

A Multi-Jurisdictional Flood Mitigation Plan for Municipalities in the Non-tidal, New Jersey Section of the Delaware River Basin



August 2008 Draft



Lambertville, NJ April 2005



Frenchtown, NJ June 2006



Trenton, NJ April 2005



Stockton, NJ April 2005

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EXECUTIVE SUMMARY

Between mid-September 2004 and late July 2006, three major floods caused severe and repeated damage to thousands of structures, and disrupted the lives of many in the Delaware River Basin. The flooding was the worst experienced since the record flood of 1955.

This Plan is the result of a multi-agency and local partnership that formed following those three Delaware River main stem flood events. The purpose of the partnership was to capitalize on resources at the federal, state and county level and assist local municipalities in completing a regional flood hazard mitigation plan. The overall goal of this Flood Mitigation Plan is to make the Delaware River Basin more disaster resilient by reducing long-term risks to loss of life and property damage from flooding. The aim is to empower local communities to mitigate and support a sustainable community plan so that, when confronted by a natural disaster, they will sustain fewer losses and recover more quickly.

The geographic scope of this Flood Mitigation Plan includes forty-three (43) New Jersey municipalities located in Mercer, Hunterdon, Warren and Sussex counties that are either entirely or partially located within the Delaware River Basin and have elected to participate in the planning process. This study area was chosen as such because although the planning requirement had been in place since 2000, as of late 2006 - no municipalities in this area had an approved All Hazards Mitigation Plan and only a few municipalities in the study area had effective Flood Mitigation Plans.

This Plan is unique in that while it will meet the flood mitigation plan requirements of each municipality and also employ a watershed management approach to ensure that final mitigation actions address both local jurisdictional needs and regional multi-jurisdictional needs. Through this Plan, local flood issues will be elevated to the county, state and regional level. This Plan is essentially an action plan that contains over one hundred and sixty (160) mitigation actions developed by individual municipalities and counties.

Key objectives of this Flood Mitigation Plan are to:

- Increase the coordination and cooperation among intergovernmental entities in carrying out flood mitigation;
- Demonstrate a firm local commitment to flood mitigation;
- Leverage a wide array of funding opportunities to implement actions;
- Comply with federal legislative requirements for local mitigation plans; and
- Reduce future flood loss.

One of the purposes of the Flood Mitigation Plan is to enable participating municipalities to get one step closer to becoming eligible to compete for FEMA funding aimed at flood mitigation. There are two types of natural hazard mitigation plans recognized by the Federal Emergency Management Agency (FEMA): a Flood Mitigation Plan and an All Hazards Mitigation Plan. As the name suggests, a Flood Mitigation Plan is specific to flooding. For participating

municipalities, this Flood Mitigation Plan is an important and significant step towards completion of the required All Hazards Mitigation Plan. It also is a stand-alone document that details regional, county-wide and municipal mitigation actions that when implemented could reduce future flood loss.

The phrase “100-Year Flood” is a cause of confusion among the public, government officials, and insurers. Many continue to believe it is a description of a flood that occurs only once every 100 years. In fact, "100-Year Flood" is an abbreviated way of describing a flood of such magnitude that has a 1-percent (or 1 in 100) statistical probability of being equaled or exceeded in any given year. This terminology describing flood events is often found to be misleading because it is based on statistical probabilities, not periodicity. By definition, more than one 100-year flood event or base flood can occur within the span of a single year or one might not be witnessed on time scales of greater than 100 years. **Based on probability theory, a building in the Special Flood Hazard Area has a 26 % (or 1 in 4) chance of experiencing a 100-year flood over the entire life of a 30-year mortgage.**

Regarding the physical nature of the flood zone, over 67,670 acres of the total county area in Mercer, Hunterdon Warren and Sussex Counties fall within the 100-year flood zone. In other words, roughly 7% of that land area is vulnerable to a 100-year flood event. These flood zone size estimates were completed using the Q3 digital flood zone maps (Section 3).

Repeat flood insurance claims indicate areas where floodplain occupancy continues in spite of repeated inundation. As of 01/31/08, FEMA identified 562 repetitive loss and 60 severe repetitive loss properties in Mercer, Hunterdon, Warren and Sussex counties. The definition of a repetitive loss property is 2 or more flood losses, where the definition of a severe repetitive loss property is 4 or more flood losses or when the payments exceed the building value. **As an example of the severity of flooding in recent years, the number of repetitive loss properties in the entire Delaware River Basin prior to September 2004 was 317. Between September 2004 and February 2007, an additional 2,266 properties were added to this list (Section 3).**

Residential flood risk was calculated by a simple methodology that uses the FEMA default present-value coefficients from the benefit-cost analysis software modules. The results of this analysis reveal that Harmony Township, Warren County has the highest projected flood risk over 100 years at \$10.3 million. Following Harmony Township is the City of Trenton, Mercer County with a projected 100-year flood risk of \$6.9M; Kingwood Township, Hunterdon County with a projected 100-year flood risk of \$4.9M; Lambertville, Hunterdon County with a projected 100-year flood risk of \$4.3M; and Knowlton, Warren County with a projected 100-year flood risk of \$4.0M (Section 4).

HAZUS-MH® (FEMA’s loss estimation software) was used in the risk assessment and examine the vulnerability from flooding using the amount of direct economic losses related to buildings. This assessment considers monetary losses from the buildings including structural damage, contents damage, and inventory loss. The results of the HAZUS-MH model for Mercer, Hunterdon, Sussex and Warren show that \$180 million is vulnerable to loss from a 100-year flood. Individually, Mercer - \$77M, Hunterdon - \$39M, Warren - \$23M and Sussex - \$41M (Section 4).

Each municipality’s vulnerability to flooding was ranked based on the repetitive risk analysis, the vulnerability assessment and the data presented by each municipality in this report. The results are presented below and described further in Section 4 of this report.

Summary of Flood Vulnerability by Jurisdiction

MERCER	
EWING TWP	Medium
HAMILTON TWP	Medium
HOPEWELL TWP	Medium
LAWRENCE TWP	Medium
PENNINGTON BOROUGH	Low
TRENTON CITY	High
HUNTERDON	
DELAWARE TWP	Medium
EAST AMWELL TWP	Low
FRANKLIN TWP	Low
FRENCHTOWN BOROUGH	High
HAMPTON BOROUGH	Low
KINGWOOD TWP	High
LAMBERTVILLE CITY	High
LEBANON TWP	Low
MILFORD BOROUGH	Low
RARITAN TWP	Medium
STOCKTON BOROUGH	High
WEST AMWELL TWP	Low

WARREN	
BELVIDERE TWP	High
BLAIRSTOWN TWP	High
FRANKLIN TWP	Low
FRELINGHUYSEN TWP	Low
HACKETTSTOWN TOWN	Low
HARDWICK TWP	Low
HARMONY TWP	High
INDEPENDENCE TWP	Low
KNOWLTON TWP	High
LOPATCONG TWP	Medium
MANSFIELD TWP	Low
OXFORD TWP	Low
PHILLIPSBURG TOWN	High
POHATCONG TWP	High
WHITE TWP	Medium
SUSSEX	
ANDOVER BOROUGH	Low
BRANCHVILLE	Low
BYRAM TWP	Low
FRANKFORD TWP	Low
FREDON TWP	Low
MONTAGUE TWP	Medium
NEWTON TOWN	Low
SANDYSTON TWP	Low
SPARTA TWP	Low
STILLWATER TWP	Low

This Plan contains forty-three (43) municipal flood profiles and action plans. Over one hundred and sixty (160) mitigation actions developed by individual municipalities and counties are presented in this Plan that when implemented could reduce future flood loss. As an overview, a subset of the desired mitigation actions contained in the report are presented below. More detail on these, as well as, the full list of desired municipal and county and regional mitigation actions can be found in Sections 5 & 6 of this Plan.

Acquisitions:

Mercer: Hamilton, Trenton
Hunterdon: Kingwood, Stockton
Warren: Harmony, Knowlton

Elevations:

Mercer: Hopewell Trenton
Hunterdon: Kingwood, Lambertville, Raritan
Warren: Belvidere, Frelinghuysen, Independence, Oxford, Pohatcong

Elevate Utilities:

Mercer: Hamilton, Trenton
Hunterdon: Frenchtown
Warren: Blairstown, Knowlton

Stream Desnagging/Restoration:

Mercer: Lawrence
Hunterdon: Franklin, Hampton
Warren: Belvidere, Blairstown, Franklin, Hackettstown, Independence, Mansfield, White
Sussex: Montague, Newton, Sparta, Stillwater

Backflow Prevention Devices:

Mercer: Ewing
Hunterdon: Frenchtown Lambertville Stockton
Warren: Belvidere, Blairstown, Phillipsburg, Pohatcong

Flood Warning:

Mercer: Hamilton
Hunterdon: East Amwell
Warren: Allamuchy, Hardwick, White
Sussex: Montague

Dam Studies:

Warren: Allamuchy
Sussex: Fredon, Newton, Sparta

Structural:

Mercer: Trenton - Flood proof Trenton Water Filtration Plant; Hopewell - Raise Canal Bank
Hunterdon: Stockton - Relocate Fire Department, Flood proof Borough Hall; Lambertville - Swan Creek Flood Gate and Lift Station
Warren: Belvidere - Decommission Pequest Dam; Blairstown - Levee along Paulinskill; Phillipsburg - Modifications to Lift Station and WWTP; Pohatcong - Musconetcong Dam
Sussex: Byram - Dam Improvements

Section 1: Introduction

This section provides an introduction to this Multi-Jurisdictional Flood Mitigation Plan for the Non-Tidal, New Jersey section of the Delaware River Basin. It is broken down into the following six sections:

- Purpose and Scope of Plan
- Goals and Objectives
- Authority
- Participating Jurisdictions
- Profile of the Delaware River Basin
- Profile of the Study Area

Purpose and Scope of Plan

Between mid-September 2004 and late July 2006, three major floods caused severe and repeated damage to thousands of structures, and disrupted the lives of many in the Delaware River Basin. The flooding was the worst experienced since the record flood of 1955.

This Plan is the result of a multi-agency and local partnership that formed following those three Delaware River main stem flood events. The purpose of this partnership was to capitalize on resources at the federal, state and county level and assist local municipalities in completing a regional flood hazard mitigation plan.

The partnership that formed to produce this Plan includes the Delaware River Basin Commission (DRBC), the New Jersey Department of Environmental Protection (NJDEP), the New Jersey Office of Emergency Management (NJOEM) and county emergency management and planning departments.

This Plan contains flood mitigation actions and projects developed by municipalities that if implemented would reduce future flood loss and support sustainable communities. Some universal comments and actions were voiced by

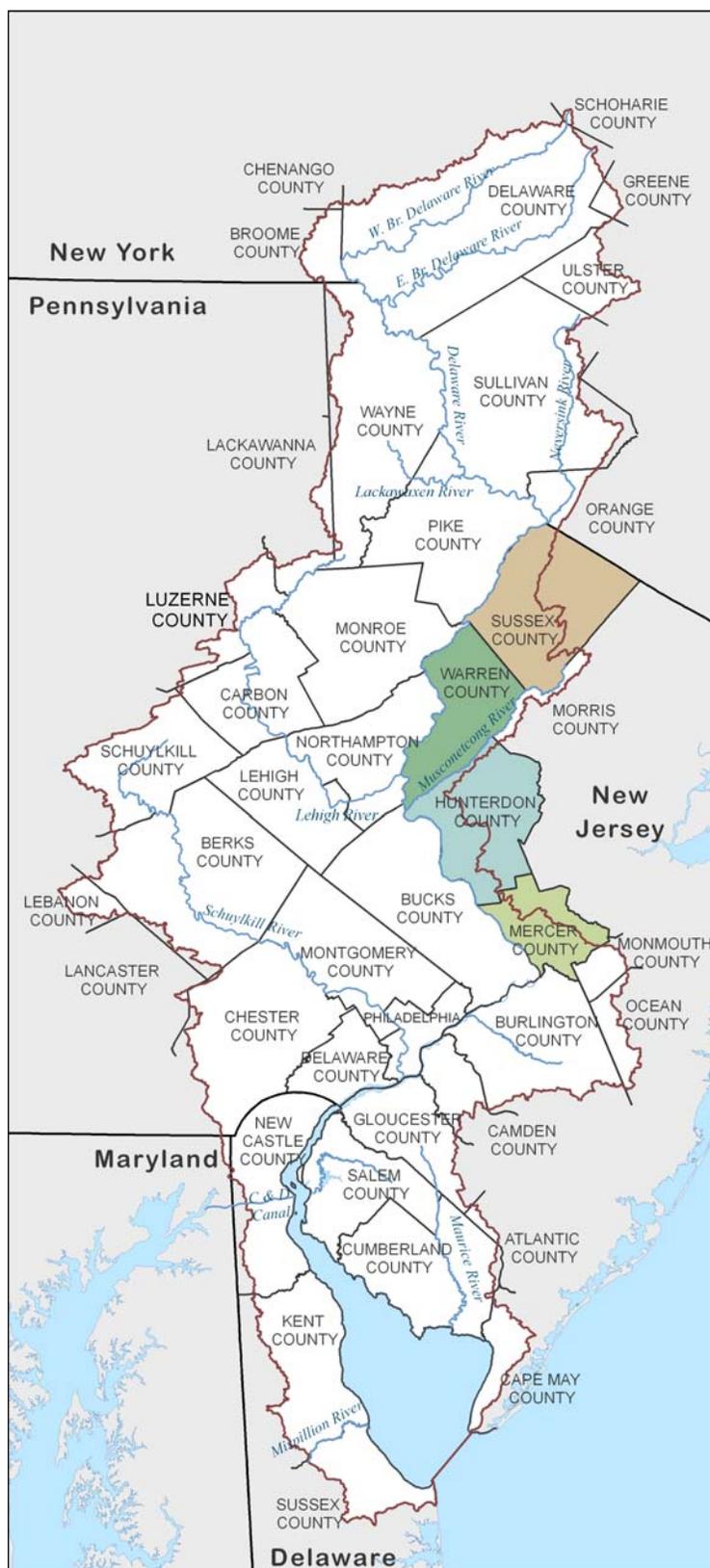


Figure 1-1. Delaware River Basin

municipalities throughout this planning process. Through this Plan, these local issues will be elevated to the county, state and regional level. County, state and regional actions are identified in this Plan with the aim of making the Delaware River Basin more disaster resilient and reducing long-term risks to loss of life and property damage from flooding.

This Plan is unique in that while it will meet the flood mitigation plan requirements of each municipality and also employ a watershed management approach to ensure that final mitigation actions address both local jurisdictional needs and regional multi-jurisdictional needs. Flooding is a hazard that does not recognize political boundaries. However, to effectively govern the floodplains, direct mitigation funds, manage rescue and response operations, and organize and deliver disaster relief, policy is often administered within politically defined boundaries. As political boundaries seldom coincide with watershed boundaries, this Plan encourages municipalities to consider their watershed and consult with their upstream and downstream neighbors when identifying mitigation actions. Local collaboration and partnership are effective and necessary means in reducing future flood loss.

There are two types of natural hazard mitigation plans recognized by the Federal Emergency Management Agency (FEMA): a Flood Mitigation Plan and an All Hazards Mitigation Plan. As the name suggests, a Flood Mitigation Plan is specific to flooding. For participating municipalities, this Flood Mitigation Plan is an important and significant step towards completion of the required All Hazards Mitigation Plan. It also is a stand-alone document that details regional, county-wide and municipal mitigation actions that when implemented will reduce future flood loss.

One of the purposes of the Flood Mitigation Plan is to enable participating municipalities to get one step closer to becoming eligible to compete for FEMA funding aimed at flood mitigation. Following a municipal or county-led process to expand this document into an All Hazards Mitigation Plan, municipalities will become eligible for future mitigation funding opportunities through FEMA's Grant Programs. The grant programs include the Flood Mitigation Assistance (FMA) program, the Pre-Disaster Mitigation (PDM) program, the Repetitive Flood Claims (RFC) program, the Severe Repetitive Loss (SRL) program and the post disaster Hazard Mitigation Grant Program (HMGP). As a note, an All Hazards Mitigation Plan is not required for the RFC program.

In addition to FEMA, this Plan will be reviewed by the United States Army Corps of Engineers (USACE), the Natural Resources Conservation Service (NRCS), New Jersey Department of Environmental Protection (NJDEP), New Jersey Department of Transportation (NJDOT), legislative officials and other organizations along the Delaware to convey the impact of flooding at a regional and local level, as well as, provide an outline of local mitigation projects and actions that can be implemented to reduce future flood loss. It is hoped that this Plan will leverage the expertise and resources of these organizations in solving local problems.

“There is no one set of mitigation measures that will stop flooding along the Delaware, it is only through a combination of local and regional measures that resiliency to flooding in the basin will be improved.”

-Delaware River Basin Interstate Flood Mitigation Task Force, July 2007 Action Agenda

Goals and Objectives

The overall goal of this Flood Mitigation Plan is:

“To make the Delaware River Basin more disaster resilient by reducing long-term risks to loss of life and property damage from flooding.

The aim is to empower local communities to mitigate and support a sustainable community plan so that, when confronted by a natural disaster, they will sustain fewer losses and recover more quickly.”

The objectives of this Flood Mitigation Plan are to:

- Increase the coordination and cooperation among intergovernmental entities in carrying out flood mitigation;
- Demonstrate a firm local commitment to flood mitigation;
- Leverage a wide array of funding opportunities to implement actions;
- Comply with federal legislative requirements for local mitigation plans;
- Protect life, safety and property by reducing the potential for future damages and economic losses that result from flooding;
- Safeguard essential public facilities and infrastructure;
- Promote a sustainable regional and local economy;
- Heighten public awareness of flood risk; and
- Support natural resource protection.

Authority

This Flood Mitigation Plan for the non-tidal, New Jersey section of the Delaware River Basin was prepared by the 43 jurisdictions covered by the Plan, with technical support and coordination provided by the Delaware River Basin Commission, the New Jersey Department of Environmental Protection and county emergency management and planning departments. It was developed in accordance with the provisions of the Disaster Mitigation Act of 2000 (Public Law 106-390) and the Pre-Disaster Mitigation Grant Program, Federal Regulations (44 CFR 206).

This Flood Mitigation Plan has been prepared to meet the requirements of 44 CFR Part 201, Hazard Mitigation Planning, which establishes criteria for State and local hazard mitigation planning authorized by Section 322 of the Stafford Act, as amended by Section 104 of the Disaster Mitigation Act. This rule specifies requirements that must be satisfied in developing State and local multi-hazard mitigation plans which are a requirement to maintain eligibility for future mitigation project funding under FEMA.

A Local Mitigation Plan Crosswalk, found in Appendix A, provides a summary of FEMA’s current minimum standards of acceptability and notes the location within the Plan where each planning requirement is met. In addition, specific requirements of 44 CFR Part 201 will be identified throughout the Plan by shaded boxes.

Currently, local governments applying for FEMA’s Flood Mitigation Assistance (FMA), Pre-Disaster Mitigation (PDM), Severe Repetitive Loss (SRL) or post disaster Hazard Mitigation Grant Program (HMGP) funds through the States are required to have an approved local mitigation plan to apply for local mitigation project grants. States are also required to have an approved State mitigation plan to receive funds for State or local mitigation projects after November 1, 2004. The State of New Jersey has an approved Standard State mitigation plan, dated April 2008.

Requirement §201.6: *The local mitigation plan is the representation of the jurisdiction’s commitment to reduce risks from natural hazards, serving as a guide for decision makers as they commit resources to reducing the effects of natural hazards. Local plans will also serve as the basis for the State to provide technical assistance and to prioritize project funding.*

In 2006, the Delaware River Basin Commission received a Flood Mitigation Assistance (FMA) Planning grant from FEMA, through NJOEM, with NJDEP contributing necessary local matching funds. The purpose of the grant was to complete a multi-jurisdictional plan covering municipalities in Mercer, Hunterdon, Warren and Sussex Counties that are located either partially or entirely within the Delaware River Basin. A strength of this Plan is its watershed approach, but in addition, the Plan will meet the requirements for each participating municipality in its entirety. Therefore, other watersheds, such as the Walkkill, South Branch of the Raritan and Millstone River will be mentioned in this Plan.

Requirement §201.6(a)(4): *Multi-jurisdictional plans (e.g. watershed plans) may be accepted, as appropriate, as long as each jurisdiction has participated in the process and has officially adopted the plan.*

This flood mitigation plan is a substantial step towards the completion of an All Hazards Plan. This Plan solely focuses on flooding as flooding is by far the area’s most substantial natural hazard. Following adoption of this flood mitigation plan, each municipality or county will be responsible for incorporating this Plan into an All Hazards Mitigation Plan by evaluating remaining natural hazards.

Participating Jurisdictions

The geographic scope (e.g. the study planning area) for the Plan includes New Jersey municipalities located in Mercer, Hunterdon, Warren and Sussex counties. Because this is a watershed based plan, only municipalities that are either entirely or partially located within the Delaware River Basin were invited to participate. Out of the 64 eligible municipalities, the following 43 municipalities chose to participate in plan development and have satisfactorily completed the required planning requirements. Participating municipalities are listed below and shown in Figure 1-2.

