to 5 years	$250,000 to $500,000	FMA, PDM-C and HMGP if available *Note #2*	Low

Mitigation action, program, or project	Hazard(s) addressed	Applies to existing or new structures	Existing local planning/ implementation mechanism	Responsible Party	Target Date	Estimated Cost ($) (1)	Funding Source (2)	Priority (3)
Pompton Lakes 10: Annual river clean-up on Wanaque, Pequannock and Ramapo Rivers	Flood	Existing	Capital Improvement Plan	Environ-mental Coordinator	Annually	$15,000	NJ DEP	Low
Pompton Lakes 11: Purchase articulating bucket truck for downed and other tree work	High wind	Existing	Capital Improvement Plan	Borough Administrator	1 to 3 years	$150,000	Pompton Lakes	High
Pompton Lakes 12: Debris removal, confluence of two rivers	Flood	Existing	Capital Improvement Plan	Borough Administrator	1 to 5 years	$250,000 to $500,000	NJ DEP	Low
Pompton Lakes 13: Install local river gauge system	Flood	Existing	Floodplain Management	Emergency Management Coordinator	1 to 3 years	$50,000	Pompton Lakes	High
Pompton Lakes 14: Determine properties at risk due to failure of Ramapo River Dam (per Section 7.3.4) and potential mitigation measures.	Dam Failure	Existing	Capital Improvement Plan	Emergency Management Coordinator	1 year	No cost	N/A	Medium
Pompton Lakes 15: Develop all hazards public education and outreach program for hazard mitigation and preparedness.	All Hazards	Existing and New	Emergency Management	OEM Coordinator, in coordination with PCOEM	1 year	Staff Time	Pompton Lakes Borough, PDM-C and HMGP	High

Mitigation action, program, or project	Hazard(s) addressed	Applies to existing or new structures	Existing local planning/ implementation mechanism	Responsible Party	Target Date	Estimated Cost ($) (1)	Funding Source (2)	Priority (3)
PROSPECT PARK BOROUGH								
Prospect Park 1: Installation of back-flow valves on storm-water outflow pipes to prevent infiltration of sewage system on Short Street near East Main Street.	Flood	Existing	Capital Improvement Plan	DPW	1 to 3 years	$400,000	FMA, PDM-C and HMGP if available *Note #2*	High
Prospect Park 2: Develop all hazards public education and outreach program for hazard mitigation and preparedness.	All	Existing and New	Emergency Management	OEM Coordinator, in coordination with PCOEM	One year	Staff Time	Prospect Park Borough, PDM-C and HMGP	High
RINGWOOD BOROUGH								
Ringwood 1: Retrofit impact resistant shutters to windows and doors on Police Department/data storage facility/Municipal Building located on Margaret King Avenue	High Wind	Existing	Capital Improvement Plan	Department of Public Works Supervisor	2-years	$300,000	FMA, PDM-C and HMGP if available *Note #2*	Medium
Ringwood 2: Flood proof utilities in Municipal Building/Police Department located on Margaret King Avenue.	Flood	Existing	Floodplain Management	Department of Public Works Supervisor	2 years	$400,000	FMA, PDM-C and HMGP if available *Note #2*	Medium
Ringwood 3: Backup power for shelter at EG Hewitt School on Sloatsburg Road	All Hazards	Existing	Capital Improvement Plan	Municipal OEM	Three months	$100,000	HMGP 5% Initiative	High
Ringwood 4: Backup power for shelter at Martin J. Ryerson School on Valley Road	All Hazards	Existing	Capital Improvement Plan	Municipal OEM	Three months	$100,000	HMGP 5% Initiative	High

Mitigation action, program, or project	Hazard(s) addressed	Applies to existing or new structures	Existing local planning/ implementation mechanism	Responsible Party	Target Date	Estimated Cost ($) (1)	Funding Source (2)	Priority (3)
Ringwood 5: Backup power for Peter Cooper School / shelter on Roger Court	All Hazards	Existing	Capital Improvement Plan	Municipal OEM	Three months	$100,000	HMGP 5% Initiative	High
Ringwood 6: Hazard threat recognition regarding mapping and capping of iron mines in Mining Halls/Upper Ringwood Area	Earthquake	Existing	Capital Improvement Plan	Ringwood Office of Engineer	5 years	$10,000,000	NJ DEP PDM-C & HMGP if available	Medium
Ringwood 7: Upgrade and improvement of storm-water culverts along McGee Road.	Flood	Existing	Floodplain Management	Department of Public Works Supervisor	1 to 2 year	$950,000	PDM-C & HMGP if available	High
Ringwood 8: Dam Inundation study of Monksville Dam.	Dam Failure	Existing	Floodplain Management	Municipal OEM	1 year	$75,000	PDM-C & HMGP if available	Low
Ringwood 9: Develop all hazards public education and outreach program for hazard mitigation and preparedness.	All Hazards	Existing and New	Emergency Management	OEM Coordinator, in coordination with PCOEM	One year	Staff Time	Ringwood Borough, PDM-C and HMGP	High
TOTOWA BOROUGH								
Totowa 1: Engineering study to determine best mitigation action for Fire Department located on 93 Lincoln Avenue	Flood	Existing	Floodplain Management	Municipal OEM	6 months	<$100,000	PDM-C and HMGP if available *Note #2*	High
Totowa 2: Backup power for Fire Department located on 400 Riverview Drive	Flood / Extreme weather	Existing	Floodplain Management	Municipal OEM	6 months	$100,000	HMGP 5% Initiative	High