<u>MERCER</u>	<u>HUNTERDON</u>	<u>WARREN</u>	<u>SUSSEX</u>
Ewing Township	Delaware Township	Belvidere Township	Andover Borough
Hamilton Township	East Amwell Township	Blairstown Township	Branchville Borough
Hopewell Township	Franklin Township	Franklin Township	Byram Township
Lawrence Township	Frenchtown Borough	Frelinghuysen Township	Frankford Township
Pennington Borough	Hampton Borough	Town of Hackettstown	Fredon Township
Trenton City	Kingwood Township	Hardwick Township	Montague Township
<hr/>	Lambertville City	Harmony Township	Town of Newton
6 Municipalities	Lebanon Township	Independence Township	Sandyston Township
	Milford Borough	Knowlton Township	Sparta Township
	Raritan Township	Lopatcong Township	Stillwater Township
	Stockton Borough	Mansfield Township	<hr/>
	West Amwell Township	Oxford Township	10 Municipalities
	<hr/>	Town of Phillipsburg	
	12 Municipalities	Pohatcong Township	
		White Township	
		<hr/>	
		15 Municipalities	

Total of 43 Participating Municipalities

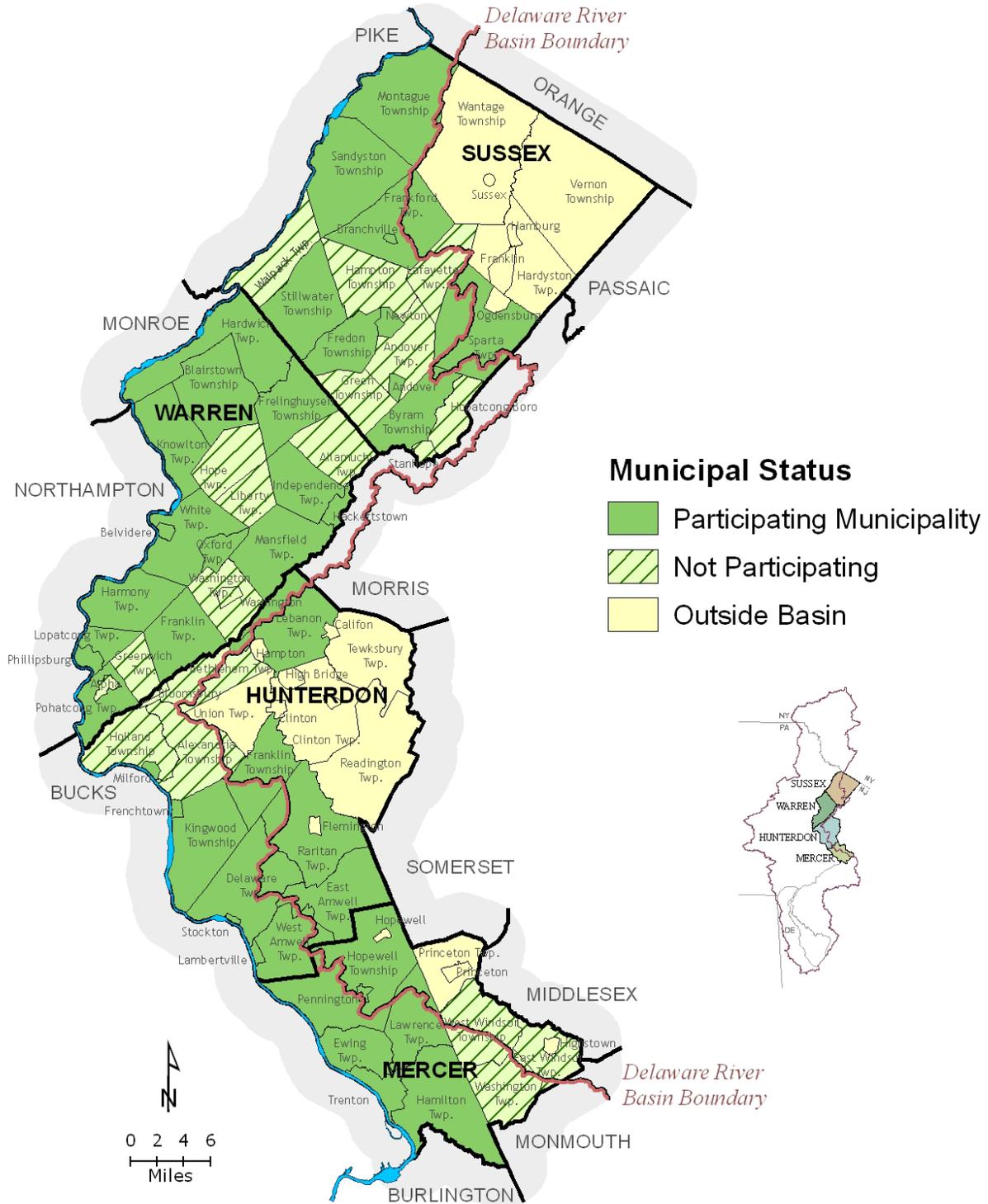


Figure 1-2. Participating Municipalities

Profile of the Delaware River Basin

The Delaware River extends approximately 330 miles from its headwaters at the confluence of the East and West Branches in Hancock, New York to the mouth of the Delaware Bay, where it feeds the Atlantic Ocean. The main stem Delaware is fed by 216 tributaries the largest of which are the Lehigh and Schuylkill Rivers in Pennsylvania. It is the longest undammed river east of the Mississippi and drains 12,800 square miles from portions of New York, Pennsylvania, New Jersey, and Delaware.

The natural drainage area of the Delaware River Basin crosses many man-made boundaries in addition to the four state lines: 25 congressional districts, two Federal Emergency Management Agency (FEMA) regions, two Environmental Protection Agency (EPA) regions, five U.S. Geological Survey (USGS) offices, four Natural Resources Conservation Service (NRCS) state offices, two National Weather Service (NWS) local forecast offices, 42 counties, and 838 municipalities. Coordination of efforts is critical for effective flood loss reduction to occur within the basin.

Nearly 15 million people (approximately five percent of the nation's population) rely on the Delaware River for drinking water, of those about seven million people live in New York City and northern New Jersey, outside the basin. Within the basin, the river supplies drinking water to much of the Philadelphia metropolitan area and northern portions of New Jersey. Throughout the Basin, waters are also used for industrial and agricultural purposes.

For the river's entire length, from its headwaters in New York to the Delaware Estuary and Bay, the Delaware also serves as an ecological and recreational resource. Over the past half century, cold-water fisheries have been established in the tailwaters of the East Branch Delaware, West Branch Delaware, and Neversink rivers and the upper main stem Delaware River as the result of cold water releases from the reservoirs. In addition, most of the main stem upstream of Trenton, NJ has been designated by Congress as part of the federal Wild and Scenic Rivers system.

The Delaware River is not only a popular river for fishing and recreation, but it is also an important economic resource. The Delaware River Port Complex is largest freshwater port in the world and generates more than \$19 billion in economic activity annually for the region.

Delaware River Basin Commission:

The Delaware River Basin Commission (DRBC) was formed in 1961 by the signatory parties to the Delaware River Basin Compact (Delaware, New Jersey, New York, Pennsylvania, and the United States) to share the responsibility of managing the water resources of the Basin. Commission programs include water quality protection, water supply allocation, regulatory



review, water conservation initiatives, watershed planning, flood loss reduction and recreation.

Geographic Setting:

The Delaware River is very much a product of the cumulative flows from its many tributaries, which in turn take their character from the underlying geology, topography, microclimates and land uses of their watersheds.

The northernmost tributaries to the Delaware River originate in the forested western slopes of the Catskill Mountains that reach elevations of up to 4,000 feet. The East and West Branches meet at Hancock, NY where the Delaware River officially begins. The River descends about 800 feet on its journey to the sea.

The Delaware River Basin straddles two very different hydrologic provinces corresponding to major physiographic divisions: the Appalachian Highlands and the Atlantic Coastal Plain. The fall line is the natural division between these provinces, running southwest to northeast along the western edge of the River and crossing it near Trenton, NJ. Above the fall line, freshwater riverine conditions exist. Below the fall line, the River is subject to tidal influences and, with increased proximity to the Bay, estuarine conditions exist.

Conditions prior to a rainfall event greatly influence the amount of stormwater runoff delivered to waterways which directly affects whether or not a rainfall event has the duration and intensity which would cause a flood event. Topography, soil type and conditions, ground cover and land use all play important roles. Dry soil accommodates greater infiltration of rainfall and reduces the amount of runoff entering streams. Conversely, soil that is saturated as a result of previous rainfall has a lower capacity for infiltration, resulting in higher rates of surface water runoff.

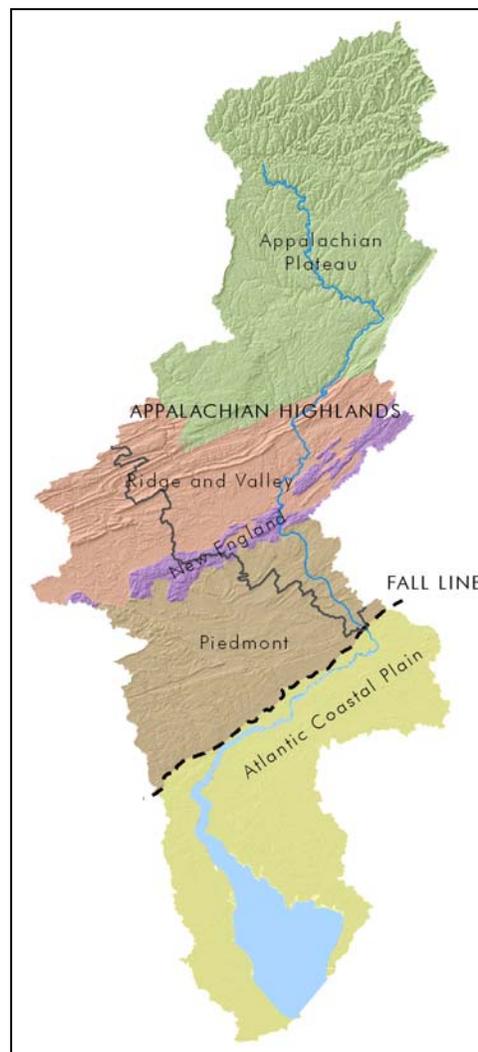


Figure 1-3: Physiographic Divisions

Population Density:

The 2000 census reported a population of 7.76 million in the Delaware River Basin. In 2000, the average population density in the Delaware River Basin was 603 persons per square mile or about 1 person/acre. Figure 1-4 represents the population density in the Basin. Population density varies across the basin and among watersheds. Density is lowest in the uppermost headwaters of the Basin (ranging from 30 to 100 persons per square mile increasing with proximity to the River and near confluences with major tributaries. The watershed is most densely populated near the greater Philadelphia area (greater than 2,000 persons/ square mile).

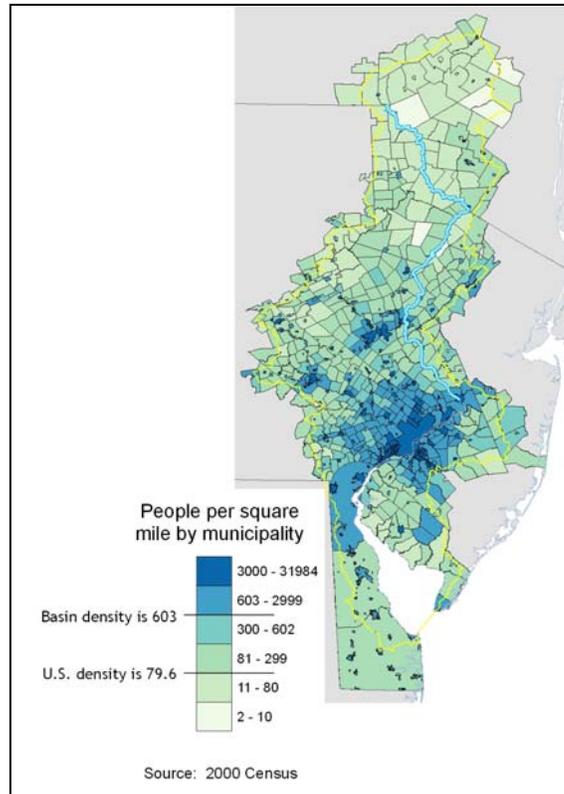


Figure 1-4. Population Density

Watersheds of the Delaware River Basin:

The study area covered by this Plan is composed of the following watershed regions of the Delaware River Basin: Upper Central, Lower Central and small portions of the Upper Estuary. These divisions are depicted in Figure 1-5. As municipal boundaries do not often follow watershed boundaries, watersheds outside the Delaware River Basin are also included in this Plan for those municipalities that are composed of one or more watersheds. These watersheds include small portions of land area that drain to the Wallkill and the Raritan River. These watersheds are described in later portions of this section.

For purposes of assessment and reporting, the *Water Resources Plan for the Delaware River Basin* divides the Delaware River Basin into nine (9) watershed regions. The nine watershed regions are shown below in Figure 1-5.

Integrating water resource and land management is essential for balancing growth and development needs with water resource stewardship.

Communities that engage in watershed-based planning acknowledge their respective roles as “upstream” and “downstream” stewards of their portion of the watershed, and participate with other communities in the watershed and with partner agencies and organizations can achieve sustainable use and protect water resources. -*Water Resources Plan for the Delaware River Basin*, Sept. 2004, pg 37.

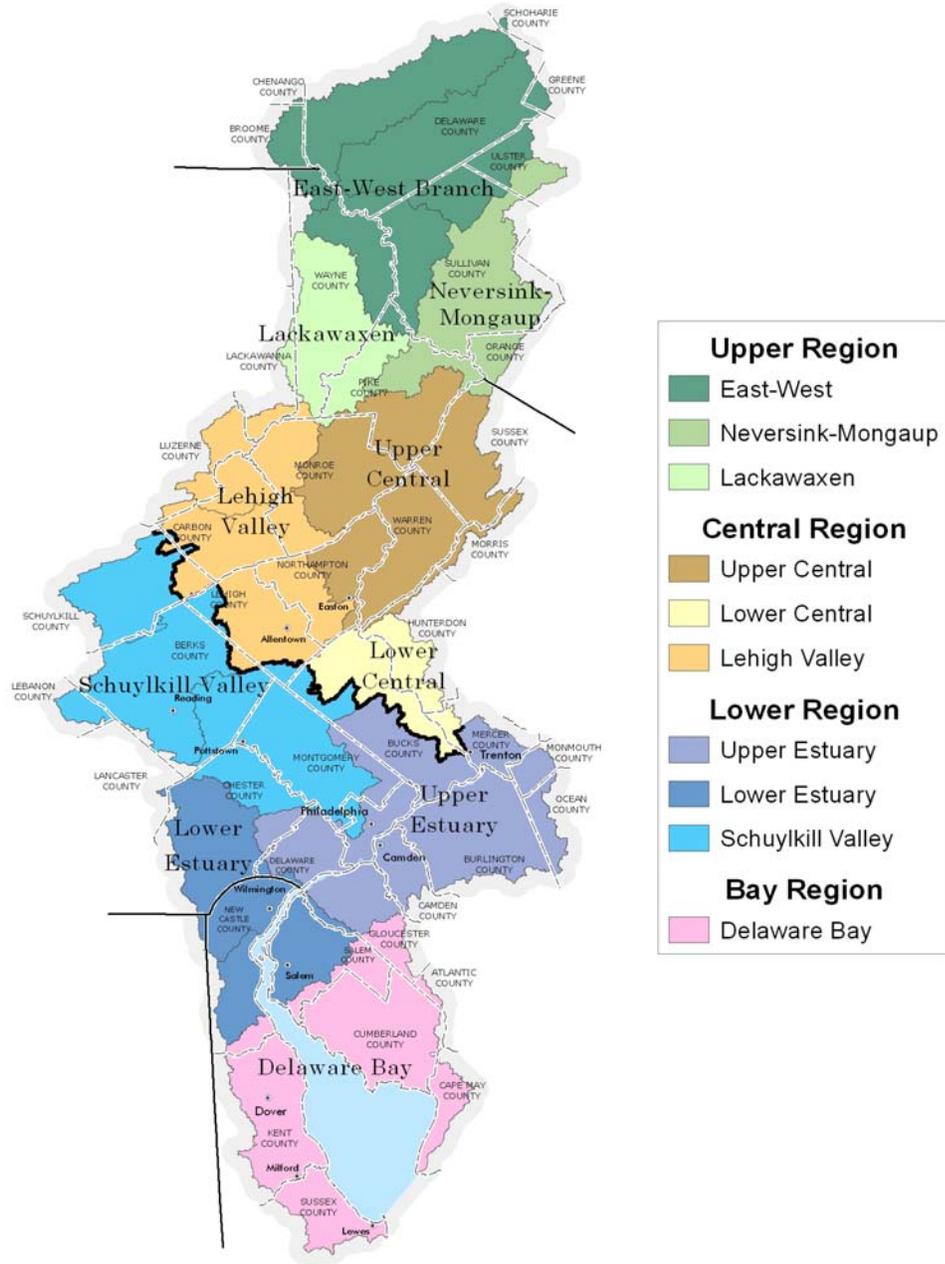


Figure 1-5. Watersheds of the Delaware River Basin

Profile of the Study Area

The proposed study region for this Plan included sixty-four (64) New Jersey municipalities, in Mercer, Hunterdon, Warren and Mercer Counties, which have at least a portion of their land located within the Delaware River Basin. Of the 64 invited to participate, 43 municipalities elected to be a part of the Plan and subsequently met the municipal requirements for satisfactory participation in the Plan.

Demographics

As presented earlier, counties are not represented in this Plan in their entirety. Instead, some municipalities are not included because they fall outside of the Delaware River Basin. Others did fall within the basin, but elected not to participate in this Plan. For brevity in some sections of this Plan, figures such as the census demographics below are reported by county.

Table 1-1: Demographics by County

Census QuickFacts	Mercer County	Hunterdon County	Warren County	Sussex County	New Jersey
Geography:					
Land area (square miles), 2000	225.93	429.94	357.87	521.26	7,417.34
Persons per square mile, 2000	1,552.00	283.7	286.1	276.7	1,134.50
Population:					
Population, 2006 estimate	367,605	130,783	110,919	153,384	8,724,560
Population, percent change, April 1, 2000 to July 1, 2006	4.80%	7.20%	8.30%	6.40%	3.70%
Population, 2000	350,761	121,989	102,437	144,166	8,414,350
Age & Gender:					
Persons under 5 years old, percent, 2006	6.10%	5.30%	5.90%	5.40%	6.40%
Persons under 18 years old, percent, 2006	23.10%	23.20%	24.00%	24.40%	23.90%
Persons 65 years old and over, percent, 2006	12.00%	10.90%	12.60%	9.80%	12.90%
Female persons, percent, 2006	50.90%	50.50%	51.30%	50.40%	51.10%
Ethnicity:					
White, percent, 2006	69.60%	93.10%	93.10%	95.30%	76.40%
Black, percent, 2006	20.60%	2.80%	3.20%	1.70%	14.50%
Native American, percent, 2006	0.20%	0.20%	0.10%	0.10%	0.30%
Asian, percent, 2006	8.10%	3.30%	2.50%	1.80%	7.40%
Hispanic, percent, 2006	12.30%	3.90%	6.00%	5.30%	15.60%
Pacific Islander, percent, 2006	0.20%	<0.05%	<0.05%	<0.05%	0.10%
Foreign born persons, percent, 2000	13.90%	6.30%	5.80%	5.70%	17.50%
Language other than English spoken at home, pct age 5+, 2000	20.20%	8.60%	8.40%	8.30%	25.50%
Education:					
High school graduates, % age 25+, 2000	81.80%	91.50%	84.90%	89.80%	82.10%
Bachelor's degree or higher, % age 25+, 2000	34.00%	41.80%	24.40%	27.20%	29.80%
Persons with a disability, age 5+, 2000	55,055	11,945	15,508	17,976	1,389,811
Household Distribution:					
Housing units, 2006	139,887	48,505	45,076	60,092	3,472,643
Housing units in multi-unit structures, %, 2000	29.00%	13.80%	21.50%	13.60%	36.10%
Median household income, 2004	\$57,705	\$87,701	\$61,281	\$71,013	\$57,338
Persons below poverty, percent, 2004	8.10%	3.10%	5.40%	4.40%	8.40%

Source U.S. Census Bureau: State and County QuickFacts.

Watershed Divisions

This Plan, in meeting the flood mitigation plan requirements of each municipality, also attempts to employ a watershed management approach to ensure that final mitigation actions address both local jurisdictional needs and regional multi-jurisdictional needs. Flood mitigation planning on a watershed basis is a comprehensive, inclusive and integrated approach that focuses on community-based planning, environmental impacts and economic vitality.

A watershed is an area of land that drains all the streams, rainfall and snowmelt to a common outlet such as a river, lake or mouth of a bay. Each watershed is separated from other watersheds by high points in the terrain, such as hills and ridges. The watershed includes not only the waterway itself, but also the entire land area that drains to it. The decisions each of us makes about use of the resources within our watershed affect its overall health. Watersheds can be defined in varying sizes. A watershed may be very small, like the drainage formed by your own driveway, or very large, like the drainage basin of the Delaware River.

In New Jersey, watersheds are referred to as the name of the water body to which the land area drains and the corresponding Hydrologic Unit Code (HUC). The HUC can range from 2 to 16 digits long- the longer the numeric code, the smaller the watershed area. NJDEP also has divided the state into 21 Watershed Management Areas (WMAs) based on large scale drainage patterns (Figure 1-6). Each WMA encompasses a particular group of major rivers.

The watershed for portions of Sussex County participating municipalities that drain to Hudson River are:

Watershed Management Area 2: **Wallkill**

Watershed Management Area 6: **Upper-Mid Passaic, Whippany, Rockaway**

The watersheds for municipalities that drain to the Delaware River are:

Watershed Management Area 1: **Upper Delaware**

Watershed Management Area 11: **Central Delaware**

Watershed Management Area 20: **Crosswicks Creek**

The watersheds for portions of Hunterdon and Mercer participating municipalities that drain to the Raritan Bay via the Raritan River are:

Watershed Management Area 8: **N&S Branch Raritan**

Watershed Management Area 10: **Millstone**

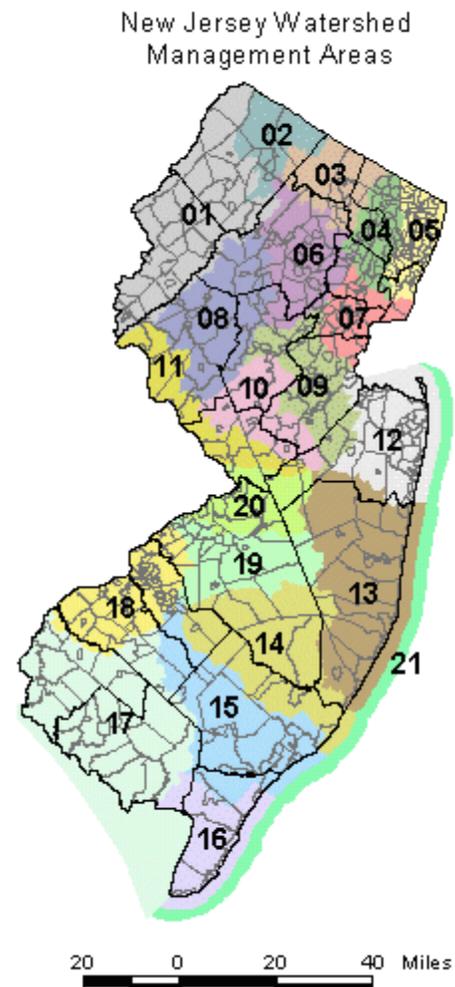


Figure 1-6: NJ Watershed Divisions

As a means of providing an overview of waterways in this Flood Mitigation Plan, the following (presented generally from north to south) is an overview of each Watershed Management Area. Some greater description of the rivers and streams and subsequent areas that experience repetitive flooding can be found in each municipal flood profile and action plan (Section 6).

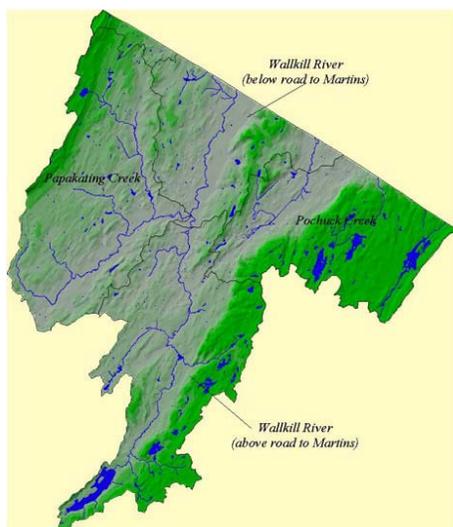


Figure 1-7: WMA 2, Wallkill

Watershed Management Area 2, the Wallkill River Watershed, includes 11 townships in Sussex County. This watershed does not drain to the Delaware. Instead, the Wallkill River Watershed has its headwaters at Lake Mohawk in Sparta Township and flows north into New York State, eventually emptying into the Hudson River.

Four participating municipalities in this Plan have portions of their township that drain to the Wallkill. This includes small portions of Byram, and Montague, in addition to portions of Frankford and Sparta. Key tributaries to the Wallkill in these Townships are the Papakating and Rutgers Creek.

Watershed Management Area 6, the Upper-Mid Passaic, Whippany and Rockaway Watershed, represents the area drained by waters from the upper reaches of the Passaic River Basin including the Whippany River and Rockaway River Watersheds and the Passaic River from its headwaters in Morris County to the confluence of the Pompton River. The watershed lies in portions of Morris, Somerset, Sussex and Essex Counties.

Only one participating municipality in this Plan, Sparta Township in Sussex County, has a portion of their township located in the headwaters of the Rockaway River.

Watershed Management Area 1, the Upper Delaware, includes portions of Sussex, Morris, Hunterdon, and all of Warren County. It contains 54 municipalities, of which 27 are participating in this Plan. This area encompasses 746 square miles in the mountainous northwestern corner of the state, within the Valley and Ridge and Highlands physiographic provinces.

Within Area 1 there are six major drainage basins: Delaware River, Flat Brook, Paulins Kill, Pequest River,

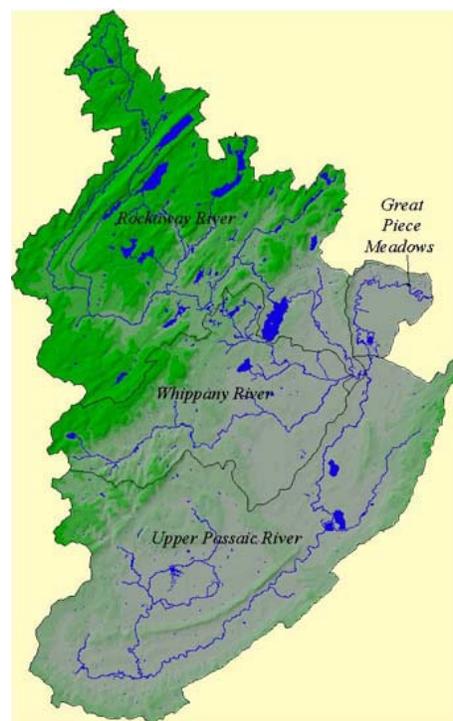


Figure 1-8: WMA 6, Upper-Mid Passaic, Whippany, Rockaway

Lopatcong Creek and Pohatcong Creek, and the Musconetcong River. These major tributaries flow in a southeasterly direction to the Delaware River, and are generally known as outstanding recreational resources for trout production and maintenance, as well as, habitat for an abundance of wildlife including threatened and endangered species.

The 65 square-mile **Flat Brook** watershed lies within state parks and forest boundaries as well as the Delaware Water Gap Recreation Area. Tributaries to the Flat Brook, the Little Flat Brook and the Big Flat Brook, originate in the northwest corner of the state and flow south through the Kittatinny Mountain Ridge until they join together in Sandyston Township to form the Flat Brook. The journey of the Flat Brook is mostly through public land until it joins the Delaware River at Flatbrookville, near Walpack Bend. The river is a classic freestone stream and it continues to be among the highest quality surface waters in the state.

In the 1960s, the proposed dam at Tocks Island on the Delaware River and its 40-mile reservoir would have encompassed the Flat Brook. The dam was a hotbed of controversy in the Delaware Valley for more than ten years, until Congress declared the area part of the national park system, prohibiting development and shelving the project. The federal government collected nearly 70,000 acres of land on both sides of the Delaware during the dam preparations. After the project was scrapped, the land went to the National Park Service and the Delaware Water Gap National Recreation Area was born. Most of the Flat Brook watershed is entirely contained within the Delaware Water Gap National Recreation Area.

The **Paulins Kill** is a 28.6 mile long tributary of the Delaware River. The Paulins Kill begins just northwest of Newton, into the northern reaches of Fredon Township. Moore's Brook is one of several small mountain streams that enter the Paulins Kill near its source. The river flows northward into Lafayette Township before curving west where it meets with the combined waters of the Culver Brook and the Dry Brook near the hamlet of Augusta in Frankford Township. The Paulins Kill then flows southwest, through Hampton and Stillwater Townships. The Trout Brook, which rises on Kittatinny Mountain, flows into the Paulins Kill near Middleville in Stillwater Township. A dam was built in the 1920s across the Paulins Kill in Stillwater Township, to create Paulinskill Lake, a narrow, 3-mile long body of water that stretches back into Hampton Township to the north. The Paulins Kill continues its course

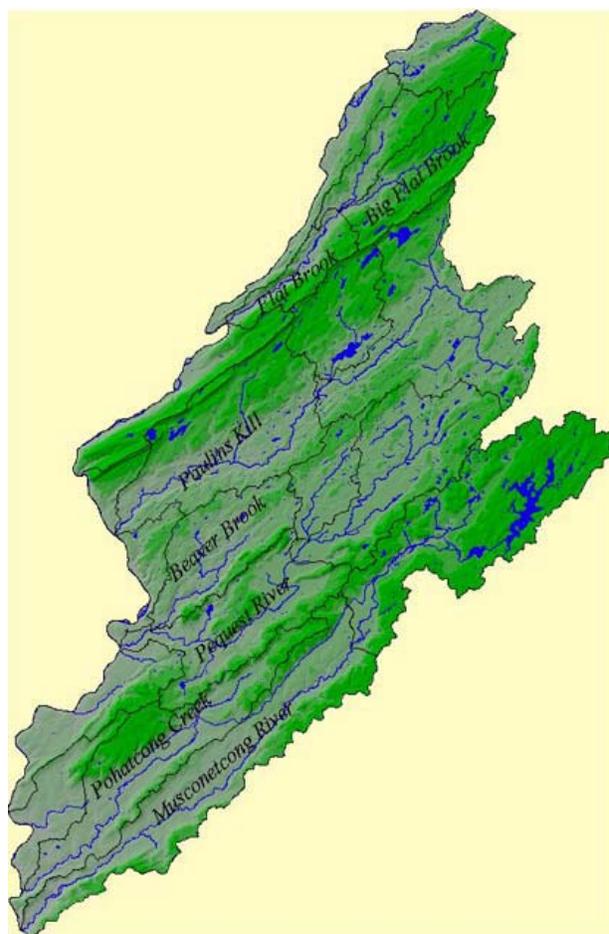


Figure 1-9: WMA 1, Upper Delaware

southwest, entering Warren County, where it initially forms the border between Frelinghuysen and Hardwick Townships. It enters Blairstown, where it is joined by Blair Creek, as well as Jacksonburg Creek, Dilts Creek and Walnut Creek. Yard's Creek, which rises at the Yard's Creek reservoir in Blairstown, enters the Paulins Kill near the hamlet of Hainesburg in Knowlton Township. Finally, in Warren County its waters enter the Delaware River just south of the Delaware Water Gap at the hamlet of Columbia in Knowlton Township. The Paulins Kill watershed is well recognized for its agriculture and forested area, as well as, recreational opportunities.

The **Pequest River** is a 24.7-mile long tributary of the Delaware River that runs through Sussex and Warren counties. The Pequest starts in the southern portion of Newton and flows southward along the northwestern side of the Allamuchy Mountain ridge near Allamuchy, where it meets Trout Brook. It joins Bear Creek in Bear Swamp and passes through the reclaimed swampy area known as the Great Meadows, lying between the ridges of Jenny Jump Mountain and Cat Swamp Mountain. Some of the land here was drained for cultivation by excavation and clearing of the Pequest and its tributaries. It exits the Great Meadows in a long loop through the gap between Cat Swamp Mountain and Danville Mountain and resumes its course along the southeastern side of Mount Mohepinoke, entering the Pequest Wildlife Management Area. Furnace Brook empties into it as it descends into a small gorge cut between Mt. Mohepinoke and Scotts Mountain. It turns west, and Mountain Lake Brook enters the stream just above Butzville. It passes west through Bridgeville, turns slightly towards the north, and meets Beaver Brook as it turns southwest again. It tumbles down to Belvidere in a series of falls, where it meets the Delaware River. There are many recreational areas in the Pequest River watershed with land use heavily forested and agricultural.

Lopatcong Creek, a tributary of the Delaware River, originates in Harmony Township and flows southwest to its confluence with the Delaware near the southern end of Phillipsburg. **Pohatcong Creek**, also a tributary of the Delaware River, runs 28 miles in Warren County. It rises in the mountains of eastern Warren County, west of Hackettstown. It flows southwest, in a valley along the northwestern side of the Pohatcong Mountain ridge, which separates its watershed from that of the Musconetcong River. It joins the Delaware in Pohatcong Township, approximately 5 miles south of Phillipsburg. Both the Pohatcong River and Lopatcong Creek are known for their agricultural features.

The **Musconetcong River** is a tributary of the Delaware River, approximately 44 miles long. It flows through the rural mountainous country of northwestern New Jersey. It rises out of Lake Hopatcong, on the border between Sussex and Morris counties. It flows through Lake Musconetcong, then flows southwest, past Stephensburg and New Hampton, passing south of Washington then along the southeastern side of the Pohatcong Mountain ridge. It joins the Delaware across from Riegelsville, Pennsylvania, approximately 10 miles south of Phillipsburg. The watershed contains some developed areas but also many forests and farms. Popular with fishermen, the river is an important recreational fishing resource. On December 22, 2006, 24.2 miles of the Musconetcong River was designated as a component of the National Wild and Scenic Rivers System.

Watershed Management Area 11, known as the Central Delaware Tributaries, includes 24 municipalities within the counties of Hunterdon, Mercer and Monmouth. The predominant drainage funnels to either the Delaware River or the Delaware and Raritan (D&R) Canal. Watershed Management Area 11 covers approximately 272 square miles and is dominated by the Assunpink Creek and its tributaries to the south and smaller creeks in the northern portions. Land uses in this area range from agricultural to urban, most notably in the State Capital, the City of Trenton.

Within Area 11 there are four major drainage basins: Hakiwokake/ Hariwokake/ Nishisakawick Creek, Lockatong Creek/ Wickecheoke Creek, Alexauken Creek/ Moore Creek/ Jacobs Creek and the Assunpink Creek.

From north to south, the **Hakiwokake, Hariwokake and Nishisakawick Creeks** are small tributaries to the Delaware River located in northern Hunterdon County. The three originate in Alexandria Township and generally flow southwest to their confluence with the Delaware. The Hakiwokake joins the Delaware at Milford. The Hariwokake stays within Alexandria Township and joins the Delaware within Township boundaries. The Nishisakawick Creek and the Little Nishisakawick Creek both have their confluence with the Delaware within the Borough of Frenchtown. Even though the Little Nishisakawick Creek originated in Kingwood Township, the mouth of the Little Nishisakawick Creek is only approximately 200 feet downstream from the mouth of the Nishisakawick Creek.

The **Lockatong Creek** has its headwaters in the southwestern part of Franklin Township and flows through Kingwood and Delaware Townships. The **Wickecheoke Creek** originates in Raritan Township, New Jersey and flows through Croton and Locktown. Turning south, it cuts through a low ridge, is joined by Plum Brook and cuts through a second, slightly larger ridge to the west of Sergeantsville. It reaches the Delaware and Raritan Canal and the Delaware River at the Prallsville Mills to the north of Stockton, NJ.



Figure 1-10: WMA 11, Central Delaware

The Lockatong (27.8 sq. mi.) and Wickecheoke Creek (26.5 sq. mi.) watersheds represent nearly 65 percent of the total drainage area to the D&R Canal. The D&R Canal was built in the 1830s to connect the Delaware River to the Raritan River as an efficient and reliable means of

transportation of coal between Philadelphia, Pennsylvania and New York City. The main section of the canal runs from Bordentown on the Delaware to New Brunswick on the Raritan. A feeder canal section stretches 22 miles from Bull's Island near Frenchtown south to Trenton. The feeder canal collects water from higher elevations to the north, and feeds it to the highest section of the main canal, which flows generally north and east to the end. The total length of the entire canal system was approximately 66 miles. The Canal system today is operated and maintained by the NJ Water Supply Authority, a major water purveyor in the state. The Canal serves as the water supply conduit to over 1.5 million Central New Jersey residents. It is also the recreational centerpiece of a 63 mile long linear state park.

The Alexauken Creek/Moore Creek/Jacob's Creek watershed drains a total of 63 square miles of land. It crosses two counties – Hunterdon and Mercer counties, and six municipalities – West Amwell, Hopewell, Hamilton, and Ewing townships; the boroughs of Stockton and Pennington; and the city of Lambertville. **Alexauken Creek and Moore Creek** originate in the Sourland Mountain ridge. The Alexauken heads through Hunterdon County to its confluence with the Delaware River just north of Lambertville. Moore Creek has its confluence with the Delaware in Hopewell Township. **Jacob's Creek** begins in Hopewell Township, at two locations, both near Harbourton Road. From these starting points, the creek flows southeast, through Hopewell Township, into Ewing Township, to form a small portion of the border between the two townships. Finally, it empties into the Delaware River, near Jacob's Creek Road, in Ewing Township.

The upper watershed of the **Assunpink Creek** has both agricultural/rural and suburban land uses. Assunpink Creek is born in rural Monmouth County, about a mile north of Clarksburg. Flowing westwards, it soon enters the Assunpink Wildlife Management Area, where it has been dammed to form Rising Sun Lake. After an unnamed tributary enters from the south, it enters another reservoir, Assunpink Lake. Below Assunpink Lake, the creek flows under Old York Road and flows into Mercer County. New Sharon Branch enters the creek from the south at Carsons Mills. The creek now turns northwest, passing under the New Jersey Turnpike and then U.S. Route 130, just southwest of Windsor. The creek enters Central Mercer County Park, Bridegroom Run enters from the north side as the creek turns west and is impounded to form Mercer County Lake. The Creek then passes under "Quaker Bridge" on Quaker Bridge Road and Interstate 295 before turning southwest and paralleling the Delaware and Raritan Canal. As the river flows through Trenton, its watershed becomes highly urbanized. Portions of the Assunpink are highly channelized for flood control. Miry Run enters near Hutchinson Mills. The canalized stream flows past the Trenton Rail Station and finally empties into the Delaware River in Trenton.

Watershed Management Area 20, Crosswicks Creek, includes 26 municipalities spanning four counties: Burlington, Mercer, Monmouth and Ocean. Although this management area encompasses 253 square miles, the extent of the study region for this Plan is Mercer County.

Crosswicks Creek is 25 miles long and drains an area of 146 square miles to the Delaware River at Bordentown. Its headwaters flow from the Fort Dix and McGuire Air Force Base Military Reserves in a northwesterly direction and then turn sharply south where it meets the Delaware River at the City of Bordentown. Major tributaries include Jumping Brook, Lahaway

Creek, North Run and Doctors Creek. Tides affect this stream up to the Crosswicks Mill Dam. Allentown Lake, Oxford Lake, Prospertown Lake and Imlaystown Lake are major impoundments in the Crosswicks Creek Watershed. Crosswicks Creek is the southernmost waterway included in this Plan.



Figure 1-11: WMA 20, Crosswicks Creek

Watershed Management Area 8, the North and South Branches of the Raritan River and their tributaries, includes large portions of Somerset, Hunterdon, and Morris Counties. The portion of the WMA included in this Plan is solely the South Branch of the Raritan River. The **South Branch** is 51 miles long and flows from western Morris County The South Branch Raritan River is 51 miles long and begins at Budd Lake in Mount Olive Township (Morris County, NJ) and flows through central Hunterdon County into western Somerset County before joining the North Branch of the Raritan River to become the main stem of the Raritan River. The tributary to the South Branch that is included in this Plan is the **Neshanic River**. The two largest reservoirs in New Jersey lie within the South Branch Raritan River watershed, Round Valley Reservoir and Spruce Run Reservoir.

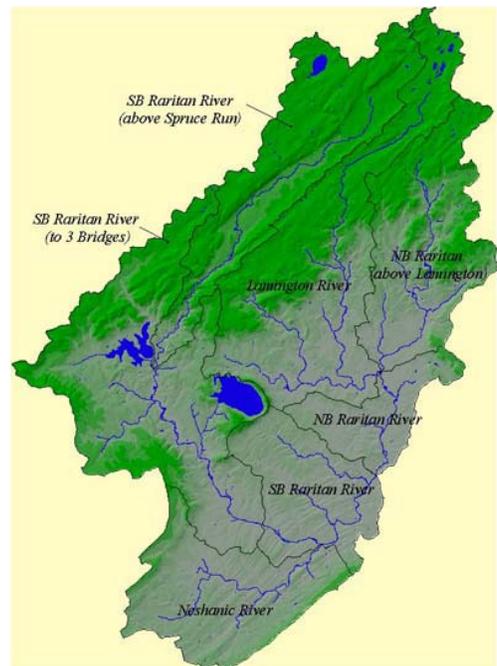


Figure 1-12: WMA 8, Raritan River

Watershed Management Area 10 includes the **Millstone River** and its tributaries. The Millstone River itself is a tributary to the Raritan River. This watershed lies in parts of Hunterdon, Somerset, Middlesex, Mercer and Monmouth Counties. The Millstone River is 38 miles long and flows from Millstone Township in Monmouth County to the Raritan River near Manville and Bound Brook. The tributary to the Millstone included in this Plan is the **Stony Brook** (55.4 sq. mi. drainage area). Other tributaries to the Millstone include Cranbury Brook, Bear Brook, Ten Mile River, Six Mile River and Bedens Brook. Land use in the Millstone Watershed is primarily suburban development with scattered agricultural areas although there is extensive, recent development present in the upper portion.

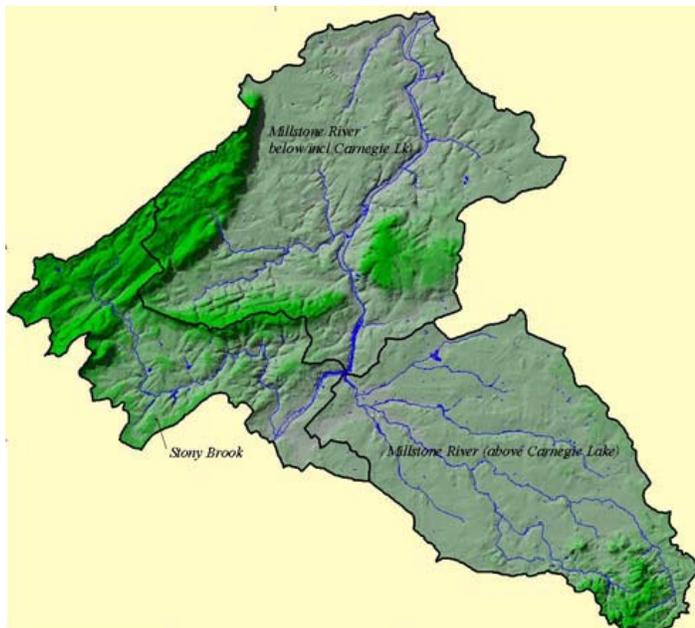


Figure 1-12: WMA 10, Millstone River

Mercer County participating municipalities are composed of portions of Watershed Management Areas 10-Millstone River, 11-Central Delaware, and 20-Crosswicks Creek.

	TOTAL SQUARE MILES	% IN DELAWARE RIVER DRAINAGE BASIN	WATERSHED MANAGEMENT AREAS (WMAs)
MERCER			
EWING TWP	15.1	100%	11
HAMILTON TWP	39.4	100%	11, 20
HOPEWELL TWP	58	50%	10, 11
LAWRENCE TWP	21.9	80%	10, 11
PENNINGTON BOROUGH	1	33%	10, 11
TRENTON CITY	7.5	100%	11, 20

Hunterdon County participating municipalities are composed of portions of Watershed Management Areas 1-Upper Delaware, 8-North and South Branch Raritan, 10-Millstone River, and 11-Central Delaware.

	TOTAL SQUARE MILES	% IN DELAWARE RIVER DRAINAGE BASIN	WATERSHED MANAGEMENT AREAS (WMAs)
HUNTERDON			
DELAWARE TWP	36.9	83%	8, 11
EAST AMWELL TWP	28.1	8%	8, 10, 11
FRANKLIN TWP	23.3	40%	8, 11
FRENCHTOWN BOROUGH	1.1	100%	11
HAMPTON BOROUGH	1.4	100%	1
KINGWOOD TWP	35.6	100%	11
LAMBERTVILLE CITY	1.1	100%	11
LEBANON TWP	31.9	25%	1, 8
MILFORD BOROUGH	1.3	100%	11
RARITAN TWP	38.6	13%	8, 11
STOCKTON BOROUGH	0.6	100%	11
WEST AMWELL TWP	21.6	88%	8, 10, 11

Warren County is entirely part of the Delaware River Basin. Participating municipalities are composed of Watershed Management Area 1, the Upper Delaware.

	TOTAL SQUARE MILES	% IN DELAWARE RIVER DRAINAGE BASIN	WATERSHED MANAGEMENT AREAS (WMAs)
WARREN			
BELVIDERE TWP	1.3	100%	1
BLAIRSTOWN TWP	30.9	100%	1
FRANKLIN TWP	24.1	100%	1
FRELINGHUYSEN TWP	23.6	100%	1
HACKETTSTOWN TOWN	3.6	100%	1
HARDWICK TWP	37.8	100%	1
HARMONY TWP	24	100%	1
INDEPENDENCE TWP	20.1	100%	1
KNOWLTON TWP	26	100%	1
LOPATCONG TWP	6.9	100%	1
MANSFIELD TWP	29.7	100%	1
OXFORD TWP	5.7	100%	1
PHILLIPSBURG TOWN	2.9	100%	1
POHATCONG TWP	14.1	100%	1
WHITE TWP	27.4	100%	1

Sussex County participating municipalities are composed of portions of Watershed Management Areas 1-Upper Delaware, 2 – Wallkill and 6 – Upper-Mid Passaic, Whippany and Rockaway Watershed.