Mitigation action, program, or project	Hazard(s) addressed	Applies to existing or new structures	Existing local planning/ implementation mechanism	Responsible Party	Target Date	Estimated Cost ($) (1)	Funding Source (2)	Priority (3)
Totowa 3: Backup power for Shelter at Totowa Community Center at 393 Union Boulevard	Flood / Extreme weather	Existing	Floodplain Management	Municipal OEM	1 month	$56,000	HMGP 5% Initiative	High
Totowa 4: Engineering study to determine risk of dam failure (bordering Little Falls / Totowa / Wayne / West Paterson municipalities)	Dam Failure	Existing	Floodplain Management	Municipal OEM	2 years	$65,000	NJ DEP FMA, PDM-C and HMGP if available *Note #2*	Low
Totowa 5: Burying power lines along Lower Borough, West End Industrial Park, the Business Section of Route 46, and the Industrial Section of Union Boulevard	High wind / Extreme weather	Existing	Capital Improvement Plan	Municipal OEM	2 to 3 years	<$100,000	PDM-C and HMPG	Medium

Mitigation action, program, or project	Hazard(s) addressed	Applies to existing or new structures	Existing local planning/ implementation mechanism	Responsible Party	Target Date	Estimated Cost ($) (1)	Funding Source (2)	Priority (3)
Totowa 6: Engineering study to determine route of flooding and appropriate mitigation action for properties (including properties on the repetitive loss lists) on the following streets: Norwood Terrace, Riverview Drive, Lincoln Avenue, Boyle Avenue, Charles Street, Franklin Place, Lewis Place, Williams Place, Totowa Road, Jackson Road, Madison Road, Vreeland Avenue, Maltese Drive, West End Road, Crescent Avenue, Margaret Street, and Rosalie Street	Flood	Existing	Floodplain Management	Municipal OEM	1 year	< $150,000	FMA, PDM-C and HMGP if available *Note #2*	High
Totowa 7: Acquisition of properties (including properties on the repetitive loss lists) on Norwood Terrace	Flood	Existing	Floodplain Management	Municipal OEM	1 year	$125,000-$250,000 per home	FMA, PDM-C and HMGP if available *Note #2*	Medium
Totowa 8: Rebuild and relocate Williams Street Sewer Pumping Station	Flood	Existing	Floodplain Management	Municipal OEM	1 year	$2.5 million	PDM-C and HMPG	Medium
Totowa 9: Rehabilitation and install new pump for storm water for Lower Borough area	Flood	Existing	Floodplain Management	Municipal OEM	2 to 3 years	$1.5 million	PDM-C and HMPG	Medium
Totowa 10: Backup power for EOC located at 22 Mitchell Avenue	Flood / Extreme weather	Existing	Floodplain Management	Municipal OEM	1 year	$75,000	HMGP 5% Initiative	High

Mitigation action, program, or project	Hazard(s) addressed	Applies to existing or new structures	Existing local planning/ implementation mechanism	Responsible Party	Target Date	Estimated Cost ($) (1)	Funding Source (2)	Priority (3)
Totowa 11: Backup power for Municipal Complex located at 537 Totowa Road	Flood / Extreme weather	Existing	Floodplain Management	Municipal OEM	1 year	$250,000	HMGP 5% Initiative	High
Totowa 12: Rebuild Riverview Pump Station located at 100 Riverview Drive	Flood / Extreme weather	Existing	Floodplain Management	Municipal OEM	5 years	2.5 million	PDM-C and HMPG	Medium
Totowa 13: Install early warning system	Flood / Extreme weather	Existing	Floodplain Management	Municipal OEM	1 year	$200,000	HMGP 5% Initiative	High
Totowa 14: Backup Power for Fire House/Shelter located at 11 Mitchell Avenue	Flood / Extreme weather	Existing	Floodplain Management	Municipal OEM	1 year	$75,000	HMGP 5% Initiative	High
Totowa 15: Develop all hazards public education and outreach program for hazard mitigation and preparedness.	All Hazards	Existing and New	Emergency Management	OEM Coordinator, in coordination with PCOEM	One year	Staff Time	Totowa Borough, PDM-C and HMGP	High
WANAQUE BOROUGH								
Wanaque 1: Dredge/deepen/widen Post Brook at Ringwood Avenue (major thoroughfare/ evacuation route)	Flood	Existing	Capital Improvement Plan	Municipal OEM	5 years	<$1 million	NJ DEP Army Corps of Engineers	Low
Wanaque 2: Dredge/deepen/widen Posts Brook tributary at DuPont Avenue and Makemoney Avenue	Flood	Existing	Capital Improvement Plan	OEM, NJDEP, US EPA (4)	5 years	<$1 million	NJDEP Army Corps of Engineers	Low