	TOTAL SQUARE MILES	% IN DELAWARE RIVER DRAINAGE BASIN	WATERSHED MANAGEMENT AREAS (WMAs)
SUSSEX			
ANDOVER BOROUGH	1.4	100%	1
BRANCHVILLE BOROUGH	0.6	100%	1
BYRAM TWP	22.5	97%	1, 2
FRANKFORD TWP	34.7	60%	1, 2
FREDON TWP	18	100%	1
MONTAGUE TWP	45.2	98%	1, 2
NEWTON TOWN	3.3	100%	1
SANDYSTON TWP	41.4	100%	1
SPARTA TWP	38.5	50%	1, 2, 6
STILLWATER TWP	27.4	100%	1

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Section 2: Planning Process

This section includes a description of the process used to develop the Plan, including how it was prepared, who was involved in the process, and how the public was involved. It is broken down into the following sections:

- Plan Development Process
- Involved Stakeholders in Mitigation Planning
 - Regional Planning Team
 - Municipal Participation
 - Public Participation – Citizen and Stakeholder Involvement
- Review and Incorporation of Existing Information

Plan Development Process

Requirement §201.6(c)(1): *The plan shall include documentation of 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.*

The floods of 2004, 2005 and 2006 along the Delaware strained the already limited resources of many municipalities in the region. This planning effort was formed to combine the resources of state, regional and county agencies in order to assist local municipalities in completing the required planning process. In October 2006, the multi-agency and local planning effort to facilitate the development of this multi-jurisdictional Flood Mitigation Plan was formed.

Although the Plan is specific to flooding, it has been prepared to meet the All Hazard Plan requirements for the flood hazard. As such, the information contained in this plan will enable municipalities that participate in this Plan to use the enclosed information when preparing their All Hazard Plan, either individually or as part of a larger regional effort.

The multi-jurisdictional planning process recommended by the Federal Emergency Management Agency (FEMA Publication Series 386) was used to develop this Plan. The Local Mitigation Plan Crosswalk, found in Appendix A, provides a detailed summary of FEMA's current minimum standards of acceptability and notes the location of where each requirement is met within the Plan. These standards are based upon FEMA's Interim Final Rule as published in the Federal Register on February 26, 2002, in Part 201 of the Code of Federal Regulations (CFR).

The Plan was written using the best available information obtained from a wide variety of sources. Throughout the plan development process, a concerted effort was made to gather information from participating municipal and county agencies, as well as, stakeholders, federal and state agencies, members of the local business and industry community, and the citizens of the Plan area. The flood mitigation strategies contained within this plan have been developed through an extensive planning process involving local jurisdictions, citizens, counties, and state, regional and federal agencies.

The plan development process for the Plan is displayed as Figure 2-1 below:

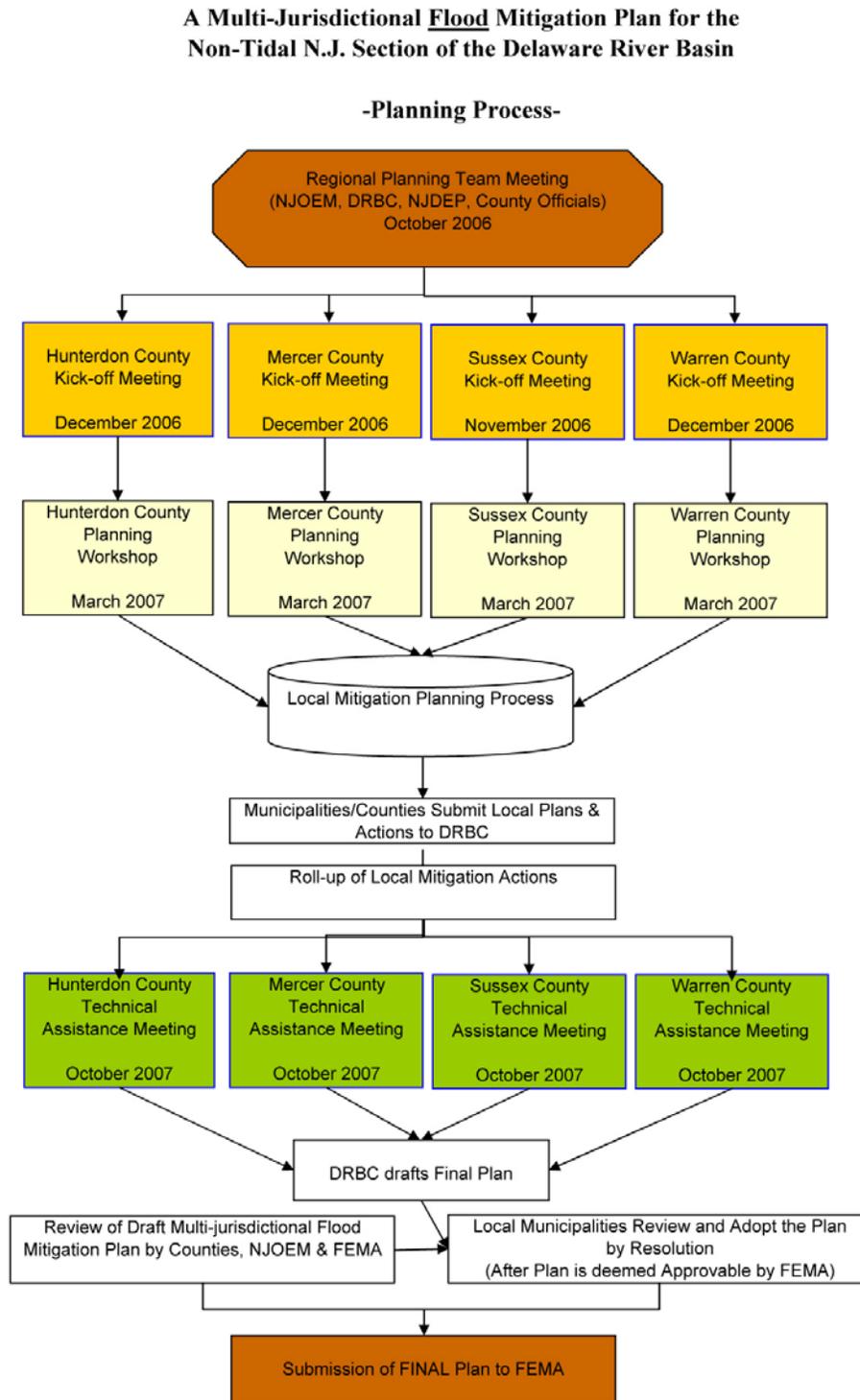


Figure 2-1: Plan Development Process Flowchart

An initial Regional Planning Team Meeting for the project was held on October 11, 2006 at a regionally central location, the NJ Water Supply Authority in Clinton, NJ. The meeting was

facilitated by the Delaware River Basin Commission. In attendance were also representatives from NJOEM, NJDEP, counties, NJ Water Supply Authority, the Delaware River Greenway Partnership, the Municipal Land Use Center, NJ State Legislature and FEMA.

At the initial meeting, the proposed planning approach, anticipated timeline and the respective roles and responsibilities of each team member were discussed. NJOEM described the benefits of having a Flood Mitigation Plan in place and the requirements of the planning process. NJDEP discussed the goals and objectives of planning process and how they parallel the findings of the Governor’s Flood Mitigation Task Force Report. The DRBC specified the technical assistance and products that would be prepared to aid the local jurisdictions in meeting the necessary requirements of the planning process. The technical assistance and products included the following:

- Analysis of flood insurance claims and repetitive loss properties
- Flood hazard identification and vulnerability assessment (HAZUS)
- Essential Facility vulnerability analysis
- Land use and impervious cover change analysis
- Historic flood damage costs by municipal damage areas
- Basin-scale mitigation strategies and priorities
- Compendium of local mitigation strategies
- DRBC flood mitigation website to disseminate products and planning tools
- Facilitation of three meetings per county with municipalities
- Draft/compile final plan

Following the initial planning meeting in October 2006, each county made a commitment to be an active participant in the planning process and pledged to provide assistance throughout the planning process to its municipalities.

County Kick-off meetings were held in the Nov/Dec 2006 timeframe in each County. The Regional Planning Team (including NJDEP, NJOEM and DRBC staff and County officials), interested municipal officials and regional agencies were in attendance. Invitations addressed to mayors were sent to all municipalities. At the County Kick-off meeting, the concept of hazard mitigation was introduced, followed by a more detailed discussion of local mitigation planning. Preliminary assessment products were made available by the DRBC. Specific data collection requests were explained, including a request for any unique local hazard risk data available at their local government level. Roles and responsibilities for the individual jurisdictions were defined, and the project timeline presented.

The intent of the County Kick-off meetings was to educate officials from all participating municipal jurisdictions on the mitigation planning process, as well as to explain the planning requirements and the individual roles being required and assigned to each of them. At this time, each municipality was charged to designate a local liaison and complete a Statement of Intent depicting their commitment to participating in the planning process.

A Statement of Intent for each participating municipality is included as Appendix B of this report. Each Statement is signed by both the designated local liaison and a local official. Some municipalities took formal action by their municipal governing body in order to participate in this planning process, others did not. Each municipality was responsible for completing the municipal process necessary to allow completion of the municipal actions required to be a part of this Plan.

Planning Workshops, one held per county, were held in March 2007. These Planning Workshops were designed to help designated local liaisons further understand the overall mitigation planning process and their responsibilities in that process. Examples of mitigation actions and a list of municipal requirements were provided to help aid municipalities in formulating their own list of desired mitigation actions and follow the FEMA required planning process.

County Technical Assistance meetings, again one per county, were held in October 2007. At these meetings the findings of the Vulnerability Assessment were presented to local officials and discussion of specific mitigation actions followed. Participants were asked to identify specific mitigation actions that their community could undertake to help their county or community become less vulnerable to flooding. A variety of planning tools and references for considering and evaluating their mitigation action alternatives was handed out. County and local officials were instructed to take the materials back to their individual jurisdictions to begin proposing and prioritizing their mitigation actions.

Essential Facilities maps were prepared by DRBC and sent to each participating municipality. The maps were prepared using GIS. Each map contained aerial photos, FEMA Q3 floodplain boundaries, county identified essential facilities and FEMA (HAZUS) identified essential facilities. Municipalities were asked to verify the information on the maps and provide any additional facility information to DRBC for inclusion in the HAZUS risk assessment.

For the purposes of this risk assessment, the label “essential facility” may refer to any of the following: hospitals and other medical facilities, police and fire stations, emergency operations centers, government and public buildings, water treatment facilities and institutions with vulnerable populations such as colleges, schools, hospitals and nursing homes.

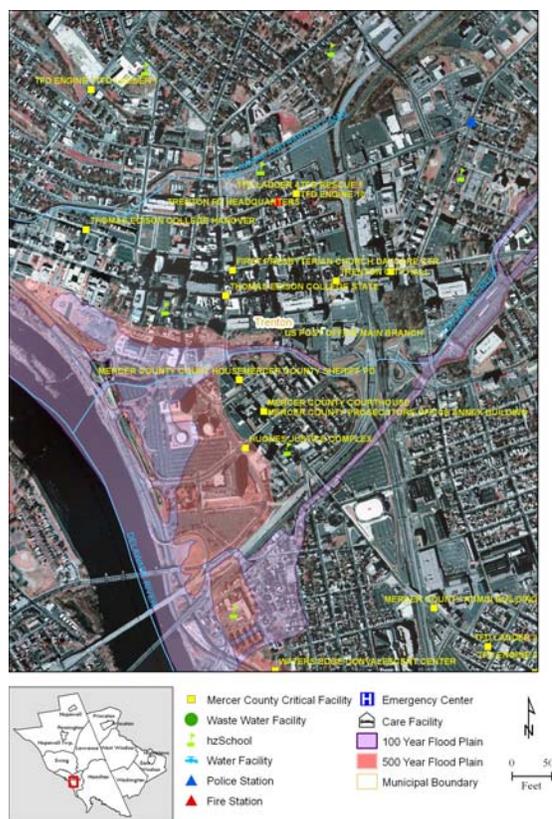


Figure 2-2: Sample Essential Facility Map

During the entire flood mitigation planning process, DRBC maintained a flood mitigation planning page on its website. The webpage was used to disseminate information and planning

tools developed to aid local municipalities in their planning process (guidelines, prepared technical assistance, questionnaires and presentations made at meetings). Some of these prepared documents are provided in Appendix C. During the review process, the plan will be posted on this website to aid in municipal and public final review.

Involved Stakeholders in Mitigation Planning

Regional Planning Team

The Regional Planning Team included the Delaware River Basin Commission (DRBC), the New Jersey Department of Environmental Protection (NJDEP), the New Jersey Office of Emergency Management (NJOEM) and county emergency management and planning departments.

Members of the Regional Planning Team established plan development goals; established a timeline for completion of the plan; ensured that the plan meets the requirements of DMA 2000 and FEMA guidance; solicited and encouraged the participation of municipalities, regional agencies, stakeholders, and citizens in the plan development process; assisted in gathering information for inclusion in the plan; organized and oversee the public involvement process; identified and profiled the flood hazard; estimated potential exposure or losses; evaluated development trends; and suggested mitigation strategies, goals, and actions.

The following agencies and individuals participated on the Regional Planning Team:

- **Delaware River Basin Commission:**
 - Robert Tudor, Deputy Executive Director – project oversight, plan review, mitigation strategy input
 - Laura M. Tessieri, P.E., CFM, Water Resources Engineer – project lead, grant administration, plan process and development, document preparation, risk assessment, mitigation strategy input
 - Karen Reavy, GIS Specialist – map and database preparation
 - Chris Koltalo, Intern - map and database preparation
 - Courtney Vanous, Intern - essential facilities database preparation, outreach to municipalities, document preparation
- **New Jersey Department of Environmental Protection:**
 - Joseph Ruggeri, P.E., CFM, – project oversight, plan review, mitigation strategy input
 - A. Chris Gould – land use/impervious surface analysis
 - Kerry Kirk-Plugh – development of project approach/ outreach
- **New Jersey State Police/ Office of Emergency Management:**
 - Sgt. Paul Miller – outreach, presentations at County meetings
 - Jeff Crapser – outreach during resolution adoptions
 - Kathy Lear – outreach, presentations at County meetings
- **Natural Resource Conservation Service:**
 - Greg Westfall – municipal worksheet summaries, outreach, plan process development, presentations at County meetings
- **Mercer County:**
 - Robert Hartman, County Emergency Management Deputy Coordinator
 - Marisa Wieczorek, AICP/PP, Senior Planner

- **Hunterdon County:**
 - Ken Bogen, Principal Planner
 - William J. Powell, County Emergency Management Coordinator
- **Warren County:**
 - Frank E. Wheatley, County Emergency Management Coordinator
 - William E. Hunt, Domestic Preparedness Planner
- **Sussex County:**
 - Chief E.S. "Skip" Danielson, Director Emergency Services
 - Mark W. Vogel, Deputy Coordinator
 - Alice Brees, Planner
 - David Kunz, GIS Manager

Municipal Participation

Participation by municipalities in the planning process is not only required by FEMA in order for the jurisdiction to be eligible to adopt the multi-jurisdictional Flood Mitigation Plan, but it is also crucial for the successful development of a Flood Mitigation Plan that contains actions able to be implemented. Municipal involvement ensures ownership of the plan, takes advantage of local expertise and experience and results in a greater probability that the Plan contains mitigation actions that will be implemented in the future.

In order for each local municipality to be eligible to adopt the Flood Mitigation Plan, they are required to complete and document the local flood mitigation planning process completed at the municipal level. The Regional Planning Team developed a list of municipal requirements to ensure adequate levels of municipal participation. Tables 2-1 – 2-4 depict the record of participation for each municipality.

The list of municipal requirements for satisfactory participation in this plan include:

1. Submit a Statement of Intent for your municipality; designate a local liaison (point of contact) for your municipality
2. Attend county meetings and the planning workshop (a minimum of 2 meetings considered satisfactory)
3. Form a local mitigation planning committee; document your local planning process, keep track of all meeting dates and notes
4. Submit a completed municipal questionnaire and worksheet
5. Publish notice of your municipality's intent to prepare a Flood Mitigation Plan to encourage public participation and comment
6. Distribute a prepared questionnaire to residents/ businesses known to be in the flood prone areas
7. Allow time for comment at two public meetings; once during the drafting stage and another prior to adopting the plan; collect resident questionnaires and summarize public comments
8. Develop a list of flood mitigation goals for your community
9. Compose and prioritize a list of desired local mitigation actions (include estimated costs,

organization responsible for implementation, implementation schedule, overall priority and potential funding sources)

10. Following determination by FEMA that the Plan is deemed “approvable”, adopt the plan locally by resolution

In order for each local municipality to successfully complete the above tasks, each municipality formed a local mitigation planning committee. There was no set requirement for the size of each committee or its composition. Each local mitigation planning committee varied by town due to size of municipality, vulnerability of the town or past history with flooding, etc. The Regional Planning Team suggested to municipalities that certain individuals fulfilling certain roles within the municipality sit on the task force. This guidance is contained in Appendix C. Although the composition of individuals on each committee varied from town to town, each participating municipality formed a committee, headed by their designated local liaison, which included a subset of one or more of the following:

- Local Emergency Management Coordinator
- Local Floodplain Administrator
- Stormwater Management Coordinator
- Public Works Supervisor
- Building Code Official
- Planning Board Member
- Zoning Board Member
- Flooded property owners
- Local Historians
- Residents/Business Owners
- Members of your Governing Body
- Administrator/Mayor
- Municipal Engineer
- Municipal Planner

Each Committee included individuals who were knowledgeable about local conditions, able to characterize the impacts of past flood events on their community, describe how existing land use planning addresses potential impacts of flooding, identify essential facilities within the municipality and evaluate local flood mitigation options. All participating municipalities were required to obtain public input by issuing public notice of intent to participate in the Plan and through a public meeting. For most municipalities, this requirement was met during a regularly held municipal governing board meeting.

Section 6 contains further details by municipality on the specific composition of each local mitigation planning committee and information on how and when each municipality met the municipal requirements for plan participation.

Public Participation – Citizen and Stakeholder Involvement

Requirement §201.6(b)(1): *The planning process shall include an opportunity for the public to comment on the plan during the drafting stage and prior to plan approval.*

Requirement §201.6(b)(2): *The planning process shall include 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*

Throughout the planning process, citizen and stakeholder input was sought through a variety of mechanisms. Some stakeholders attended county meetings, others provided information to the plan process and still more reviewed the final plan. These stakeholders will be important resources following plan approval and adoption, in helping to identify funding or opportunities to leverage funds in order to complete the prioritized mitigation actions contained in this Plan.

Stakeholders to this Plan include

- NJ Water Supply Authority;
- National Park Service;
- National Resources Conservation Service;
- NJ State legislative offices;
- Delaware Joint Toll Bridge Commission;
- Delaware Raritan Canal Commission;
- Municipal Land Use Center at TCNJ;
- New Jersey Department of Transportation; and
- local watershed groups.

Each participating municipality was required to hold and publicly notice a public meeting at which time local input to the plan was gathered. Public notice was often accomplished through announcements in local newspapers. A survey aimed at gaining information from flood impacted residents and businesses was produced by DRBC for use by municipalities. The survey sought information from citizens about flooding and asked for specific action recommendations to reduce future risks. The survey results provided a source of information to the municipalities for use in formulating mitigation actions. Details on how each municipality solicited public and interested stakeholder input, including survey results, is contained in each specific municipal flood profile and mitigation action plan in Section 6.

The DRBC Website was also used to disseminate information to the public and other interested parties during the Flood Mitigation Plan process. For example, posted materials include an article about the planning project, the residential survey, presentations made at public meetings, a summary of historical disasters in the DRBC, and information on grant opportunities. Many of these materials are included in Appendix C. The final draft Plan will also be made available on the DRBC's website for public review and comment. Each participating jurisdiction plans to allow for public review and comment prior to their Governing Bodies' adoption of the Plan. A copy of each resolution adopting the Plan is in Appendix F (forthcoming upon adoption).

Review and Incorporation of Existing Information

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

The New Jersey State Hazard Mitigation Plan (accessible online at <http://www.njmit.net/njshmp/>) was reviewed by the Project Management Team. The State's plan acknowledges "Hazard mitigation plans, which include a hazard and vulnerability analysis, long term hazard reduction strategies and hazard minimization activities, are part of series of major plans and reports associated with the emergency management cycle" and is the "demonstration of New Jersey's commitment to reduce risk 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". (State Hazard Mitigation Plan, pg. 2)

Municipalities were also requested to review their Municipal Master Plan, Land Use/Zoning ordinances, Floodplain Management Ordinance, any Open Space and Farmland Preservation programs in their community and any other ordinances enacted in their municipality to help mitigate flooding impacts. (e.g. Stream Corridor, Woodland Conservation, Steep Slopes, Stormwater Management).

In addition to these, other plans deemed necessary for review by each municipality's Local Flood Mitigation Planning Committee are listed in the Flood Profile and Mitigation Action Plan by Jurisdiction in Section 6.