Mitigation action, program, or project	Hazard(s) addressed	Applies to existing or new structures	Existing local planning/ implementation mechanism	Responsible Party	Target Date	Estimated Cost ($) (1)	Funding Source (2)	Priority (3)
Wanaque 3: Storm-water management culvert upgrade and improvement along Crescent Road and Treemont Terrace	Flood	Existing	Capital Improvement Plan	Municipal OEM	1 to 3 years	$350,000	FMA, PDM-C and HMGP if available *Note #2*	High
Wanaque 4: Assess risk from Ramapo Fault on Algonquin and Texas Eastern pipelines and Raymond Dam	Earthquake	Existing	Capital Improvement Plan	Municipal OEM	1 to 3 years	< $100,000	NJDEP FMA, PDM-C and HMGP if available *Note #2*	Low
Wanaque 5: Flood proof flood prone properties along Dupont Ave, Makemoney Avenue and Evergreen Avenue	Flood	Existing	Floodplain Management	Municipal OEM	1 year	$950,000	FMA, PDM-C and HMGP if available *Note #2*	High
Wanaque 6: Determine properties at risk due to failure(s) of Monksville Dam and Raymond Dam (per Section 7.3.4) and potential mitigation measures.	Dam Failure	Existing	Capital Improvement Plan	Municipal OEM	1 year	Staff time	N/A	Low
Wanaque 7: Develop all hazards public education and outreach program for hazard mitigation and preparedness.	All Hazards	Existing and New	Emergency Management	OEM Coordinator, in coordination with PCOEM	One year	Staff Time	Wanaque Borough, PDM-C and HMGP	High

Mitigation action, program, or project	Hazard(s) addressed	Applies to existing or new structures	Existing local planning/ implementation mechanism	Responsible Party	Target Date	Estimated Cost ($) (1)	Funding Source (2)	Priority (3)
WAYNE TOWNSHIP								
Wayne 1: Acquisition of properties on Fayette Avenue in Hoffman Grove section (in planning stages)	Flood	Existing	Floodplain Management	Municipal OEM	2009	$200,000	NJDEP; Blue Acres FMA, PDM-C and HMGP if available *Note #2*	Medium
Wayne 2: Acquisition of properties in Old Wayne section	Flood	Existing	Floodplain Management	Municipal OEM	2009	$2,800,000	NJDEP; Blue Acres FMA, PDM-C and HMGP if available *Note #2*	Medium
Wayne 3: Acquisition of properties in Hoffman Grove (active project partially funded)	Flood	Existing	Capital Improvement Plan	Municipal OEM	2010	$13,540,000	NJDEP; Blue Acres FMA, PDM-C and HMGP if available *Note #2*	High
Wayne 4: Old Wayne Dike upgrade.	Flood	Existing	Floodplain Management	Municipal OEM	2015	$4,200,000	US Army Corps of Engineers	High

Mitigation action, program, or project	Hazard(s) addressed	Applies to existing or new structures	Existing local planning/ implementation mechanism	Responsible Party	Target Date	Estimated Cost ($) (1)	Funding Source (2)	Priority (3)
Wayne 5: Planning and Zoning on-going project to review and revise Wayne Floodplain Management regulations and the Wayne Township Master Plan to meet NFIP standards and regulate land development.	All hazards	Existing and new	Floodplain Management / Master Plan	Wayne Department of Planning and Zoning	2009 (2007 Master Plan Revisions)	< $10,000	NJDCA Smart Future Planning Grants; FMA, PDM-C and HMGP if available *Note #2*	High
Wayne 6: Develop all hazards public education and outreach program for hazard mitigation and preparedness.	All Hazards	Existing and New	Emergency Management	OEM Coordinator, in coordination with PCOEM	One year	Staff Time	Wayne Township, PDM-C and HMGP	High
WEST MILFORD TOWNSHIP								
West Milford 1: Upgrade and improve storm-water culverts along Burnt Meadow Road	Flood	Existing	Floodplain Management	Township Engineer	18 months	$450,000	FMA, PDM-C and HMGP if available *Note #2*	Medium
West Milford 2: Armor Lower Pond Dam at Bubbling Spring	Dam Failure	Existing	Floodplain Management	Township Engineer	18 months	$550,000	NJDEP Army Corps of Engineers	Low
West Milford 3: Stream bank stabilization of banks by High Crest Dam	Flood	Existing	Floodplain Management	Township Engineer	18 months	$550,000	NJDEP Army Corps of Engineers	Low
West Milford 4: Replace Crescent Road Bridge	Flood	Existing	Floodplain Management	Township Engineer	18 months	$250,000 – $500,000	NJDOT NJDEP	Low
West Milford 5: Replace High Crest Drive Bridge at spillway	Flood	Existing	Floodplain Management	Township Engineer	18 months	$250,000 – $500,000	NJDOT NJDEP	Low

Mitigation action, program, or project	Hazard(s) addressed	Applies to existing or new structures	Existing local planning/ implementation mechanism	Responsible Party	Target Date	Estimated Cost ($) (1)	Funding Source (2)	Priority (3)
West Milford 6: Dredge Belcher Creek (in part to relieve flooding of repetitive loss properties	Flood	Existing	Floodplain Management	Township Engineer	90 days	$1 million	NJDEP Army Corps of Engineers	Low
West Milford 7: Upgrade storm drainage system on Cherry Ridge Road	Flood	Existing	Floodplain Management	Township Engineer	90 days	$250,000	FMA, PDM-C and HMGP if available *Note #2*	High
West Milford 8: Back-up generator for Township emergency management shelters and Public Safety Buildings	All hazards	Existing	Capital Improvement Plan	OEM	1-year	$350,000	HMGP 5% Initiative	High
West Milford 9: Public warning / alert system	All hazards	Existing	Capital Improvement Plan	OEM	1-year	$100,000	NJDEP FMA, PDM-C and HMGP if available *Note #2*	High
West Milford 10: Acquisition/Elevation of 50 flood prone properties located near Belchers Creek.	Flood	Existing	Floodplain Management	OEM	2 years	$10 million	FMA, PDM-C and HMGP if available *Note #2*	High
West Milford 11: Determine properties at risk due to failure(s) of Clinton Reservoir and Charlottesburg Dam (per Section 7.3.4) and potential mitigation measures.	Dam Failure	Existing	Capital Improvement Plan	OEM	1 year	Staff time	N/A	Low

Mitigation action, program, or project	Hazard(s) addressed	Applies to existing or new structures	Existing local planning/ implementation mechanism	Responsible Party	Target Date	Estimated Cost ($) (1)	Funding Source (2)	Priority (3)
West Milford 12: Develop all hazards public education and outreach program for hazard mitigation and preparedness.	All Hazards	Existing and New	Emergency Management	OEM Coordinator, in coordination with PCOEM	One year	Staff Time	West Milford Township, PDM-C and HMGP	High
WOODLAND PARK BOROUGH								
Woodland Park 1: Construct a bypass tunnel from Peckman River to divert water and avoid flash flooding along these roads: *(continued)* McBride Avenue, Lackawanna Avenue, Bergen Boulevard, Pompton Avenue, Ryle Park Avenue, Passaic Avenue, Rockaway Avenue, Ramapo Avenue, Dowling Parkway, Hromiak Terrace, Lozrovich Place, Wallace Lane, Vetrone Drive, Browertown Road, Andrews Drive, Ray Avenue, and Radcliffe Avenue	Flood	Existing	Floodplain Management	Municipal OEM	3-5 years	< $ 10 million	Army Corps of Engineers PDM-C and HMPG	Low
Woodland Park 2: Construct dikes, improve conveyance, flood tunnel along Passaic River	Flood	Existing	Floodplain Management	Municipal OEM	3-5 years	< $1 million	NJDEP Army Corps of Engineers	Low

Mitigation action, program, or project	Hazard(s) addressed	Applies to existing or new structures	Existing local planning/ implementation mechanism	Responsible Party	Target Date	Estimated Cost ($) (1)	Funding Source (2)	Priority (3)
Woodland Park 3: Work with Passaic County to improve storm drainage carrying capacity, confluence (straighten out to reduce debris), adjust to address bridge and culvert replacement issue on McBride Avenue and /or Browertown Road	Flood	Existing	Floodplain Management	Municipal OEM	> 1 year	> $1 million	FMA, PDM-C and HMGP if available *Note #2*	Medium
Woodland Park 4: Install emergency flood warning system	Flood	New	Floodplain Management	Municipal OEM	3 months	$100,000	NJDEP FMA, PDM-C and HMGP if available *Note #2*	High
Woodland Park 5: Retrofit Municipal Building/Police/Tri-Town EOC (Woodland Park / Totowa / Little Falls) on 5 Brophy Lane	Earthquake	Existing	Capital Improvement Plan	Municipal OEM	2 months	$250,000 to $500,000	PDM-C and HMPG	High
Woodland Park 6: Relocate/elevates shelter eight or more feet, install backup power at the Youth and Senior Center located at 8 Memorial Drive	Flood / Extreme weather	Existing	Floodplain Management	Municipal OEM	1 year	$300,000 for contents damage	HMPG HMGP 5% Initiative	Medium
Woodland Park 7: Backup power/improve mechanical plumbing of shelter at Beatrice Gilmore School located at 1068 McBride Avenue	All Hazards	Existing	Floodplain Management	Municipal OEM	1 month	< $250,000	HMGP 5% Initiative	High