Table 2-1. Record of Participation for Mercer County

Nature of Participation	Ewing	Hamilton	Hopewell	Lawrence	Pennington	Trenton
Submitted Statement of Intent	✓	✓	✓	✓	✓	✓
Attended County Meetings	✓	✓	✓	✓	✓	✓
Formed a local mitigation planning committee	✓	✓	✓	✓	✓	✓
Completed municipal questionnaire and worksheet	✓	✓	✓	✓	✓	✓
Published notice of intent	✓	✓	✓	✓	✓	✓
Distributed questionnaires and summarized public comment	✓	✓	✓	✓	✓	✓
Allowed time for comment at public meetings	✓	✓	✓	✓	✓	✓
Developed community flood mitigation goals	✓	✓	✓	✓	✓	✓
Developed a mitigation strategy	✓	✓	✓	✓	✓	✓
Adopted plan by resolution						

Table 2-2. Record of Participation for Hunterdon County

Nature of Participation	Delaware	East Amwell	Franklin	Frenchtown	Hampton	Kingwood	Lambertville	Lebanon Twp	Milford	Raritan	Stockton	West Amwell
Submitted Statement of Intent	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Attended County Meetings	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Formed a local mitigation planning committee	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Completed municipal questionnaire and worksheet	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Published notice of intent	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Distributed questionnaires and summarized public comment	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Allowed time for comment at public meetings	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Developed community flood mitigation goals	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Developed a mitigation strategy	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Adopted plan by resolution												

Table 2-3. Record of Participation for Warren County

Nature of Participation	Belvidere	Blairstown	Franklin	Frelinghuysen	Hackettstown	Hardwick	Harmony	Independence	Knowlton
Submitted Statement of Intent	✓	✓	✓	✓	✓	✓	✓	✓	✓
Attended County Meetings	✓	✓	✓	✓	✓	✓	✓	✓	✓
Formed a local mitigation planning committee	✓	✓	✓	✓	✓	✓	✓	✓	✓
Completed municipal questionnaire and worksheet	✓	✓	✓	✓	✓	✓	✓	✓	✓
Published notice of intent	✓	✓	✓	✓	✓	✓	✓	✓	✓
Distributed questionnaires and summarized public comment	✓	✓	✓	✓	✓	✓	✓	✓	✓
Allowed time for comment at public meetings	✓	✓	✓	✓	✓	✓	✓	✓	✓
Developed community flood mitigation goals	✓	✓	✓	✓	✓	✓	✓	✓	✓
Developed a mitigation strategy	✓	✓	✓	✓	✓	✓	✓	✓	✓
Adopted plan by resolution									

Table 2-3. Record of Participation for Warren County (continued)

Nature of Participation	Lopatcong	Mansfield	Oxford	Phillipsburg	Pohatcong	White
Submitted Statement of Intent	✓	✓	✓	✓	✓	✓
Attended County Meetings	✓	✓	✓	✓	✓	✓
Formed a local mitigation planning committee	✓	✓	✓	✓	✓	✓
Completed municipal questionnaire and worksheet	✓	✓	✓	✓	✓	✓
Published notice of intent	✓	✓	✓	✓	✓	✓
Distributed questionnaires and summarized public comment	✓	✓	✓	✓	✓	✓
Allowed time for comment at public meetings	✓	✓	✓	✓	✓	✓
Developed community flood mitigation goals	✓	✓	✓	✓	✓	✓
Developed a mitigation strategy	✓	✓	✓	✓	✓	✓
Adopted plan by resolution						

Table 2-4. Record of Participation for Sussex County

Nature of Participation	Andover Borough	Branchville	Byram	Frankford	Fredon	Montague	Newton	Sandyston	Sparta	Stillwater
Submitted Statement of Intent	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Attended County Meetings	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Formed a local mitigation planning committee	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Completed municipal questionnaire and worksheet	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Published notice of intent	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Distributed questionnaires and summarized public comment	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Allowed time for comment at public meetings	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Developed community flood mitigation goals	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Developed a mitigation strategy	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Adopted plan by resolution										

Section 3: Flood Hazard Identification and Profiling

Requirement §201.6(c) (2) (i): *[The plan shall include a] description of the ... location and extent of ... 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.*

With the aim to identify and profile this region's most serious natural hazard - flooding, this section is broken down into the following five sections:

- Nature of the Flood Hazard
- Types of Flooding
- History of Past Flood Events
- Location and Extent of Flood Hazard
- Analysis of Repetitive Loss Properties

Nature of the Flood Hazard

Flooding is a natural and recurring event for a river or stream which is a result of heavy or continuous rainfall exceeding the absorptive capacity of soil and the flow capacity of rivers, streams, and coastal areas. This causes a watercourse to overflow its banks onto adjacent lands. As illustrated in Figure 3-1, floodplains are land areas adjacent to rivers and streams that are subject to recurring inundation.

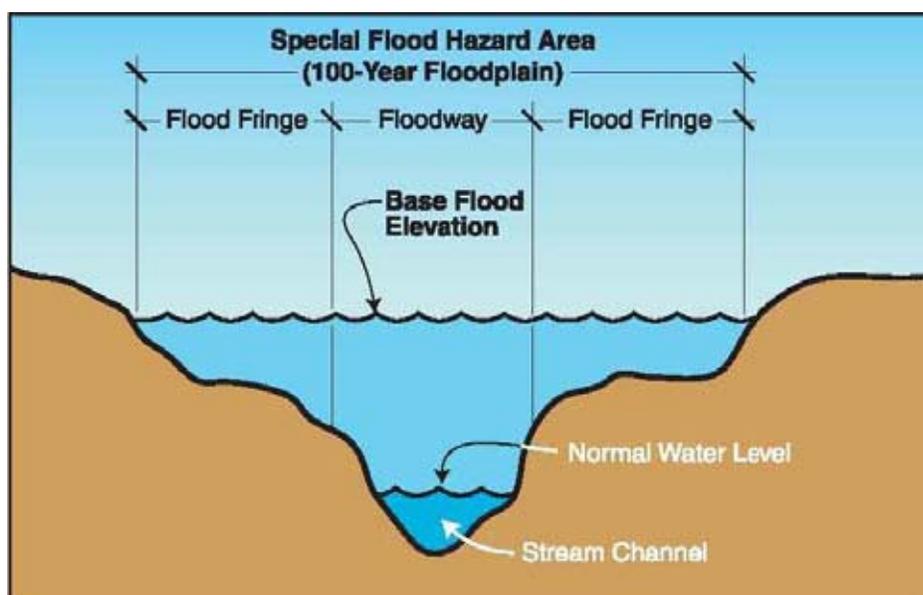


Figure 3-1: Floodplain definition (Source: FEMA, August 2001)

Floodplains are a vital part of the river ecosystem. From the human and economic perspective, flooding is a problem for communities which are built on and around floodplains. But, undeveloped floodplains provide numerous benefits to neighboring communities. These benefits include:

1. **Temporary storage of flood waters.** During intense precipitation events and periods of

high water, floodplains store excess runoff which is then slowly released. This storage capacity slows floodwater velocity and reduces peak flows downstream.

2. **Improvement of water quality.** As stormwater runoff traverses the floodplain, established vegetation improves water quality by filtering out pollutants and sediment before they enter the receiving water. In addition, floodplains store excess sediments which are deposited during flooding events, creating a deposition of nutrient rich sediments historically attracting farming activities to the floodplain.
3. **Stabilization of river banks.** Vegetation along the stream bank anchors and stabilizes the soils, effectively reducing erosion and providing shade to maintain water temperatures.
4. **Habitat.** Floodplains provide habitat for plants and animals and are particularly important as breeding and feeding areas.
5. **Recreation.** Floodplains are appropriate areas for open space, parks, greenways, and recreation areas, all of which protect the natural functions of the floodplain.

In an attempt to quantify the eco-service value of undeveloped land in New Jersey, the NJDEP released an April 2007 report entitled, “Valuing New Jersey’s Natural Capital: An Assessment of the Economic Value of the State’s Natural Resources”. One acre of riparian buffer was reported to have an eco-service value of nearly \$117,000 per acre for goods and services alone (this did not include ecotourism benefits). Riparian buffers in this report were defined as areas adjacent to the river that were not classified as freshwater wetlands. One acre of freshwater wetlands was reported to have an eco-service value of \$393,000 per acre. It can be surmised that the most benefit from a floodplain is realized when it is left in its natural state.

Floods are natural events that are only considered hazards when people and property are affected. Nationwide, hundreds of floods occur each year, making them one of the most common hazards in the U.S. (FEMA, 1997). People have been lured to floodplains since ancient times, by the rich alluvial soil, by the need for access to water supplies, water transportation, and power development, and later as value was assigned to property and development in close proximity to scenic waterways. Human activity has profound impacts on flooding. While some activities can be designed to mitigate the effects of flooding, many current practices and structures have increased the flood risk.

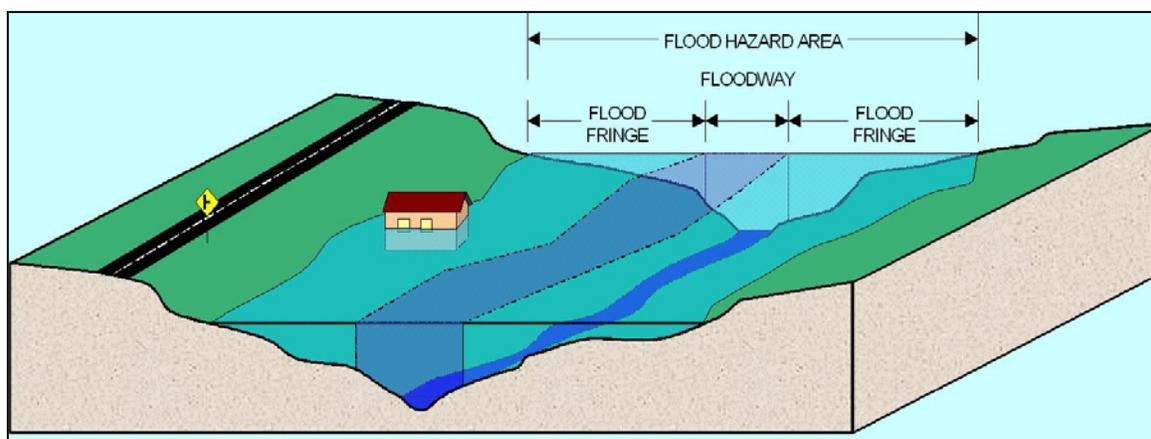


Figure 3-2: Development in the Floodplain (Source: NJDEP, 2007)

National Flood Insurance Program

In 1968, Congress established the National Flood Insurance Program (NFIP). In 1979, the Federal Emergency Management Agency (FEMA) became responsible for administering the NFIP. The NFIP is a Federal program enabling property owners in participating communities to purchase insurance as a protection against flood losses. Participation in the NFIP is based on an agreement between communities and the Federal Government. If a community adopts and enforces a floodplain management ordinance to reduce future flood risk to new construction in floodplains, the Federal Government will make flood insurance available within the community as a financial protection against flood losses. The NFIP is composed of three components: 1) floodplain identification and mapping; 2) floodplain management; and 3) flood insurance.

In addition to providing flood insurance and reducing flood damages through floodplain management regulations, FEMA is required to identify and map the Nation's flood-prone areas and to establish flood-risk zones. Two standard flood zones used to describe risk are the 100-year and 500-year flood zone. The term "100-year" flood zone, also known as the Special Flood Hazard Area (SFHA), is depicted on Flood Insurance Rate Maps (FIRMs) produced by FEMA. The SFHA is essentially the regulatory floodplain, composed of both the floodway and the flood fringe (Figure 3-2). The SFHA is the area where the NFIP's floodplain management regulations must be enforced and the area where the mandatory purchase of flood insurance applies.

Definition of a "100-Year Flood"

The phrase "100-Year Flood" is a cause of confusion among the public, government officials, and insurers. Many continue to believe it is a description of a flood that occurs only once every 100 years. In fact, "100-Year Flood" is an abbreviated way of describing a flood of such magnitude that has a 1-percent (or 1 in 100) statistical probability of being equaled or exceeded in any given year. This terminology describing flood events is often found to be misleading because it is based on statistical probabilities, not periodicity.

Floods are classified according to their statistical frequency of frequency and depth. For instance, there are 10-Year, 25-Year, 50-Year, 100-Year, and 500-Year Floods. A 10-Year flood event occurs more frequently than a 100-Year flood event, but a 100-Year flood event has a larger volume and greater depth of water. The NFIP, adopted the "100-Year Floodplain" as the national standard to describe Special Flood Hazard Areas (SFHA) that are depicted as Zone A on Flood Insurance Rate Maps (FIRMS). In an effort to better communicate flood risk, use of term "100-Year Floodplain" has been replaced with the term "base flood". Base Flood Elevations (BFEs) are listed on FIRMs and are used on Elevation Certificates to indicate the expected depth of water should a flood occur.

Table 3-1 shows the statistical chances of a building located in the 100-Year Floodplain (or Zone A on the Flood Insurance Rate Maps) experiencing different levels of flood events over different periods of time. By definition, more than one 100-year flood event or base flood can occur within the span of a single year or one might not be witnessed on time scales of greater than 100 years. **Based on probability theory, a building in the Special Flood Hazard Area has a 26 % (or 1 in 4) chance of experiencing a 100-year flood over the entire life of a 30-year mortgage.**

Table 3-1: Statistical Chance of Being Flooded

Period of Time	Flood Level			
	10-Yr Flood	25-Yr Flood	50-Yr Flood	100-Yr Flood
1 Year	10%	4%	2%	1%
10 Year	65%	34%	18%	10%
20 Year	88%	56%	33%	18%
30 Year	96%	71%	45%	26%
50 Year	99%	87%	64%	39%

Source: National Flood Insurance Program's Watermark (Fall/Winter 1998 issue)

Flood Frequency

Following the three floods, the flood magnitude and frequency for the eight active streamflow-gaging stations along the main stem Delaware River in New Jersey, New York, and Pennsylvania was updated to include the three recent floods. The Delaware River flood frequency report, "Flood magnitude and frequency of the Delaware River in New Jersey, New York, and Pennsylvania: U.S. Geological Survey Open-File Report 2008–1203" was published in 2008 and is now on line at: <http://pubs.er.usgs.gov/usgspubs/ofr/ofr20081203>

The updated flood-frequency values indicate that the recurrence interval of the September 2004 flood ranged from 20 to 35 years, the recurrence interval of the April 2005 flood ranged from 40 to 70 years, and the recurrence interval of the June 2006 flood ranged from 70 to greater than 100 years.

Precipitation Frequency

A 100-year precipitation event does not automatically produce a 100-year flood. This is because several factors, including topography, soil moisture and ground cover, independently influence the cause-and-effect relation between rainfall and streamflow. A 100-year rainfall event and a 100-year flood are completely different statistical accounts and cannot often be correlated. In determining precipitation frequency, two key elements are rainfall intensity and duration. Precipitation frequency tables developed by the National Oceanic and Atmospheric Administration can be used to determine the statistical probability for the combination of these two factors for the period of observed record in a specific area (NOAA Atlas 14; http://hdsc.nws.noaa.gov/hdsc/pfds/orb/nj_pfds.html).

Flood Depth, Velocity and Duration

Flood damage is often a function of three factors: flood depth, velocity and duration. The floodway, which is the inner portion of the flood hazard area nearest the stream or river, is characterized by deeper flows and higher velocities during a flood. New construction is generally prohibited in floodways because it is unsafe and obstructs the passage of floodwaters. However, areas immediately adjacent to floodways are often subject to flood depths and velocities similar to those of the floodway.

Deeper flooding means greater hydrostatic pressure on walls and floors, more of the building

contents get wet and water soaks materials and contents for a longer time. Flood velocity is important because the faster water moves, the more pressure it puts on a structure and the more it will erode stream banks and scour the earth around a building's foundation. Another concern is how long floodwaters remain, or duration. The longer the duration, the more damage will be done to property and the longer businesses and roads will stay closed.

FEMA Flood Insurance Studies include the “average floodway velocity” for those streams that were studied in detail. This figure is specific to location and is helpful in determining the relative hazard of an area, but is not an accurate indication of the velocity of a flood at any individual site. Sites close to the channel will probably have higher velocities than this figure and sites at the fringe of the floodplain will be subject to lower velocities.

The Corps of Engineers are currently producing digital flood inundation maps for the main stem Delaware using existing data. These maps are expected to be completed by the close of 2008 and will be available through NWS AHPS website and to County Emergency Managers. This mapping is expected to provide useful, detailed information which will convey flood depths at specific locations given a predicted stage height at a nearby stream gage.

Types of Flooding

Riverine flooding is when the rate of rainfall or snowmelt exceeds the rate of infiltration to the ground and the excess water, called runoff, moves across the ground to the lowest section of the watershed. As surface water enters stream channels, stream levels increase. If the rate of runoff is high enough, water in the stream overflows the banks and flooding occurs. Riverine flooding is the type of flooding most often observed in this part of New Jersey.

Two key contributors to flooding are rainfall intensity and duration. Rivers and streams may flood when prolonged rainfall occurs over the course of several days or when intense rainfall occurs over a short period of time. Conditions prior to a rainfall event greatly influence the amount of stormwater runoff into waterways. Thus, topography, soil conditions, and ground cover play important roles. Dry soil allows more infiltration of rainfall and reduces the amount of runoff entering streams. Conversely, soil that is saturated as a result of previous rains has a lower capacity for infiltration, and results in higher rates of surface water runoff.

Floods are the result of a multitude of naturally occurring and human-induced factors, but all can be defined as the accumulation of too much water in too little time in a specific area. Flood hazards include riverine and stormwater flooding, including overflow from a river channel, flash floods, ice-jam floods, flooding due to dam failure, local drainage or high groundwater levels, and erosion.

Regional Floods: Regional floods along the Delaware are often associated with one of the following: spring snow melt combined with heavy rains, slow-moving, low-pressure or frontal storm systems including decaying hurricanes, tropical storms or nor'easters or heavy rainstorms. Regional floods most often occur along the Delaware when one of these weather events occurs during times of saturated soil conditions. Extended wet periods during any part of the year can create saturated soil conditions, after which rain runs off into streams and rivers rather than infiltrate into soil, until river capacities are exceeded. In addition, floods can occur seasonally

when winter or spring rains coupled with snowmelt fill river basins with too much water too quickly. During these times, the ground may be frozen and vegetation dormant, thereby preventing or reducing infiltration into the soil and increasing runoff.

Historically, the flood of 1955 was caused by the remnants of two hurricanes, Connie and Diane, which converged on the Delaware Basin within the span of one week. The remnants of Hurricane Ivan, interacting with a cold front produced tremendous rainfall amounts in September 2004. Two back-to-back early spring rainstorms combined with snowmelt to cause major flooding in the Delaware River Basin in April 2005. Extremely heavy rainfall during June 2006 caused flash flooding and record to near-record flood crests along the Delaware. An intense nor'easter brought heavy rain and flooding to New Jersey in April 2007. All of these events were dependant on both extreme weather events and precursor conditions which caused saturated conditions and set the stage for flood events. More detail can be found later in this Section.

As a recent example of the importance of precursor conditions, one can look to the extreme rainfall in October 2005 caused by the remnants of Tropical Storm Tammy. This event did not cause regional flooding due to below normal precipitation over multiple months preceding the storm which resulted in very low streamflow, soil moisture, reservoir storage, and ground water levels. The soil, vegetation, rivers and reservoirs were able to absorb and contain this event.

Flash Floods: Flash floods can occur within several seconds to several hours, with little warning. Flash floods may be deadly because they produce rapid rises in water levels and have high flow velocities. Several factors can contribute to flash flooding. Among these are rainfall intensity, rainfall duration, surface conditions, and topography and slope of the receiving basin. Urban areas are susceptible to flash floods because a high percentage of the surface area is composed of impervious streets, roofs, and parking lots where runoff occurs rapidly. Mountainous areas also are susceptible to flash floods, as steep topography may funnel runoff into narrow low-lying areas.

Ice-Jam Floods: Ice-jam floods occur on rivers that are totally or partially frozen. A rise in water level will break up a frozen river and create ice flows that can pile up on channel obstructions such as shallow riffles, log jams, or bridge piers. The jammed ice creates a dam, allowing for more jamming to occur. Backwater upstream from the ice dam can rise rapidly and overflow the channel banks. Flooding moves downstream when the ice dam fails, and the water stored behind the dam is released. At this time the flood takes on the characteristics of a flash flood, with the added danger of ice flows that, when driven by the energy of the floodwaters, can inflict damage to structures.

Dam- and Levee-Failure Floods: Fortunately, New Jersey has not had the misfortune of experiencing a catastrophic dam failure but there have been an increasing number of small dam failures. This is largely attributed to the lack of maintenance and inspection as well as the fact that many of the dams in the state are nearing the end of their design life. Dams and levees are built for various purposes and are usually engineered to withstand a flood with a computed risk of occurrence. Like all structures, dams and levees can deteriorate. Many dam owners, including most private dam owners, lack the resources necessary to perform dam maintenance or to make significant repairs. Lack of maintenance causes dams to be more susceptible to failure.

If a large flood occurs, and the dam or levee fails or is washed out, the water behind it is released to become a flash flood. Failed dams or levees can create floods that are catastrophic to life and property because of the energy of the released water.

In 1912, the legislature of the State of New Jersey 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, under the rules and regulations promulgated in May 1985 known as the Dam Safety Standards. Dams under State jurisdiction are artificial barriers, together with appurtenant works that raise the waters of a stream more than five (5) feet above the usual mean low water height.

History of Past Flood Events

Significant flood damage occurs annually in the basin. Figure 3-3 presents peak annual stage at the USGS gage in Trenton, NJ from 1900 through 2007. The figure demonstrates that the Delaware River Basin has had two periods of intense flooding in the last 107 years with relatively quiescent periods between more active flooding periods. Of note, the 1904 flood crest was created by backwater behind an ice jam and not necessarily the result of high stream flows, although heavy rain did precede the event.

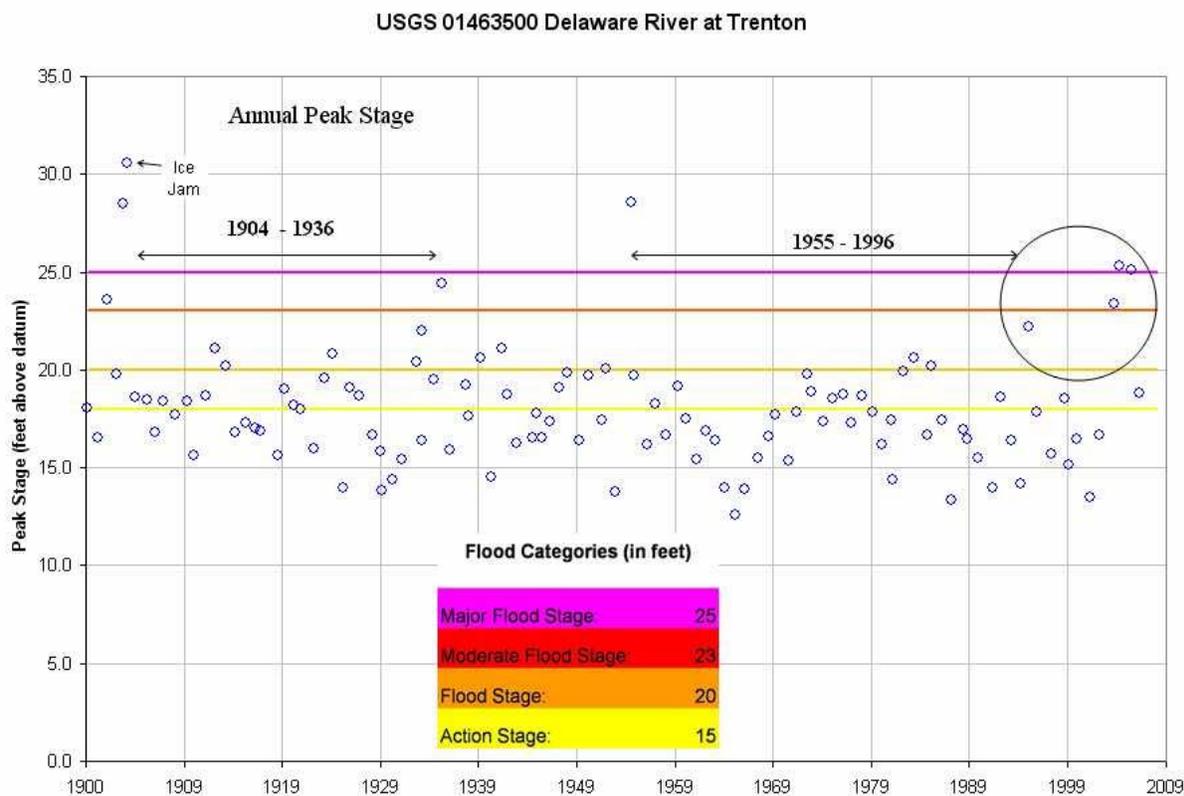


Figure 3-3: Peak Annual Stage at Trenton, New Jersey (Source, USGS)

Table 3-2 presents the ranked flood stage peaks and flows recorded at selected USGS gages

located along the Delaware River. Inspection of the table indicates that 2005 and 2006 floods were among the worst seen on the Delaware River since 1955.