Mitigation action, program, or project	Hazard(s) addressed	Applies to existing or new structures	Existing local planning/ implementation mechanism	Responsible Party	Target Date	Estimated Cost ($) (1)	Funding Source (2)	Priority (3)
Woodland Park 8: Backup power for shelter at Memorial School located on Memorial Drive	All Hazards	Existing	Floodplain Management	Municipal OEM	1 to 6 months	< $250,000	HMGP 5% Initiative	High
Woodland Park 9: Upgrade sewer system, valve checks on plumbing, and retrofit Fire Company #2 on 1070 McBride Avenue	Flood/High wind/ Earthquake	Existing	Floodplain Management	Municipal OEM	1 to 6 months	< $250,000	FMA, PDM-C and HMGP if available *Note #2*	High
Woodland Park 10: Backup power for shelter at Charles Olban School located at 8 Lincoln Lane	All Hazards	Existing	Capital Improvement Plan	Municipal OEM	1 month	< $250,000	HMGP 5% Initiative	High
Woodland Park 11: Backup power for EMS building located on 23 Rose Place	All Hazards	Existing	Capital Improvement Plan	Municipal OEM	1 month	< $250,000	HMGP 5% Initiative	High
Woodland Park 12: Elevate and/or flood-proof private dwellings that have had repetitive loses (Mc Bride Avenue and Bergen Boulevard)	Flood	Existing	Floodplain Management	Municipal OEM	2 to 4 months	> $1,000,000	FMA, PDM-C and HMGP if available *Note #2*	High
Woodland Park 13: Determine properties at risk due to failure(s) of New Street Reservoir Dam (per Section 7.3.4) and potential mitigation measures.	Dam Failure	Existing	Capital Improvement Plan	Municipal OEM	1 year	Staff time	N/A	High

Mitigation action, program, or project	Hazard(s) addressed	Applies to existing or new structures	Existing local planning/ implementation mechanism	Responsible Party	Target Date	Estimated Cost ($) (1)	Funding Source (2)	Priority (3)
Woodland Park 14: Develop all hazards public education and outreach program for hazard mitigation and preparedness.	All Hazards	Existing and New	Emergency Management	OEM Coordinator, in coordination with PCOEM	One year	Staff Time	Woodland Park Borough, PDM-C and HMGP	High

Notes:

(1) If a study is incorporated as an initial phase within a capital improvement project, it is more likely to receive federal funding from programs such as FMA, PDM-C and HMGP. If the study is a stand alone project, it is less likely that FEMA funded programs will be able to be utilized.

(2) Priorities and definitions of eligible projects under FEMA funding programs can change from year to year and disaster to disaster. Where multiple federal funding sources are identified under "Funding Source", the applicant will need to be aware of when notices of funding availability are published by FEMA and then carefully review to determine if a particular project will be eligible for that specific funding source. In addition, the definition and scope of the project may need to be adjusted to best conform to eligibility guidelines at the time of application

(3) Priority rankings were developed with the participation of the municipalities. See Appendix G, Table G-2 for details of STAPLEE analysis of these mitigation actions.

9.4 Flood Mitigation Projects

A significant percentage of the projects identified in Table 9.3.3-1 are related to flooding; in all 67 projects are related to flood hazards in the participating municipalities. The following exhibit, Figure 9.4-1, shows the relationship between designated floodplains and these projects.

Figure 9.4-1: Flood Related Mitigation Projects in Passaic County, New Jersey

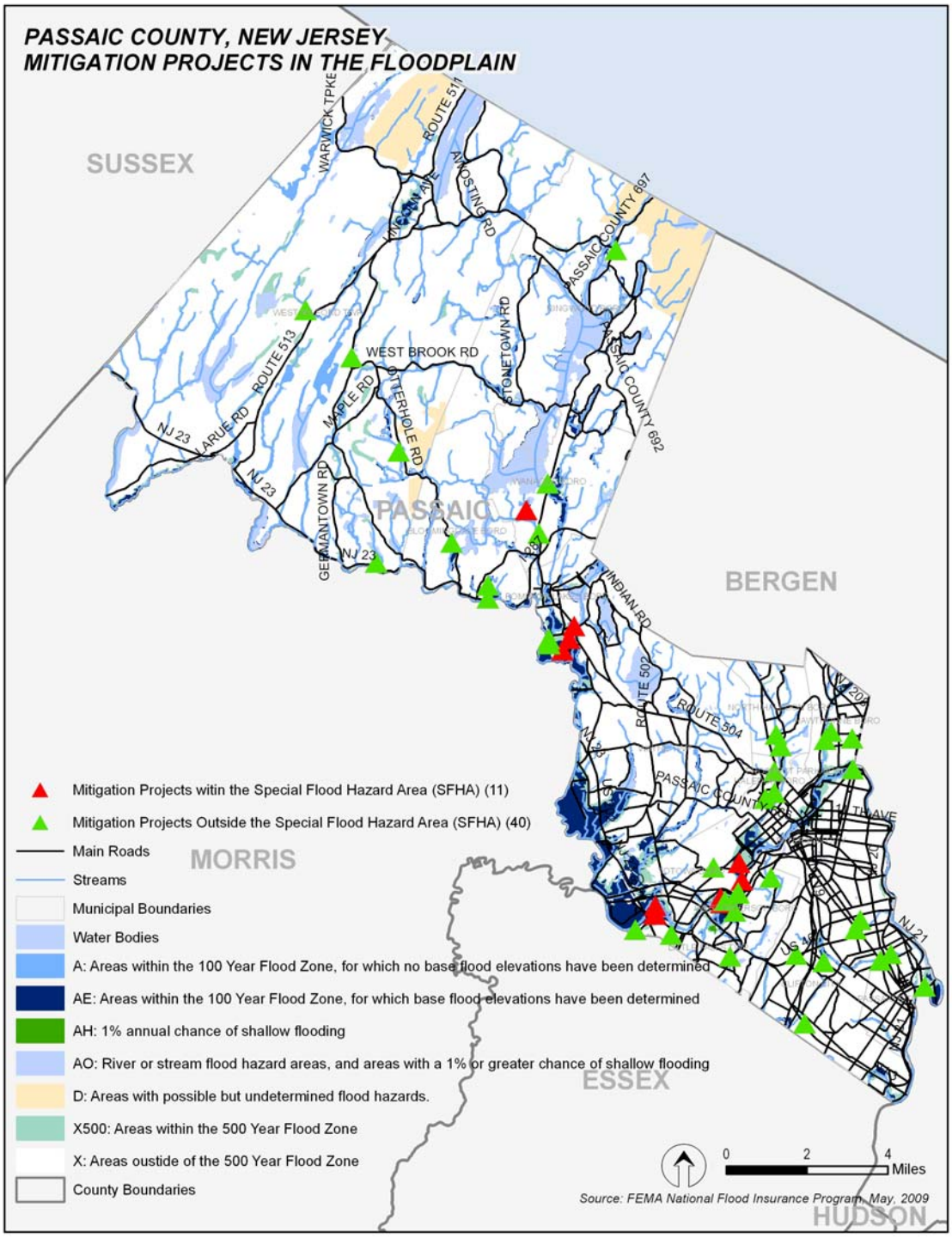


Table 9.4-1 shows the number of these projects that fall within the delineated flood zones[1]

Table 9.4-1−Flood Mitigation Projects versus Flood Zone Locations

Flood Zone	Number of Flood Mitigation Projects
AE	11
X500	6
X	34
Total	51

According to this tabulation, 51 of the flood mitigation projects, or 76% fall into the A, AE, or the new 0.2% Annual Change Flood Hazard Zone. This is a relatively small percentage of the total number of projects. A visual inspection of the figure however shows that a much higher percentage of the projects appear to be located in or near delineated flood zones. The differences could be attributed to the following:

- Many of the flood mitigation projects are in fact out of the delineated flood zones but represent recurrent problem areas in close proximity of the delineated flood zones that the participating municipalities desire to address in their mitigation actions.
- Location information for the projects includes a margin of error.

Due to limitations in available data regarding structures in and around the flood zones, it is difficult to better correlate the current risk assessment and identified flood mitigation projects. However, there are several action items identified in this Section that are specifically intended to improve the available information for future Plan updates.

9.5 Prioritization and Implementation of Mitigation Actions

The preceding sections identify specific actions to achieve identified goals, an appropriate responsible party for each action, and a schedule for accomplishment and suggested funding sources. These tables also indicate an initial prioritization of the actions.

In the case of the countywide actions, priorities were initially determined on a qualitative basis by the HMPC. The considerations were general feasibility and anticipated effectiveness in reducing risk. Detailed benefit cost analyses were not performed (see notes below) but general cost effectiveness of the types of actions being considered was taken into account.

In addition, an analysis of these actions was undertaken in a systematic way that is called the *Social, Technical, Administrative, Political, Legal, Economic, and Environmental* (STAPLEE) method. Table 9.5-1 describes the basic steps in the STAPLEE methodology.

[1] The floodzone delineations used in this figure are per DFIRM data. DFIRMs were finalized and adopted by the Passaic County Board of Freeholders at the time of plan

Table 9.5-1: STAPLEE Methodology

STAPLEE	Criteria Explanation
S-Social	Mitigation actions are acceptable to the community if they do not adversely affect a particular segment of the population, do not cause relocation of lower income people, and if they are compatible with the community's social and cultural values.
T-Technical	Mitigation actions are technically most effective if they provide long-term reduction of losses and have minimal secondary adverse impacts.
A-Administrative	Mitigation actions are easier to implement if the jurisdiction has the necessary staffing and funding.
P-Political	Mitigation actions can truly be successful if all stakeholders have been offered an opportunity to participate in the planning process and if there is public support for the action.
L-Legal	It is critical that the jurisdiction or implementing agency have the legal authority to implement and enforce a mitigation action.
E-Economic	Budget constraints can significantly deter the implementation of mitigation actions. Hence, it is important to evaluate whether an action is cost-effective, as determined by a cost benefit review, and possible to fund.
E-Environmental	Sustainable mitigation actions that do not have an adverse effect on the environment, that comply with federal, state, and local environmental regulations, and that are consistent with the community's environmental goals, have mitigation benefits while being environmentally sound.

This method was used by PCOEM to weigh the various criteria for each of the identified actions and objectives, including the relative cost-effectiveness as part of the "Economic" criteria. The resulting priority rankings are shown in Table 9.3.2-1. The detailed scoring of each action for each criterion is shown in Table G-1 in Appendix G.

For the municipal mitigation actions, initial priorities were set in a similar manner by the Local Coordinators; the mitigation action items with highest priority were generally considered to be the most cost effective and most compatible with the communities' social and cultural values.