Table 3-2: Top Ten Peak Stage Measurements at Selected USGS Gages in New Jersey

Rank	Montague		Riegelsville		Lambertville		Trenton	
	Date	Stage (ft)	Date	Stage (ft)	Date	Stage (ft)	Date	Stage (ft)
1	10/10/1903	35.5	8/20/1955	38.85	8/20/1955	24.27	3/8/1904*	30.6
2	8/19/1955	35.15	10/10/1903	35.9	10/11/1903	21.8	8/20/1955	28.6
3	6/29/2006	32.16	4/3/2005	34.07	4/4/2005	19.6	10/11/1903	28.5
4	4/3/2005	31.69	6/29/2006	33.62	6/29/2006	19.08	4/4/2005	25.33
5	3/18/1936	28.45	3/19/1936	32.45	3/19/1936	18	6/29/2006	25.09
6	1/20/1996*	26.61	9/19/2004	30.95	01/08/1841	17.9	3/19/1936	24.43
7	5/23/1942	25.7	1/20/1996*	28.72	3/2/1902	17.8	3/2/1902	23.6
8	4/1/1940	24.33	5/24/1942	27.5	03/15/1846	15.5	9/19/2004	23.41
9	6/30/1973	23.4	4/1/1940	26.47	1/20/1996*	15.34	1/20/1996*	22.2
10	3/15/1986	23.28	12/12/1952	25.4	5/24/1942	14.23	5/24/1942	21.12

* Flood caused by backwater from ice jam.
Source: National Weather Service Advanced Hydrologic Prediction Service (6/2008)

Since 1996, seven floods have resulted in Presidential Disaster Declaration for at least one or more of the four NJ counties in this study. Table 3-3 presents a summary of the presidential declared disasters in New Jersey from 1955 – 2007.

Table 3-3. Summary of Presidential Declared Disasters in New Jersey from 1955-2007

New Jersey Disaster Declarations 1955-2007			All NJ	Atlantic	Bergen	Burlington	Camden	Cape May	Cumberland	Essex	Gloucester	Hudson	Hunterdon	Mercer	Middlesex	Monmouth	Morris	Ocean	Passaic	Salem	Somerset	Sussex	Union	Warren	
Aug-55	Hurricane, floods	41-DR	n										y	y											
Mar-62	Severe storms, high tides, flooding	124-DR	n										y	y											
Aug-65	Water shortage	205-DR	n										y	y											
Jun-68	Heavy rains, flooding	245-DR	n										y	y											
Sep-71	Heavy rains, flooding	310-DR	n										y	y											
Aug-73	Severe storms, flooding	402-DR	n										y	y											
Jul-75	Heavy rains, high winds, hail, tornadoes	477-DR	n										y	y											
Aug-76	Severe storms, high winds, flooding	519-DR	n										y	y											
Feb-77	Ice conditions	528-DR	n										y	y											
Apr-84	Coastal storms, flooding	701-DR	n										y	y											
Oct-85	Hurricane Gloria	749-DR	n										y	y											
Mar-92	Coastal storm	936-DR		y				y	y	y			y	y		y		y					y		
Dec-92	Coastal storm	973-DR		y				y	y	y			y	y		y		y		y	y		y		
Jan-96	Snow, blizzard	1088-DR		y	y	y		y	y	y			y	y		y	y	y	y	y	y	y	y	y	y
Nov-96	Flooding	1145-DR			y		y						y	y								y	y		
Sep-97	Severe storms, flooding	1189-DR		y							y	y	y	y											
Mar-98	Coastal storm	1206-DR		y				y					y	y				y							
Sep-99	Hurricane Floyd	1295-DR								y			y	y		y		y			y				
Aug-00	Flooding	1337-DR											y	y								y			y
Jul-04	Severe storm, flooding	1530-DR				y	y						y	y											
Oct-04	Tropical Depression Ivan	1563-DR											y	y								y			y
Apr-05	Severe storms and flooding	1588-DR			y					y	y		y	y			y		y				y		y
Jul-06	Severe storms and flooding	1653-DR											y	y								y			y
Apr-07	Severe storms, inland and coastal flooding	1694-DR		y	y	y	y			y	y	y	y	y		y		y			y	y	y	y	y

Descriptions of major floods that have historically occurred in the study area are presented below. Data presented was obtained from municipalities, counties and the NOAA National Climatic Data Center (NCDC) Storm Event Database (www4.ncdc.noaa.gov). Where data is readily available, the effect of flooding on specific municipalities and counties is presented.

1903 - October

In October of 1903, the river stage reached 28.50 ft at Trenton, the third highest recorded crest to date. The flood waters caused nearly one million dollars in damage and 9 bridges were washed away including the bridge between Lambertville and New Hope, the Yardley Bridge, and a new steel bridge between Byram and Point Pleasant. The wreckage from bridges was distributed over 57 miles. Train tracks were also washed out or submersed by flood waters and the Delaware and Raritan Canal embankments failed in several places.

1904 - March

In March 1904, Trenton experienced its worst flood of record to date. After a few days of heavy rains, ice melt upstream, and an ice jam at Terriwig Bar in South Trenton, the river rose rapidly and crested at 30.6 ft. A great majority of South Trenton was underwater, the statehouse boiler room was flooded with at least two feet of water, and the City Water Works pump house was submerged. The New York Times reported that the Pennsylvania Railroad parked loaded coal cars on a new three million dollar bridge to prevent it from being washed away.

1936 - March

The March 1936 warm rain fell on a significant amount of snow creating flooding from the combined rainfall and snow melt runoff. The USGS reported (Water Supply Paper 799) that “two extraordinarily heavy” rain events occurred in succession over the Northeastern U.S. and noted that the precipitation amounts from the storms ranged from 10 to 30 inches. Combined with the accumulated snow and warm temperatures, the amount of water to be drained overwhelmed the waterways. Flooding events in the Delaware and other areas in 1936, most notably the Johnstown flood, contributed to the justification for the Flood Control Act of 1936.

1955 - August

After a relatively quiescent period between the 1904 flood and the 1936 flood, the basin was hit by the remnants of two hurricanes, Connie and Diane, in one week. Although Connie did not inflict damage, saturated conditions were created throughout the basin. When Diane hit two weeks later, little water could soak into the ground and flash flooding conditions occurred. The flood stage was the highest on record since the flood of 1903 and the ice jam flood of 1904.

The 1955 flood killed between 25 and 99 individuals in the Delaware River Basin according to the National Weather Service and newspapers, respectively. In August 1955, Pennsylvania, New York, New Jersey, and Connecticut declared emergencies due to wide-spread flooding. The New York Times reported that the Delaware River overtopped its banks around the Port Jervis, Sussex County area and smaller tributaries began to flood parts of the towns that were not affected by the Delaware River. Northwestern New Jersey was also adversely affected by the storm. The National Weather Service reports that Diane caused \$831,700,000 worth of damage. Without adjusting for inflation, this makes Hurricane Diane the 27th costliest mainland tropical cyclone from 1900-2006.



The Washington Crossing Bridge is battered by the fury of what was to become known as the Great Flood of 1955. Further downstream, the steel bridge linking Ewing Township, N.J. to Yardley, Pa. was destroyed by the Delaware's record-high flows.

1996 - January

The winter flood of mid-January 1996 was the result of heavy snowfall, a frozen river and several unseasonably warm days with constant rainfall. In the days leading up to the flooding, temperatures reached into the 50's and created ideal conditions to melt the snowpack that was covering the entire basin. Intense rainfall accelerated the snowmelt, resulting in large amounts of runoff being directed to streams and the rivers. A Pennsylvania State University weather forecaster said the flooding was the result of the primarily density of the snow pack rather than the warm weather and rainfall. The snow pack was so dense in places that four or five inches melted yielded an inch of water. The break-up of an ice jam on the Delaware River near the Delaware Water Gap (Kittatinny Point) caused a rapid rise of the river on the 20th. This flooding was the worst to hit the basin in more than 20 years. Some smaller streams broke their all-time flood records.

In Mercer County, more than 2,000 persons were evacuated from Hopewell, Ewing and Trenton as the Delaware rose above flood stage on the 20th and 21st. The flooding from the river reached the State House Annex and parking lot in Trenton. The Assunpink Creek also flooded basements along Mulberry Street and caused what was described as a "littany of street closures".

In Hunterdon County, flooding forced the evacuation of over 500 residents, over half of which were from Lambertville. The worst damage occurred in Kingwood, Lambertville and Holland. Some homes in Lambertville had up to 5 feet of water in them. The footbridge to Lewis Island washed away.

In Warren County, about 800 persons were evacuated by boat, half of which from Harmony Township. Hardest hit were Harmony, Pohatcong, White and Knowlton Townships. Water from

the Delaware surrounded many homes. Some homes had water damage up to the second floor. Porches were washed away and chunks of ice were left behind. It was estimated that 130 residences including mobile homes and apartment buildings were badly damaged along with about twenty businesses. Besides the Delaware, flooding along the Musconetcong River inundated homes in Hackettstown; flooding along the Shabbecong Creek forced the evacuation of 50 people and caused water damage to 70 homes and flooding along the Pequest River inundated homes and businesses on Water and Wall Streets in Belvidere.

In Sussex County, the worst damage was in Montague, Sandyston, Vernon and Walpack Townships. There were many washed out roads and damage to culverts and bridges.

1996 - October

Rain, heavy at times, especially during the morning of the 19th caused widespread urban flooding and the flash flooding of several streams within Mercer County. The rain was over by early afternoon, but flooding along the Assunpink Creek lasted through the morning of the 20th. Flood waters from the Assunpink Creek reached the stoops of houses on two blocks in Trenton. The worst flooding was along Mulberry Street.

1999 - September

Hurricane Floyd spread heavy rainfall throughout the basin on September 16, 1999, producing six- to ten-inches over an 18-hour period. Extensive flooding damage occurred along tributaries in the lower portion of the basin. The hurricane caused record breaking flooding in the Raritan River Basin. Several people lost their lives and many homes were severely damaged. In addition, the transportation systems were disrupted and a number of bridges were destroyed.

In Mercer County about 400 persons were evacuated in Ewing, Lawrence, and Trenton. About 85 major roads were closed including sections of Interstate 95, U.S. Routes 1 and 130 and New Jersey State Route 33. Hundreds of water rescues from trapped vehicles occurred. In Trenton the worst flood damage occurred along the Assunpink Creek. Forty homes and three businesses were damaged on Mulberry Street, Dickinson Street and North Clinton Avenue. In Ewing Township, about 150 residents were evacuated from the Willow Creek Rehabilitation and Care Center. In Lawrence Township, six homes were badly damaged by flood waters from the Delaware and Raritan Canal. Businesses, car dealerships and residents near the Shabakunk Creek also suffered flood damage.

In Hunterdon County five homes were destroyed, 117 had major damage and 582 had minor damage. Two apartments suffered major damage and 7 suffered minor damage. Twenty-four businesses also were damaged. About 125 persons were evacuated. Five percent of all county roads were damaged and three bridges were expected to remain closed through mid November. Hardest hit was Lambertville, especially the south side of the city near Swan Creek. Nearly 100 homes were flooded and half the evacuations within the county occurred in this city. The flooding creek also cracked a water pipe leaving the south side of the city with no water. Elsewhere the elementary school was flooded with nearly two feet of water (damage estimate 1.1 million) as a creek behind the school overflowed. Other streams and rivers flooded in Alexandria, Califon, Frenchtown and Holland Townships.

On a relative basis the effects of Floyd diminished across Warren and Sussex Counties. About 38,000 homes and businesses lost power in these counties. Hardest hit were Byram Township, Frankford Township, Hopatcong Borough and the town of Newton. Flooding caused by Floyd contaminated municipal wells in Andover and Hampton Townships.

2004 - September

The remnants of Hurricane Ivan, interacting with a cold front that dropped into the northeastern United States late Friday, September 17, 2004, produced tremendous rainfall amounts across northeast Pennsylvania and southern New York. Most of the Delaware River Basin upstream of Trenton received three- to five-inches of rain in a 12-hour period, with some isolated areas receiving as much as seven or eight inches. Much of the heavier rain occurred in the mountainous regions of the basin in the Poconos and Catskills, while many areas in the southern half of the watershed received an inch or less. This rain fell on soils already saturated by a wet summer, including Tropical Storm Frances just a week before. Even before the rains from Ivan arrived, the Delaware River at Montague and Trenton, N.J. was flowing at 298 percent and 265 percent of normal, respectively, for the first half of September. The flooding on the main stem Delaware River was the worst since August 1955. No fatalities were reported in the basin as a result of Ivan, thanks in large part to the efforts by the National Weather Service, emergency management officials (including police, fire, and other rescue personnel), and the media, among others. New warning products and other tools that were developed or upgraded since the last time major flooding occurred along the Delaware in January 1996, such as Advanced Hydrologic Prediction Service (AHPS), helped to provide the necessary lead time to get hundreds of people out of harms way.

While the rain was not as heavy in Mercer and Hunterdon County, the runoff from the heavy rain upstream produced the worst flooding along the Delaware River since 1955. Townships and roadways along the Delaware River were hardest hit. Damage was estimated at two and a half million dollars in Mercer County and close to one million dollars in Hunterdon County (reported by the National Climatic Data Center).

In Warren County, storm totals averaged 3 to 6 inches with locally higher amounts throughout the county. The torrential rain caused widespread poor drainage, creek and river flooding. Damage was estimated at twenty-eight million dollars. The Delaware River washed a home from Harmony Township. The home crashed into the Easton-Phillipsburg Free Bridge. The impact sheared the roof from the home and the remainder floated under the bridge. In White Township officials condemned more than two dozen cottages as Delaware River flood waters broke windows and filled the homes with mud.

In Sussex County, Doppler Radar storm total estimates averaged between 2 and 5 inches throughout the county. The torrential rain caused widespread poor drainage, creek and river flooding.

On September 28, 2004, the remnants of Tropical Storm Jeanne brought four to eight inches of rain to the Philadelphia metropolitan area, primarily in Delaware, Pennsylvania, and New Jersey north of the "Fall Line" (a geologic divide that separates the Coastal Plain from the more highly elevated Piedmont region to the west). The heavy precipitation caused widespread urban

and small stream flooding. Streams from northern Delaware to central New Jersey rose rapidly above flood stage during the evening hours, making roadways hazardous and evacuation difficult.

2005 – April

Two back-to-back early spring rainstorms, the first on March 28-29 and a second on April 2-3, 2005, combined with snowmelt to cause major flooding in the Delaware River Basin. Along the main stem of the Delaware River, the flood crests exceeded those reached in Tropical Storm Ivan only six-and-a-half months earlier, and again caused evacuations, bridge and road closures, and extensive damage. The first storm brought over two inches of rain to western and northern portions of the basin. Warm temperatures melted about half of the snow pack, which totaled over three inches water equivalent in some northern watersheds. The second storm produced three- to five-inches of rain in the middle half of the basin, over two inches in the Catskill headwaters, and melted most of the remaining snow. By April 3rd, flood stages were exceeded on rivers and streams throughout the Delaware River Basin. Flooding was the most severe along the main stem Delaware River and headwater tributaries. Until 2006, flood stages from these events ranked third at several USGS monitoring locations, including Montague, Belvidere, Riegelsville, and the fourth largest at Trenton.

In Sussex, Warren, Hunterdon, Mercer and Morris Counties, about 1,800 homes and businesses were flooded, 25 homes were destroyed. Many of the homes and businesses that were flooded, had flooding into the first floor of their dwellings. About 4,000 people were evacuated from the five counties. Many major roads and a dozen low-lying bridges from Trenton north were closed. As river levels rose, low-lying bridges across the Delaware River were damaged. Damage to the bridges was estimated at \$1.5 million with the greatest damage and longest closure to the Washington Crossing Bridge between Bucks and Mercer Counties. Total statewide damage from this storm was estimated at \$52 million dollars. Miraculously there were no deaths or major injuries.

In Mercer County about 1,900 people were evacuated from Trenton, Ewing and Hopewell Township. Many roads (including New Jersey State 29) were flooded and bridges were closed. In Trenton, the entire Island section between the Delaware River and New Jersey State Route 29 was evacuated. Additional evacuations occurred in the Glen Afton section and the West Ward. The Island residents could not return until April 8, 2005. Over 100 homes had to be rewired as flooding reached into the first floor. Flooding reached up to eight feet in the lower level of the Statehouse parking lot, and prevented non-essential state personnel from working on April 4-5. About 500 persons were evacuated in Ewing Township including residents in the River Edge Apartments. A few evacuations also occurred in the Titusville Section of Hopewell Township. The Calhoun Street Bridge was reopened on the 5th and New Jersey State Route 29 was reopened on the 6th. The Washington Crossing Bridge was briefly reopened during the afternoon of the 6th, but was closed shortly thereafter when erosion was found around one of the bridges piers. A 3 foot by 8 foot section of one pier was eroding. It was believed that had been struck by a dumpster.

In Hunterdon County, Lambertville, Frenchtown, Stockton and Milford Boroughs were affected the most by the flooding along the Delaware River. In Lambertville, the Delaware

River merged with the Delaware and Raritan Canal. Swan Creek also flooded. Flood waters inundated the first floor of the Justice Complex. About 200 homes were damaged as first floor flooding occurred. South Union Street and Lambert Lane were hit the hardest. In Frenchtown Borough about 50 homes suffered substantial damage as did the borough's post office. The sewage treatment plant was also damaged. Four hundred feet of River Road was washed away. New Jersey State Route 29 between Frenchtown and Lambertville was closed. In Stockton, the locks in the canal at Prallsville Mills broke and sent Delaware River water into the borough. Five homes on Mill Street were condemned as the water blew out some back doors. In Alexandria Township, mudslides tore down trees and wires. In Kingwood Township, sheds were ripped from their foundations. The Musconetcong River flooded along the Hunterdon and Warren County border. In the Delaware River itself, flooding at the Treasure Island Boy Scout Camp located between Pt. Pleasant, PA and Frenchtown, NJ forced the closure of the facility for the year.

In Warren County, about 1,350 people were evacuated from every municipality along the Delaware River as well as along the U.S. Route 46 corridor. U.S. Route 46 was closed for days. Knowlton and Harmony Townships along the Delaware River suffered the most monetary damage. Flooding also occurred along the Musconetcong, Paulins Kill, and Pequest Rivers. Fourteen homes in the county were destroyed, one hundred ninety-two suffered major damage, one hundred twenty-five homes suffered minor damage and another eighty-four had water in their basements. The Easton-Phillipsburg Bridge was closed from the 3rd through the 7th and suffered some superficial damage. In Harmony Township, about 350 people were evacuated. Several trailers were displaced from their foundations. The Town of Phillipsburg evacuated about 500 persons.

In Sussex County, the hardest hit townships were Montague and Sandyston Townships along the Delaware River. Two homes in each township were destroyed. All inhabitants of Mashipacong Island in Montague Township were evacuated. Other residents along the Delaware River were also evacuated in Montague and Sandyston Townships. The Dingman's Ferry Bridge between Layton (Sandyston Township) and Pike County was closed. Flooding problems also occurred in Byram, Hardyston and Stillwater Townships. A voluntary evacuation was suggested for residents in Hardyston and Franklin Townships after the Summit Lake Dam was found to be leaking. The dam did not fail. Numerous basements were flooded in Newton and Lubbers Run flooded in Byram Township. Numerous roads throughout the county were closed. In addition to the destroyed homes, four homes in the county suffered major damage while 62 others suffered minor damage.

2006 - June

Extremely heavy rainfall over the Delaware River Basin during the June 24-28 period caused flash flooding and record to near-record flood crests along many streams and rivers throughout the basin, including the main stem Delaware River. Although hydrologic conditions were normal to dry prior to Saturday, June 24, the broad area of the rainfall and its intensity in the western half of the basin produced the flooding. National Weather Service data indicate that six to over 15 inches of rain fell in the Schuylkill, Lehigh, and upper Delaware River watersheds during the period. At least five inches fell throughout nearly all of the Delaware River Basin, with the exception of portions of New Jersey and the immediate Philadelphia area which received less.

Heavy rainfall during June 24-26 saturated the ground and produced bank full and minor flooding conditions by early Tuesday, June 27. Then, precipitation on June 27 and early on Wednesday, June 28 produced an additional two to over six inches of rainfall in the Schuylkill, Lehigh, and Lackawaxen watersheds as well as in Sullivan and Delaware counties in New York State. The high rate of runoff combined with the already bank full conditions to produce the near-record flooding conditions. The flood crests on the main stem Delaware River occurred on June 28 and 29. To date, the June 2006 storm is the third largest crest at Montague, fourth largest crest at Belvidere and Riegelsville, and the fifth largest crest at Trenton.

Between Mercer and Sussex Counties ten Delaware River bridges operated by the Delaware River Joint Toll Bridge Commission were closed. In Mercer County, over 400 homes and apartments were flooded, one was destroyed and over 50 suffered major damage. Over 4,000 people were evacuated, mainly from Ewing Township and Trenton. In Trenton, about 1,500 people were evacuated from the Island and Glen Afton sections. About 280 homes were flooded. Evacuations included senior citizens from the Water's Edge Convalescent Home. Most people returned by the 4th of July, except for residents in two apartment complexes. Trenton's water filtration system was shut down because of the debris in the Delaware River. A water emergency was declared for all areas served by the Trenton Water Works in Trenton, Lawrence, Ewing, Hamilton and Hopewell. Water use restrictions and calls for conservation were in place. The system started running at half of capacity on the 30th and was back at full strength on July 1st when the water emergency was cancelled. Non-essential state workers were told to stay home from the 28th through the 30th. The Statehouse parking garage suffered over half a million dollars in damage to its electrical and mechanical equipment after it flooded. Major New Jersey State Route 29 was flooded and closed in and out of Trenton. In Ewing, about 2,500 people from apartments and condominiums from Lower River Road to Upper Ferry Road were evacuated. In the Titusville section of Hopewell Township, about 20 homes were evacuated between the Raritan and Delaware Canal and the Delaware River. The Washington's Crossing State Park was also flooded and closed.