The mitigation actions for the municipalities were also analyzed using the STAPLEE criteria and results reviewed and approved by each of the municipal coordinators. The resulting priority rankings are shown in Table 9.3.3-1. The detailed scoring of each action for each criterion is shown in Table G-2 in Appendix G.

Per the results of the Capability Assessment in Section 8, of particular concern regarding the effective implementation of mitigation actions and strategies is that there is often little to no staffing available at the local level to devote to hazard mitigation related activities. Staffing, resources, and coordination of effort are at a premium with little chance of significant change to these issues in the foreseeable future. Therefore, the inclusion of any specific action item in this document does not commit the county or municipalities to implementation. Each item will be considered for implementation in terms of the available staff and funding resources on a periodic basis. In addition, certain items may require regulatory changes or other decisions that must be implemented through standard processes, such as changing regulations.

Individual communities will implement identified projects with their own resources as they are able to program capital improvement funds. The individual municipalities will generally follow the priorities set in this Plan, although variations in funding may alter the specific order. However, it is anticipated that the majority of the actions in the Plan will be implemented as funds become available through various federal mitigation grant programs.

The HMPC will also use the STAPLEE methodology to help them consider and prioritize potential action items for funding applications at that time.

The HMSC determined that it will be appropriate to revisit this STAPLEE analysis when funding is either available or being actively sought, because the qualitative characteristics of certain projects or priorities may shift over time or as a result of changing circumstance.

Once funding sources are identified (e.g., via grant announcements from NJOEM or FEMA) the list of mitigation actions will be reviewed to select actions that meet the particular grant criteria. Then, the HMPC will determine priority rankings for the short list of projects. Tentatively, the HMPC have defined High, Medium, and Low priorities to be assigned in this process as follows:

- High: Meets five or more of the seven STAPLEE criteria
- Medium: Meets four of the seven STAPLEE criteria
- Low: Meets three or fewer of the seven STAPLEE criteria

Depending on the available grant funding, the HMPC will determine how many of the selected and prioritized projects should be submitted for funding starting with the highest priority projects as determined at the time.

Benefit-Cost Analysis

Per the IFR, communities are required to use benefit cost analysis to prioritize projects for implementation. At this stage, the analysis of costs and benefits has been done at a general level as part of the STAPLEE methodology. However, as project funding becomes available, the county and municipalities will undertake a more extensive process.

Benefit-cost analysis (BCA) compares the benefits of mitigation measures to the costs, and is a technique used for evaluating the cost-effectiveness of mitigation measures. FEMA requires a BCA for all mitigation projects that receive FEMA funding.

The HMPC discussed the potential costs associated with each type of mitigation measure and decided that any project could be cost effective if its scope were properly tailored to the situation. For example, one of the most effective mitigation measures identified for repetitively flooded structures is elevation. It may not be cost effective to elevate every single repetitively flooded structure in the county, but it certainly would be cost effective to elevate those that cause the largest drain to the NFIP.

After discussing the possible costs of the various mitigation measures, the HMPC decided that instead of working on developing a very generic BCA at this time for projects that may not ever be authorized, they would wait until specific funding sources are identified and available. For example, most municipalities are not financially capable of elevating or acquiring any repetitively flooded structures without federal grant assistance. However, at the time that grants become available (HMGP, after disasters or PDM and FMA grants, annually), the county will collect detailed information on each structure that is interested in participating in the grant program and perform a BCA to help rank the structures as part of the STAPLEE process to determine which should receive funding first.

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Section 10
Plan Monitoring and Maintenance

Contents of this Section

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10.6 Other Local Planning Mechanisms
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10.1 Interim Final Rule Requirement for Plan Monitoring and Maintenance

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.*

10.2 Method for Monitoring the Plan

This Plan will be monitored by the Passaic County Office of Emergency Management (PCOEM) for several related purposes:

- Maintain the currency of hazard and risk information.
- Ensure that mitigation projects and actions reflect the priorities of Passaic County and stakeholders.
- To comply with Federal Emergency Management Agency (FEMA) and New Jersey state requirements for plan maintenance and maintain Passaic County's eligibility for federal disaster assistance and mitigation grants.

The Passaic County Emergency Management Coordinator will monitor the Plan with respect to the purposes noted above, according to the schedule described in Section 10.3 and with respect to the update triggers noted in Section 10.5 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;
  - 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 regarding the need and/or advantages of undertaking updates to all or part of the Plan prior to the five-year required update (see Section 10.4).

10.3 Schedule for Monitoring the Plan

Informal Plan-monitoring activities will be ongoing. In addition to the FEMA mandated five year update cycle, the Passaic County Emergency Management Coordinator or their designee (Coordinator) will perform monitoring activities for the Plan as described in Section 10.2 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 9 may be made or additional event-specific actions identified.

10.4 Method and Schedule for Evaluating and Updating the Plan

Comprehensive evaluation of and updates to this Plan will be undertaken on a five-year cycle (at a minimum). This Plan was adopted on August 12, 2010, and thus must undergo a formal FEMA-compliant update process by August 12, 2015. Approximately one year prior to the five year anniversary of Plan adoption or sooner if circumstances require, the Coordinator will initiate a comprehensive evaluation 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 Passaic County;
- 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 implemention; and

- Results in implementing the Plan per monitoring reports (per Sections 10.2 and 10.3).