In Hunterdon County nearly 400 homes and businesses were damaged. Nearly 100 homes and about 5 Lambertville businesses suffered major damage. About 1000 people were evacuated from river municipalities. The worst reported damage was in Frenchtown, Lambertville and Stockton. Flood damage was also reported on West Amwell, Delaware, Kingwood, Alexandria, Milford and Holland Townships. Flooding caused approximately one million dollars in roadway damage. In Lambertville, a 39-year-old man was found dead in Swan Creek near the Lambertville Municipal Court on the 29th. He was last seen alive leaving the Inn of the Hawk on South Main Street. The borough's sewage and dechlorination plant were under water. In Stockton, a levee breach compounded the flooding. In Frenchtown, the sewage treatment plant was damaged. Most of the home damage in the borough occurred along River Road where up to four feet of water amassed on the first floor. Flood waters from the Delaware River backed the Nishisakawick Creek, which also flooded. In Holland Township, 15 homes were flooded into their first floor. In the middle of the Delaware River, about 200 boy scouts and counselors were evacuated from the Treasure Island Boy Scout Camp. For the second year in a row, extensive damage caused its closure for the season. Bull's Island Recreation Area was also badly damaged by the flooding.

In Warren County, about 400 homes, businesses and apartments were affected by the flooding and 1300 persons were evacuated from seven riverside municipalities. Three homes and one business were destroyed. Nearly 200 homes suffered major damage. A shelter was opened in Phillipsburg where up to 900 persons were evacuated. In the borough, about a dozen roads were closed and 14 streets near the Delaware River were evacuated. Evacuations also occurred in Belvidere, Harmony, Knowlton, Pohatcong and White Townships. Harmony Township though suffered the worst property damage as one home was literally lifted off its foundation. In Belvidere, water from the Delaware River backed up the Pequest River, which also flooded in the borough. Flood waters reached into the first floor of some homes. The water treatment plant in Hackettstown was closed because of the flooding. Major U.S. Route 46 was closed from exit four of Interstate 80 in Knowlton Township to its intersection with County Route 519 in White Township.

In Sussex County, twelve homes were damaged in the county by flood waters, ten suffered major damage. Most of the damaged homes were in Montague Township along River Road. About 60 homes in the township were evacuated. People were evacuated from Sandyston Township and five people were rescued from Mashipacong Island. The Dingman's Ferry Bridge in Sandyston Township was closed after chunks of roadway were displaced. Beaches at the Delaware River Water Gap National Recreational Area were closed for three weeks.

2007 – April

An intense nor'easter brought heavy rain and flooding to New Jersey that started on the 15th. The worst flooding occurred along the Raritan and Passaic River Basins. It was the worst flooding in the Raritan Basin since Hurricane Floyd in 1999. Numerous streams and rivers flooded, but the flooding along the Delaware River was minimal. Statewide damage was estimated at \$180 million dollars.

In Mercer County, many major roadways in the county were flooded and closed in sections including U.S. Routes 1, 130 and 206 and New Jersey State Route 33. It was estimated that over 1,000 basements were flooded in the county. Flooding waterways included the Assunpink, Little Brook and Stony Brook. In Trenton, Assunpink Creek flooding affected eight homes on Mulberry Street. North Olden Street was also flooded by the creek.

In Hunterdon County, the Delaware River only flooded low-lying areas. In Raritan Township, about a dozen people evacuated from the Darts Mills Grove section. In Stockton, the school was flooded into the first floor. In Lebanon Township, flooding along both the Musconetcong River and the South Branch of the Raritan River flooded three roads. Major roadways that were closed included U.S. Route 22 in Clinton and Readington and New Jersey State Route 29 in West Amwell Township.

In Warren County, heavy rain caused several creeks and streams to flood and forced the closure of eighteen major roadways. Westbound Interstate 80 was closed in Knowlton Township because of a rockslide. In Blairstown both the Paulins Kill and Blair Creek flooded. There were a few evacuations near the flooded creek and one home suffered flood damage. The Paulinskill overflowed a bridge in the township and forced the closure of State Route 94. Roads were also closed in White, Hardwick, Harmony, Pohatcong and Greenwich Townships. Flooding was also

reported along the Pohatcong Creek and the Musconetcong River.

In Sussex County, the heavy rain and flooding caused several major roads including New Jersey State Route 23 in Wantage and Hardyston, New Jersey State Route 94 in Hardyston and Vernon, U.S. Route 206 in Newton and County Route 517 in Hamburg and Hardyston.

Precipitation Trend

Figure 3-4 presents the 72 month precipitation departure between April 2002 and March 2008 for the United States. The New Jersey municipalities in the project area received between 50 and 65 inches of excess rainfall in the past six years. The excess rainfall amounts to between 8 and 11 inches per year on average, or up to 25 percent greater rainfall than normal. In the upper Delaware Basin, the watershed experienced an even greater departure from normal of up to 80 inches.

Although many factors contributed to flooding in the Delaware River, excess precipitation clearly played a major role.

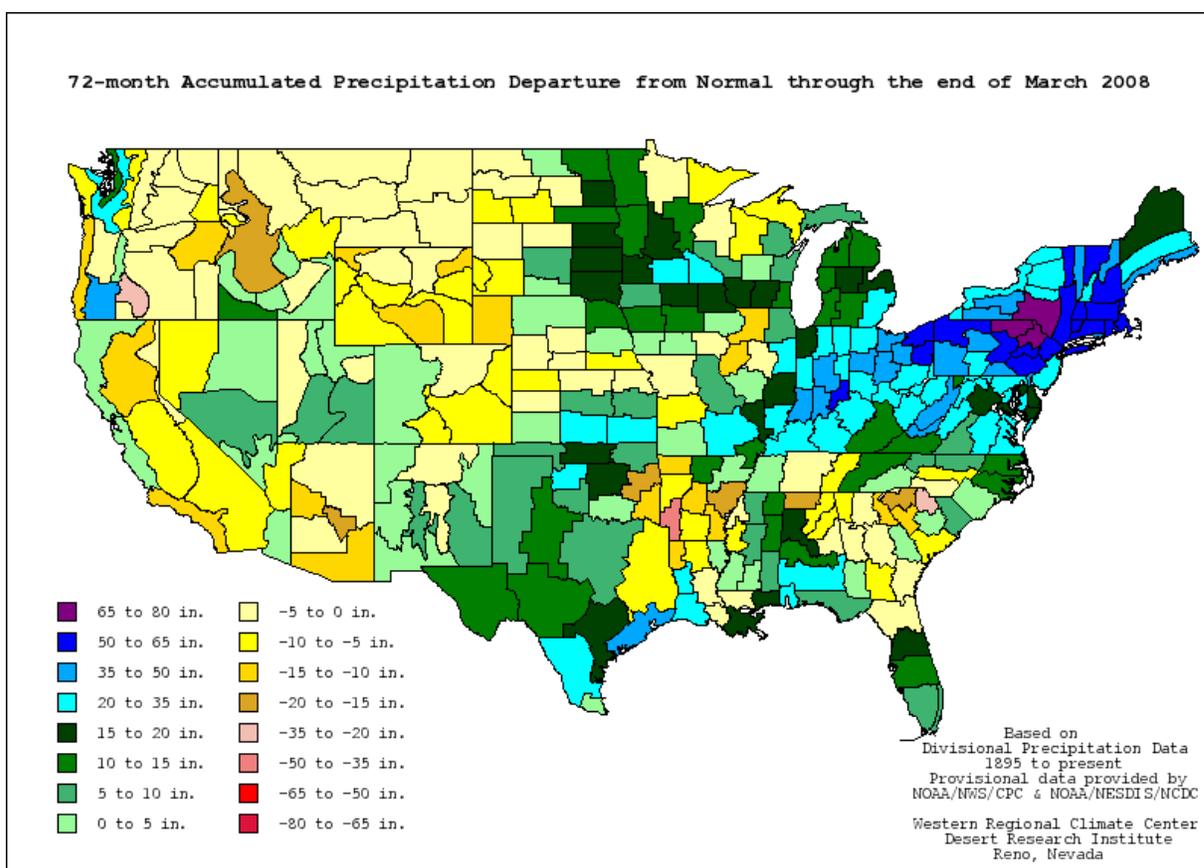


Figure 3-4. Nation-wide Precipitation Departure from Normal for the Past Six Years

Location and Extent of Flood Hazard

Although the area in floodplains is not a perfect indicator of flood, it nevertheless provides a reasonable proxy for potential exposure. Table 3-3 shows the number and percentage of floodplain acres per County and the percentage of those floodplains that ultimately drain to the Delaware River Basin (DRB). County-level graphics of the FEMA Q3 data are located in Appendix D.

Table 3-3. Land Area per County in the Special Flood Hazard Area

County	Acres of Floodplain per County	Percentage of Total Land Area	Acres of Floodplain in the DRB	Percentage of Floodplains in the DRB
Mercer	15,564	10.65%	12,107	77.79%
Hunterdon	14,546	5.19%	5,466	37.57%
Warren	13,212	5.69%	13,212	100%
Sussex	24,350	7.38%	13,946	57.27%

Source: 2008 State of New Jersey Hazard Mitigation Plan (data derived from FEMA Q3 data)

Notes:

1. Floodplain in this table is defined as the FEMA designated Special Flood Hazard Area. This risk zone is depicted on FEMA Flood Insurance Rate Maps (FIRMs) as Zone A. An A Zone is equivalent to an area with a 1% annual chance of flooding (otherwise known as the 100-year floodplain)
2. DRB = Delaware River Basin, i.e. drains to the Delaware River

Analysis of Repetitive Loss Properties

Flooding affects all watersheds in the Delaware River Basin. However, flood damage potential is a function of human development in floodplains. The National Flood Insurance Program (NFIP), administered by the Federal Emergency Management Agency (FEMA), makes federally-backed flood insurance available in communities that adopt and enforce floodplain management ordinances in the effort to help reduce future flood losses. Through the collection of insurance premiums, the program aims to transfer the cost of flood loss reimbursement from tax payers to floodplain property owners. In addition to reimbursing flood victims for their losses, NFIP encourages development away from flood-prone areas and requires new and substantially improved structures to be constructed in a way that minimizes or prevents flood damage.

Close to 20,000 flood insurance claim reimbursements have been awarded in the Delaware Basin since the late 1970s. Flood insurance claims reflect only a fraction of the total cost of property damage caused by flooding. The numbers presented in this analysis are most likely grossly underestimated and do not represent all properties that have experienced flood loss. This is due in part to the fact that only a small percentage of property is insurable. For example, roads, bridges, public utilities and the natural environment cannot be insured. Further, many owners choose not to purchase the insurance because they are required to do so only if their property was purchased with a federally-backed mortgage and is located in the Special Flood

Hazard Area (100-year flood zone). Notwithstanding these limitations, insurance claims (since the NFIP's inception in the late 1970's) can provide a general depiction of flood damage centers.

Repeat flood insurance claims indicate areas where floodplain occupancy continues in spite of repeated inundation. As of 01/31/08, FEMA identified 562 repetitive loss¹ and 60 severe repetitive loss² properties in Mercer, Hunterdon, Warren and Sussex counties. The definition of a repetitive loss property is 2 or more flood losses, where the definition of a severe repetitive loss property is 4 or more flood losses or when the payments exceed the building value.

As an example of the severity of flooding in recent years, the number of **repetitive loss properties in the entire Delaware River Basin prior to September 2004 was 317**. Between September 2004 and February 2007, **an additional 2,266 properties** were added to this list. Repetitive loss properties by of the four counties in this plan are presented in Table 3-4. These numbers are for each entire county and include both participating and nonparticipating municipalities, as well as, municipalities that fall outside of the study area of this Plan but are within county boundaries.

Table 3-4. Repetitive Loss Properties by County

County	Number of Repetitive Loss Properties	Total Payouts for Repetitive Loss Properties	Number of Severe Repetitive Loss Properties	NFIP Policies in Force as of 01/31/08
Mercer	197	\$27,699,461	5	2389
Hunterdon	169	\$25,085,048	10	1032
Warren	192	\$27,926,993	45	724
Sussex	4	\$639,765	-	322

Source: Federal Emergency Management Agency (FEMA); 01/31/08

Notes:

1. FEMA provided the repetitive loss properties list to DRBC. Properties were then mapped and summaries compiled by DRBC using Lat/Long coordinate points provided by FEMA. On occasion, the Lat/Long location does not match the FEMA assigned community name for specific claims.
2. Entire counties are represented in the above table, all municipalities that have repetitive loss properties are included whether or not they participated in the Plan.
3. This analysis does not capture uninsured flood damage.
4. Only FEMA validated severe repetitive loss properties are included.

Flood prone communities often state that available funds are not sufficient for either

¹ A property is considered a repetitive loss property by FEMA when there are 2 or more losses reported which were paid more than \$1,000 for each loss. The 2 losses must be within 10 years of each other and be at least 10 days apart.

² A property is considered a severe repetitive loss property by FEMA either when there are at least 4 losses each exceeding \$5000 or when there are 2 or more losses where the building payments exceed the property value.

acquisition or elevation of residences and other buildings that are repeatedly flooded. As a means of illustrating the need for additional funding and in an effort to identify the most flood-prone communities, a summary of participating municipalities with the greatest number of repetitive loss properties is presented below.

Table 3-5. Top Ranked Participating Municipalities with Repetitive Loss Properties

Municipality	County	Number of Repetitive Loss Properties	Total Payouts for Repetitive Loss Properties	Number of Severe Repetitive Loss Properties	NFIP Policies in Force as of 01/31/08
City of Trenton	Mercer	155	\$22,611,451	3	470
Harmony Township	Warren	66	\$27,926,993	24	105
Lambertville	Hunterdon	64	\$9,278,749	1	225
Town of Belvidere	Warren	36	\$9,567,744	4	96
Stockton Borough	Hunterdon	32	\$5,257,575	2	92
Knowlton Township	Warren	32	\$4,702,982	6	61
Pohatcong Township	Warren	27	\$3,994,785	5	73
Kingwood Township	Hunterdon	24	\$3,357,547	4	47
Ewing Township	Mercer	22	\$2,354,703	1	402
Frenchtown Borough	Hunterdon	20	\$2,974,853	0	78

Source: Federal Emergency Management Agency (FEMA); 01/31/08

Each of the following four pages present a table and map of repetitive loss properties for each County. All data presented in this analysis was supplied by FEMA and includes closed claims reported up to and including January 31, 2008. FEMA provided the repetitive loss and validated severe repetitive loss listings. Properties were then mapped and summaries compiled by DRBC using Lat/Long coordinate points provided by FEMA. On occasion, the Lat/Long location does not match the FEMA assigned community name for specific claims. Therefore, the numbers of repetitive loss properties in each municipality may differ slightly from other numbers published by FEMA.

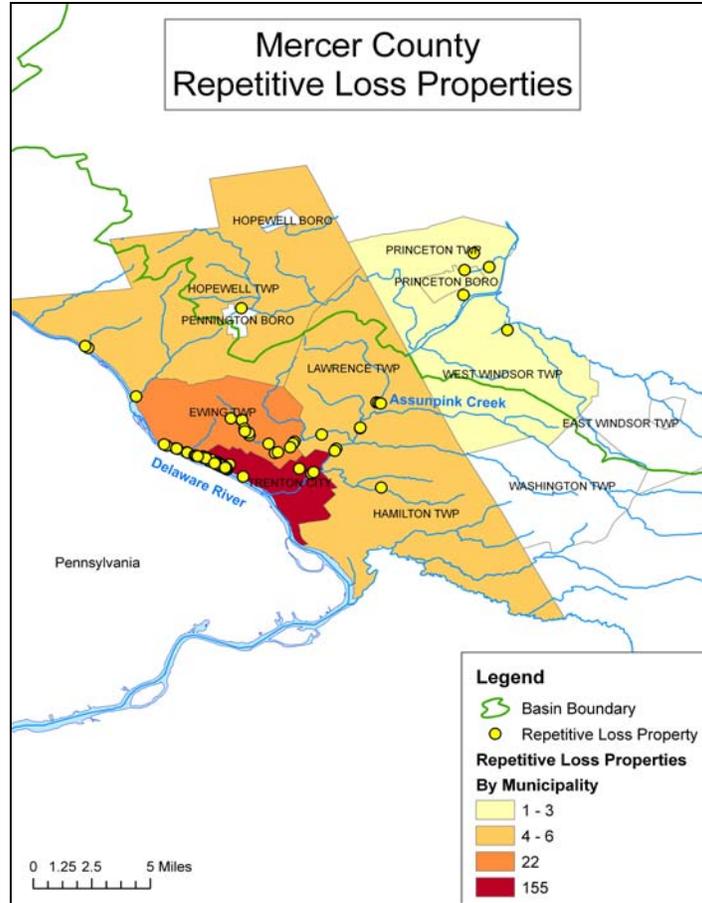


Table 3-6. Mercer County Municipalities Ranked by Repetitive Loss Properties

Municipality	Number of Repetitive Loss Properties	Total Payouts for Repetitive Loss Properties	Number of Severe Repetitive Loss Properties	NFIP Policies as of 01/31/08
City of Trenton	155	\$22,611,451	3	470
Ewing Township	22	\$2,354,703	1	402
Hopewell Township	6	\$771,947	-	81
Hamilton Township	5	\$853,613	-	770
Lawrence Township	4	\$624,795	-	232
Princeton Township**	3	\$210,434	1	112
West Windsor Township*	1	\$171,736	-	118
Princeton Borough**	1	\$100,782	-	52

Source: Federal Emergency Management Agency (FEMA); 01/31/08

Notes: * non-participating municipality, ** municipality outside of study area

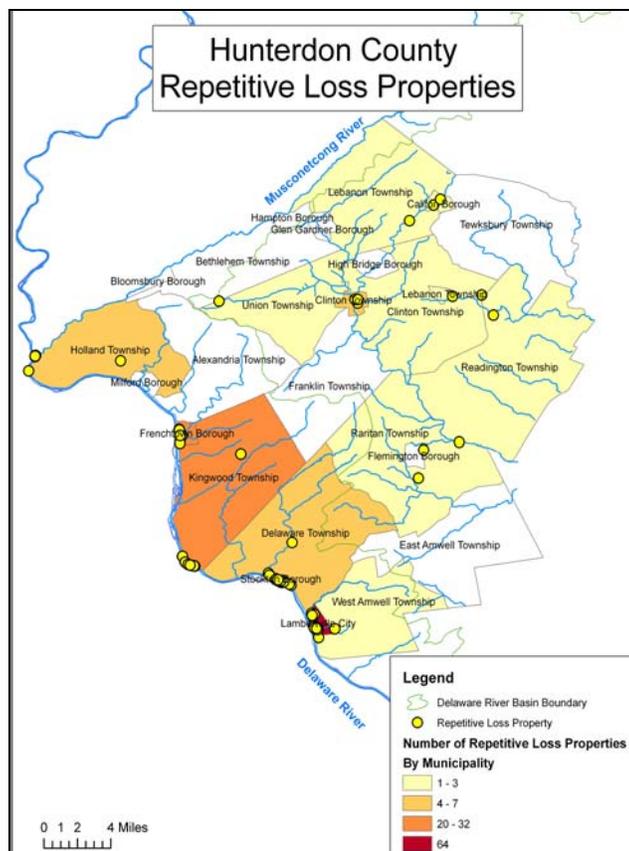


Table 3-7. Hunterdon County Municipalities Ranked by Repetitive Loss Properties

Municipality	Number of Repetitive Loss Properties	Total Payouts for Repetitive Loss Properties	Number of Severe Repetitive Loss Properties	NFIP Policies as of 01/31/08
Lambertville	64	\$9,278,749	1	225
Stockton Borough	32	\$5,257,575	2	92
Kingwood Township	24	\$3,357,547	4	47
Frenchtown Borough	20	\$2,974,853	-	78
Holland Township*	7	\$1,002,137	1	35
Delaware Township	6	\$916,463	1	31
Clinton Township**	5	\$727,583	-	40
Raritan Township	3	\$479,228	-	69
Califon Borough**	2	\$129,278	1	19
Lebanon Township	2	\$194,669	-	42
West Amwell Township	2	\$304,464	-	10
Readington Township**	1	\$89,316	-	41
Union Township**	1	\$84,191	-	10

Source: Federal Emergency Management Agency (FEMA); 01/31/08

Notes: * non-participating municipality, ** municipality outside of study area

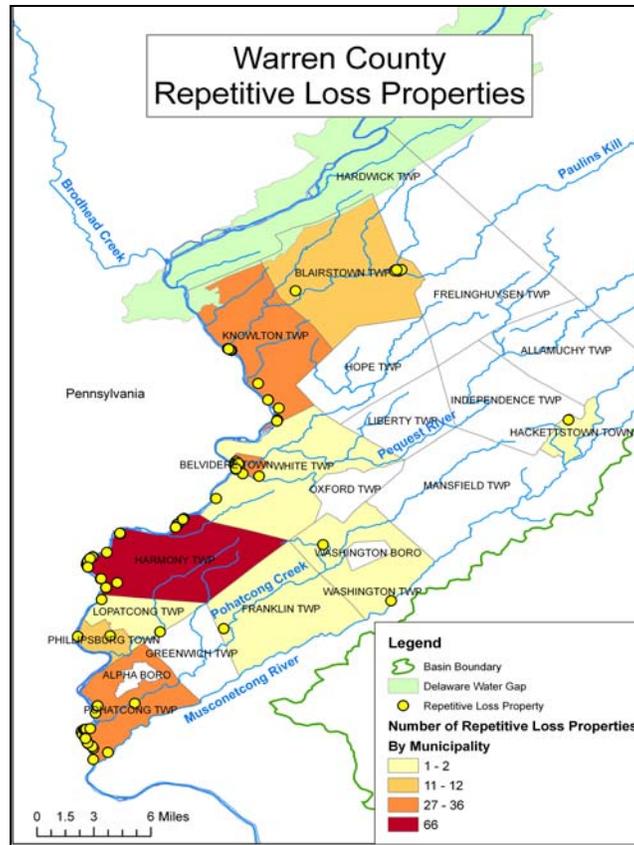


Table 3-8. Warren County Municipalities Ranked by Repetitive Loss Properties

Municipality	Number of Repetitive Loss Properties	Total Payouts for Repetitive Loss Properties	Number of Severe Repetitive Loss Properties	NFIP Policies as of 01/31/08
Harmony Township	66	\$27,926,993	24	105
Town of Belvidere	36	\$9,567,744	4	96
Knowlton Township	32	\$4,702,982	6	61
Pohatcong Township	27	\$3,994,785	5	73
Town of Phillipsburg	12	\$1,742,751	3	39
Blairstown Township	11	\$1,779,621	1	49
Lopatcong Township	2	\$273,656	-	17
Washington Township*	2	\$183,149	1	26
White Township	2	\$276,901	-	28
Franklin Township	1	\$131,508	-	7
Hackettstown	1	\$124,832	1	78

Source: Federal Emergency Management Agency (FEMA); 01/31/08

Notes: * non-participating municipality, ** municipality outside of study area

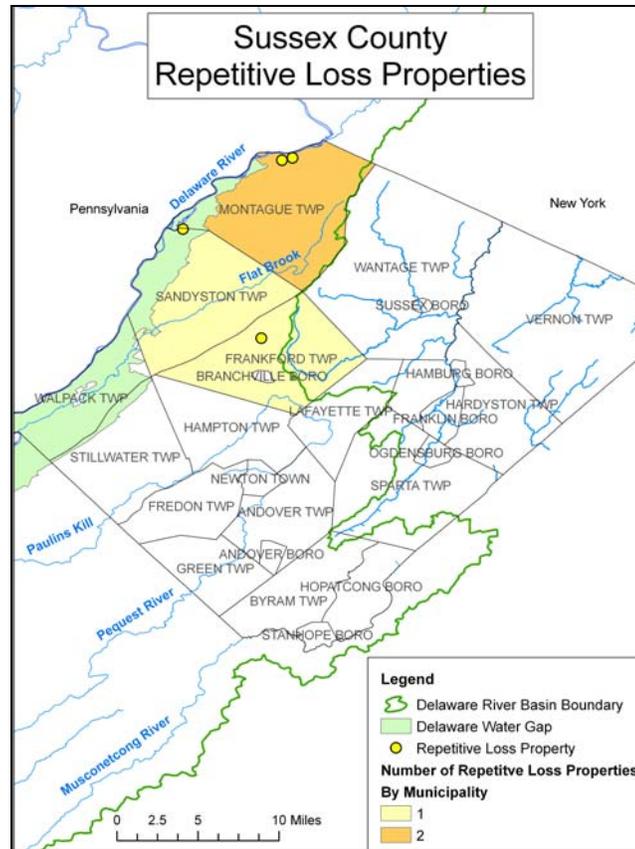


Table 3-9. Sussex County Municipalities Ranked by Repetitive Loss Properties

Municipality	Number of Repetitive Loss Properties	Total Payouts for Repetitive Loss Properties	Number of Severe Repetitive Loss Properties	NFIP Policies as of 01/31/08
Montague Township	2	\$304,566	-	19
Frankford Township	1	\$168,535	-	22
Sandyston Township	1	\$166,664	-	15

Source: Federal Emergency Management Agency (FEMA); 01/31/08

Notes: * non-participating municipality, ** municipality outside of study area

Section 4: Risk Assessment

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.*

This section is broken down into the following sections:

- Assessing Vulnerability (Estimating Potential Losses, Essential Facilities)
- Analyzing Land Use and Development Trends

Assessing Vulnerability

The potential for loss, or the degree of vulnerability, was measured using four different factors: amount of county land area susceptible to a 100-year flood, the number of buildings potentially damaged, the amount of direct economic losses related to those buildings and a projected 100-year risk to repetitive loss areas. These four measures of loss help give a more complete picture of the complex issue of vulnerability to floods.