The Coordinator will prepare a report (1) describing the update 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 Passaic County Hazard Mitigation Planning Committee (HMPC) and Passaic County Board of Chosen Freeholders for consideration. The report will also be posted on the Passaic CountyOEM website for public review and comment.

The HMPC and the Board of Chosen Freeholders will review the report and recommendations and advise the Coordinator how to proceed on the individual recommendations for the updates. The Coordinator will initiate activities to carry out the recommendations, and will prepare draft updates to the Plan on a schedule determined in cooperation with the HMPC and the Board of Chosen Freeholders.

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

10.5 Circumstances that will Initiate Plan Review and Updates

This section identifies the circumstances or conditions under which (PCOEM) will initiate Plan reviews and updates.

- On the recommendation of the Coordinator or on its own initiative, the Passaic County Board of Chosen Freeholders may initiate a Plan review at any time.
- At approximately the six month anniversary of the initial Plan adoption, and every six months thereafter.
- After natural hazard events that appear to significantly change the apparent risk to Passaic County assets, operations and/or constituents.

10.6 Other Local Planning Mechanisms

It should be noted that Passaic 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. This Plan will be incorporated, to the extent possible, into the Passaic County Farmland Preservation, Open Space, Parks and Recreation Trust Fund Plan, and the Passaic County Capital Improvement Program. In addition, Passaic County OEM will work with individual municipalities to incorporate the recommendations of the Plan into local comprehensive planning and capital improvement programs.

Participating municipalities in this Plan will work to incorporate the goals of this Plan into the next update of relevant plans and regulations, including master or comprehensive plans, zoning codes, and capital improvement plans. Table 10.6-1 shows dates of upcoming municipal updates to these plans and documents. It should be noted that counties and municipalities are not empowered to make alterations or improvements to the state's building code, the Uniform Construction Code.

Table 10.6-1
Scheduled Updates to Relevant Plans and Documents

Plan or Document	Next Update
Bloomingdale Borough Master Plan	2011
Bloomingdale Borough Zoning Plan	2010
Bloomingdale Borough Capital Improvement Plan	Annually
Clifton City Master Plan	2009
Clifton City Zoning Plan	Not updated on a regular schedule
Clifton City Capital Improvement Plan	2009
Haledon Borough Master Plan	2012
Haledon Borough Zoning Plan	Not updated on a regular schedule
Haledon Borough Capital Improvement Plan	Not updated on a regular schedule
Hawthorne Borough Master Plan	2012
Hawthorne Borough Zoning Plan	Not updated on a regular schedule
Hawthorne Borough Capital Improvement Plan	Yearly
Little Falls Township Master Plan	2012
Little Falls Township Zoning Plan	2012
Little Falls Township Capital Improvement Plan	Annually
North Haledon Borough Master Plan	2009
North Haledon Borough Zoning Plan	2009
North Haledon Borough Capital Improvement Plan	Annually
Passaic City Master Plan	June 27, 2013
Passaic City Zoning Plan	Updated on an ongoing basis
Passaic City Capital Improvement Plan	Annually
Paterson City Master Plan	2003
Paterson City Zoning Plan	2006
Paterson City Capital Improvement Plan	Annually
Pompton Lakes Borough Master Plan	2012
Pompton Lakes Borough Zoning Plan	Updated as needed
Pompton Lakes Borough Capital Improvement Plan	Annually
Prospect Park Borough Master Plan	2011
Prospect Park Borough Zoning Plan	2011
Prospect Park Borough Capital Improvement Plan	Annually
Ringwood Borough Master Plan	Updated on an ongoing basis
Ringwood Borough Zoning Plan	Updated on an ongoing basis
Ringwood Borough Capital Improvement Plan	Annually
Totowa Borough Master Plan	2006
Totowa Borough Zoning Plan	2006
Totowa Borough Capital Improvement Plan	Annually
Wanaque Borough Master Plan	2010
Wanaque Borough Zoning Plan	Not updated on a regular schedule
Wanaque Borough Capital Improvement Plan	2010
Wayne Township Master Plan	2010
Wayne Township Zoning Plan	2010

Plan or Document	Next Update
Wayne Township Capital Improvement Plan	Annually
West Milford Township Master Plan	2009
West Milford Township Zoning Plan	Not updated on a regular schedule
West Milford Township Capital Improvement Plan	2009
Woodland Park Borough Master Plan	2009
Woodland Park Borough Zoning Plan	2009
Woodland Park Borough Capital Improvement Plan	Annually

10.7 Continued Public Involvement

As noted above, this Plan will be evaluated and updated periodically and when certain triggering events occur. Passaic County will utilize public notices and a centralized website in an effort to include the public in the update process. In addition, PCOEM will undertake public outreach and awareness activities as outlined in the Mitigation Action Plan that will include continuing updates on the progress of implementing the Plan and future updates.

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