This subsection of the Plan provides estimates of future flood loss to existing infrastructure. Each of the loss calculations is based on best available data, but must be considered estimates because highly detailed engineering analysis were not performed as part of this planning process.

Regarding the physical nature of the flood zone, over 67,670 acres of the total county area in Mercer, Hunterdon Warren and Sussex Counties fall within the 100-year flood zone. In other words, roughly 7% of that land area is vulnerable to a 100-year flood event. These flood zone size estimates were completed using the Q3 digital flood zone maps (see Section 3).

Estimating Potential Losses

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

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

HAZUS-MH® (FEMA's loss estimation software) applies engineering and scientific risk calculations that have been developed by hazard and information technology experts to provide damage and loss estimates; these methodologies are accepted by FEMA and provide a consistent framework for assessing risk across a variety of hazards and locations. A conceptual schematic of HAZUS can be seen in Figure 4-1.

As described in Section 2, flood data from the HAZUS-MH software package was supplemented with local data for essential facilities and hazard areas. Inventory data were superimposed over the hazard areas to enable GIS queries to estimate the quantity of assets at risk (population, structures, essential facilities, etc.)

One measure generated by HAZUS-MH is to examine the level of vulnerability using the number of buildings potentially damaged by a 100-year flood. The results of the modeling effort reveal that the county with the most buildings in danger of experiencing a 100-year flood is Mercer (4,941). Hunterdon, Warren and Sussex resulted in damage estimated of 1,904, 1,505 and 1,895 buildings, respectively. The majority of damage to buildings in the four counties would be to residential buildings. Approximately 97% of all the potential damage from the 100-year flood comes from residential buildings.

Another measure generated by HAZUS-MH is to examine the level of vulnerability from flooding using the amount of direct economic losses related to buildings. This measure considers monetary losses from the buildings including structural damage, contents damage, and inventory loss. The result of the HAZUS-MH model for Mercer, Hunterdon, Sussex and Warren shows that \$180 million is vulnerable to loss from a 100-year flood. Individually, Mercer - \$77M, Hunterdon - \$39M, Warren - \$23M and Sussex - \$41M. Tables 4-1 through 4-4 provide HAZUS generated estimates of general building stock and economic loss by county.

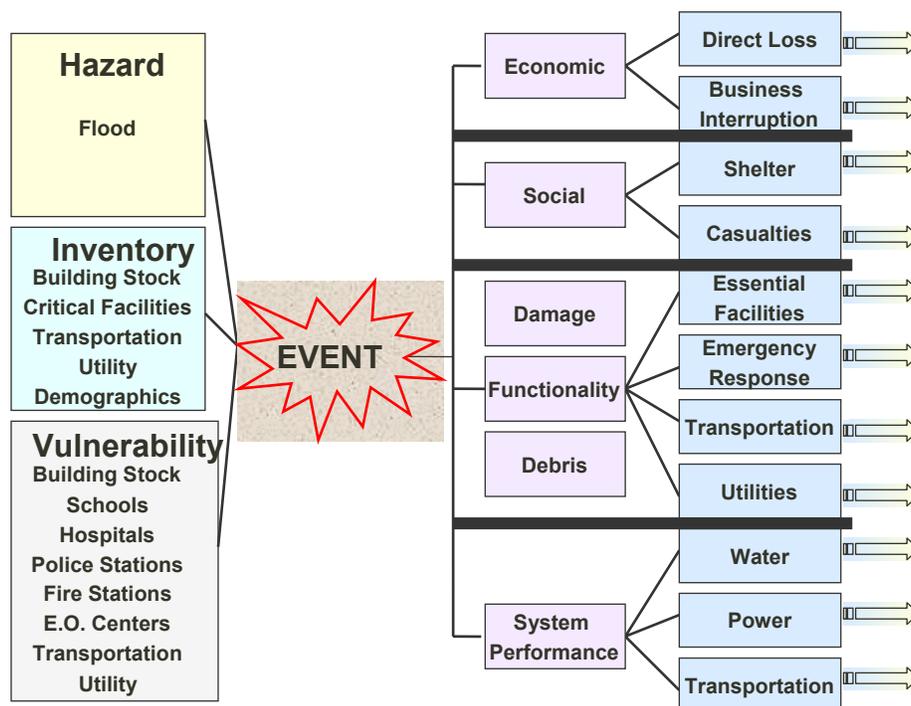


Figure 4-1 Conceptual Schematic of a Vulnerability Assessment (Source, HAZUS-MH, FEMA)

Table 4-1: Mercer County General Building Stock and Economic Loss

General Building Stock in the Floodplain

Building Exposure in the Floodplain (thousands of dollars)

Return Period:	County Name	Population	Residential	Commercial	Industrial	Agriculture	Religion	Government	Education
100 year	Mercer	18400	\$1,146,277	\$347,232	\$46,460	\$2,258	\$19,552	\$4,992	\$17,240
500 year	Mercer	23950	\$1,466,680	\$443,823	\$59,076	\$2,706	\$25,104	\$13,535	\$20,195
Contents Exposure in the Floodplain (thousands of dollars)									
100 year	Mercer	18400	\$573,468	\$353,774	\$66,160	\$2,258	\$19,552	\$5,215	\$21,378
500 year	Mercer	23950	\$733,752	\$452,449	\$84,437	\$2,706	\$25,104	\$13,786	\$24,525
Total Exposure in the Floodplain (thousands of dollars)									
100 year	Mercer	18400	\$1,719,745	\$701,005	\$112,620	\$4,516	\$39,104	\$10,206	\$38,617
500 year	Mercer	23950	\$2,200,432	\$896,271	\$143,512	\$5,413	\$50,207	\$27,321	\$44,720
Building Count (# of buildings) in the floodplain									
100 year	Mercer		4786	129	12	1	7	4	2
500 year	Mercer		6004	166	16	1	8	11	2

Economic Loss (General Building Stock)

Building Loss (thousands of dollars)

Return Period:	County Name	Residential	Commercial	Industrial	Agriculture	Religion	Government	Education
100 year	Mercer	\$50,028	\$19,169	\$1,450	\$222	\$1,877	\$55	\$3,023
500 year	Mercer	\$71,626	\$51,142	\$3,098	\$255	\$4,011	\$177	\$3,734
Content Loss (thousands of dollars)								
100 year	Mercer	\$27,409	\$22,442	\$2,718	\$248	\$2,451	\$80	\$4,304
500 year	Mercer	\$39,304	\$59,190	\$6,634	\$286	\$5,327	\$241	\$5,356
Total Loss (thousands of dollars)								
100 year	Mercer	\$77,437	\$41,611	\$4,168	\$470	\$4,327	\$134	\$7,326
500 year	Mercer	\$110,931	\$110,331	\$9,731	\$540	\$9,338	\$418	\$9,090

Table 4-2: Hunterdon County General Building Stock and Economic Loss

General Building Stock in the Floodplain

Building Exposure in the Floodplain (thousands of dollars)

Return Period:	County Name	Population	Residential	Commercial	Industrial	Agriculture	Religion	Government	Education
100 year	Hunterdon	5400	404,486.30	108,621.90	39,892.90	2,334.40	8,600.10	3,386.50	3,496.30
500 year	Hunterdon	7020	515,785.60	149,951.40	46,905.20	2,879.50	12,819.40	4,202.90	4,359.20
Contents Exposure in the Floodplain (thousands of dollars)									
100 year	Hunterdon	5400	202,435.20	111,954.10	57,492.00	2,334.40	8,600.10	3,983.10	3,496.30
500 year	Hunterdon	7020	258,143.60	154,545.50	67,375.80	2,879.50	12,819.40	4,832.70	4,359.20
Total Exposure in the Floodplain (thousands of dollars)									
100 year	Hunterdon	5400	606,921.50	220,576.00	97,384.90	4,668.80	17,200.20	7,369.60	6,992.60
500 year	Hunterdon	7020	773,929.20	304,496.90	114,281.00	5,759.00	25,638.80	9,035.60	8,718.40
Building Count (# of buildings) in the floodplain									
100 year	Hunterdon		1843	43	10	1	4	3	0
500 year	Hunterdon		2370	58	11	1	5	4	0

Economic Loss (General Building Stock)

Building Loss (thousands of dollars)

Return Period:	County Name	Population	Residential	Commercial	Industrial	Agriculture	Religion	Government	Education
100 year	Hunterdon	25,711.90	12,222.10	3,425.30	199.2	594	269.2	317.2	
500 year	Hunterdon	47,279.70	26,759.20	5,171.70	272.4	1,670.00	474.8	592.3	
Content Loss (thousands of dollars)									
100 year	Hunterdon	13,734.10	15,112.00	7,364.90	227.5	764.00	679.40	391.7	
500 year	Hunterdon	25,358.50	32,570.00	10,773.10	312.1	2,178.30	1,020.60	734.8	
Total Loss (thousands of dollars)									
100 year	Hunterdon	39,446.00	27,334.10	10,790.20	426.7	1,358.00	948.6	708.9	
500 year	Hunterdon	72,638.20	59,329.20	15,944.80	584.5	3,848.30	1,495.40	1,327.10	

Table 4-3: Warren County General Building Stock and Economic Loss

General Building Stock in the Floodplain

Building Exposure in the Floodplain (thousands of dollars)

Return Period:	County Name	Population	Residential	Commercial	Industrial	Agriculture	Religion	Government	Education
100 year	Warren	5010	296,444.90	57,166.70	5,443.10	2,246.60	3,589.60	435.10	3,282.90
500 year	Warren	6600	390,451.60	84,215.10	6,657.10	2,586.90	4,873.70	1,040.60	4,503.10

Contents Exposure in the Floodplain (thousands of dollars)

100 year	Warren	5010	148,386.10	60,223.30	6,958.80	2,246.60	3,589.60	584.80	3,411.30
500 year	Warren	6600	195,454.90	88,467.60	8,589.10	2,586.90	4,873.70	1,190.30	4,631.60

Total Exposure in the Floodplain (thousands of dollars)

100 year	Warren	5010	444,831.00	117,390.00	12,401.90	4,493.20	7,179.20	1,019.90	6,694.20
500 year	Warren	6600	585,906.50	172,682.70	15,246.20	5,173.80	9,747.40	2,230.90	9,134.70

Building Count (# of buildings) in the floodplain

100 year	Warren		1476	22	2	1	2	1	1
500 year	Warren		1966	32	2	1	2	1	1

Economic Loss (General Building Stock)

Building Loss (thousands of dollars)

Return Period:	County Name	Residential	Commercial	Industrial	Agriculture	Religion	Government	Education
100 year	Warren	15,002.40	3,731.70	293.10	271.4	361.00	11.5	231.40
500 year	Warren	26,387.70	7,276.40	475.50	421.3	849.70	32.4	510.00

Content Loss (thousands of dollars)

100 year	Warren	7,918.80	4,437.60	401.50	313.2	454.00	22.70	281.40
500 year	Warren	14,013.30	8,822.40	693.70	481.8	1,021.20	54.40	631.40

Total Loss (thousands of dollars)

100 year	Warren	22,921.20	8,169.30	694.60	584.6	815.00	34.2	512.80
500 year	Warren	40,401.00	16,098.80	1,169.20	903.1	1,870.90	86.80	1,141.40

Table 4-4: Sussex County General Building Stock and Economic Loss

General Building Stock in the Floodplain

Building Exposure in the Floodplain (thousands of dollars)

Return Period:	County Name	Population	Residential	Commercial	Industrial	Agriculture	Religion	Government	Education
100 year	Sussex	5390	360,731.10	54,963.80	9,133.70	1,721.30	4,703.10	2,016.70	10,150.70
500 year	Sussex	5890	388,108.20	62,942.50	11,676.40	1,903.80	5,623.80	2,221.00	15,281.50

Contents Exposure in the Floodplain (thousands of dollars)

100 year	Sussex	5390	180,473.40	57,871.30	11,991.50	1,721.30	4,703.10	2,249.00	13,415.30
500 year	Sussex	5890	194,172.50	66,160.80	15,670.30	1,903.80	5,623.80	2,460.30	21,033.40

Total Exposure in the Floodplain (thousands of dollars)

100 year	Sussex	5390	541,204.50	112,835.10	21,125.20	3,442.60	9,406.20	4,265.70	23,566.00
500 year	Sussex	5890	582,280.70	129,103.30	27,346.70	3,807.60	11,247.60	4,681.30	36,314.90

Building Count (# of buildings) in the floodplain

100 year	Sussex		1862	25	2	1	2	1	2
500 year	Sussex		2009	28	3	1	2	1	2

Economic Loss (General Building Stock)

Building Loss (thousands of dollars)

Return Period:	County Name	Residential	Commercial	Industrial	Agriculture	Religion	Government	Education
100 year	Sussex	26,596.20	9,014.40	769.60	226.4	1,024.60	205.8	328.10
500 year	Sussex	30,323.20	10,580.20	945.10	305	1,237.50	260.2	485.00

Content Loss (thousands of dollars)

100 year	Sussex	14,154.60	11,563.10	1,207.10	247.5	1,298.00	318.90	398.40
500 year	Sussex	16,126.70	13,470.30	1,491.50	334.1	1,568.90	405.90	598.90

Total Loss (thousands of dollars)

100 year	Sussex	40,750.80	20,577.50	1,976.70	473.9	2,322.60	524.7	726.50
500 year	Sussex	46,449.90	24,050.50	2,436.60	639.1	2,806.40	666.10	1,083.90

Flood Risk - Repetitive Loss Properties

The fourth risk assessment method is based on an analysis of National Flood Insurance Program (NFIP) data on repetitive flood loss properties. The NFIP defines repetitive loss properties as those that have submitted at least two (2) insurance claims of more than \$1,000 in a ten-year period. Table 4-5 provides a summary of residential repetitive loss claims for building and contents damages by municipality. Note that these figures are as of January 31, 2008.

Residential flood risk is calculated by a simple methodology that uses the FEMA default present-value coefficients from the benefit-cost analysis software modules. To perform this calculation, the repetitive loss data was reviewed to determine an approximate period over which the claims occurred. There is not an exact method of doing this, 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. The majority of the flood claims range from 1996 through the present, a period of about 11 years with most of the flood claims occurring in 2004, 2005 and 2006.

The results of this analysis reveal that Harmony Township, Warren County has the highest projected 100-year flood risk. As shown in Table 4-5, Harmony Township has had 205 claims for 66 properties in the 11-year period, for an average number of claims per year of 18.6. Based on a 100-year horizon and a present value coefficient of 14.27 (the coefficient for 100 years using the mandatory OMB discount rate of 7.0 percent), the projected flood risk over 100 years is \$10.3 million.

Following Harmony Township is Trenton, Mercer County with a projected 100-year flood risk of \$6.9M, Kingwood Township, Hunterdon County with a projected 100-year flood risk of \$4.9M, Lambertville, Hunterdon County with a projected 100-year flood risk of \$4.3M, and Knowlton, Warren County with a projected 100-year flood risk of \$4.0M. Table 4-6 presents each municipality's vulnerability to flooding based on the repetitive risk analysis and the data presented by each municipality in this report. A rating of High was given to those municipalities with a projected 100-year flood risk of over \$1M.

It must be understood that this analysis is based on repetitive loss properties, which requires individuals to have a flood insurance policy. This projection is simply an estimate of potential damages. Many factors including the ability of individuals to cancel flood insurance policies, and future variables, including the weather exist. 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 4-5: Projected 100-Year Flood Risk in Repetitive Loss Areas

Municipality	County	Number of RLPs	Total Value of Claims	Total Number of Claims	Avg Claims/ year	Average value of claims per year	Projected risk, 100-year horizon
TRENTON CITY	MERCER	155	\$5,300,600	433	39.4	\$481,873	\$6,876,323
EWING TWP	MERCER	22	\$483,969	60	5.5	\$43,997	\$627,839
HOPEWELL TWP	MERCER	6	\$410,244	18	1.6	\$37,295	\$532,199
LAWRENCE TWP	MERCER	4	\$241,634	8	0.7	\$21,967	\$313,466
HAMILTON TWP	MERCER	5	\$75,396	10	0.9	\$6,854	\$97,809
KINGWOOD TWP	HUNTERDON	24	\$3,779,650	76	6.9	\$343,605	\$4,903,237
LAMBERTVILLE CITY	HUNTERDON	64	\$3,323,384	172	15.6	\$302,126	\$4,311,336
STOCKTON BORO	HUNTERDON	32	\$1,888,816	68	6.2	\$171,711	\$2,450,309
FRENCHTOWN BORO	HUNTERDON	20	\$1,268,951	52	4.7	\$115,359	\$1,646,175
DELAWARE TWP	HUNTERDON	6	\$425,271	16	1.5	\$38,661	\$551,693
RARITAN TWP	HUNTERDON	3	\$112,425	7	0.6	\$10,220	\$145,846
WEST AMWELL TWP	HUNTERDON	2	\$41,049	5	0.5	\$3,732	\$53,252
LEBANON TWP	HUNTERDON	1	\$7,010	2	0.2	\$637	\$9,094
HARMONY TWP	WARREN	66	\$7,905,076	205	18.6	\$718,643	\$10,255,039
KNOWLTON TWP	WARREN	32	\$3,058,188	85	7.7	\$278,017	\$3,967,303
POHATCONG TWP	WARREN	27	\$2,389,689	74	6.7	\$217,244	\$3,100,079
BELVIDERE TOWN	WARREN	36	\$1,797,571	93	8.5	\$163,416	\$2,331,939
PHILLIPSBURG TOWN	WARREN	12	\$1,255,298	34	3.1	\$114,118	\$1,628,464
BLAIRSTOWN TWP	WARREN	11	\$928,624	26	2.4	\$84,420	\$1,204,678
LOPATCONG TWP	WARREN	2	\$132,815	5	0.5	\$12,074	\$172,297
WHITE TWP	WARREN	2	\$60,031	6	0.5	\$5,457	\$77,877
HACKETTSTOWN	WARREN	1	\$55,423	4	0.4	\$5,038	\$71,899
FRANKLIN TWP	WARREN	1	\$7,416	2	0.2	\$674	\$9,620
SANDYSTON TWP	SUSSEX	1	\$133,492	2	0.2	\$12,136	\$173,175
MONTAGUE TWP	SUSSEX	2	\$127,635	5	0.5	\$11,603	\$165,577
FRANKFORD TWP	SUSSEX	1	\$13,371	2	0.2	\$1,216	\$17,345

Table 4-6. Summary of Flood Vulnerability by Jurisdiction

MERCER	
EWING TWP	Medium
HAMILTON TWP	Medium
HOPEWELL TWP	Medium
LAWRENCE TWP	Medium
PENNINGTON BOROUGH	Low
TRENTON CITY	High
HUNTERDON	
DELAWARE TWP	Medium
EAST AMWELL TWP	Low
FRANKLIN TWP	Low
FRENCHTOWN BOROUGH	High
HAMPTON BOROUGH	Low
KINGWOOD TWP	High
LAMBERTVILLE CITY	High
LEBANON TWP	Low
MILFORD BOROUGH	Low
RARITAN TWP	Medium
STOCKTON BOROUGH	High
WEST AMWELL TWP	Low

WARREN	
BELVIDERE TWP	High
BLAIRSTOWN TWP	High
FRANKLIN TWP	Low
FRELINGHUYSEN TWP	Low
HACKETTSTOWN TOWN	Low
HARDWICK TWP	Low
HARMONY TWP	High
INDEPENDENCE TWP	Low
KNOWLTON TWP	High
LOPATCONG TWP	Medium
MANSFIELD TWP	Low
OXFORD TWP	Low
PHILLIPSBURG TOWN	High
POHATCONG TWP	High
WHITE TWP	Medium
SUSSEX	
ANDOVER BOROUGH	Low
BRANCHVILLE	Low
BYRAM TWP	Low
FRANKFORD TWP	Low
FREDON TWP	Low
MONTAGUE TWP	Medium
NEWTON TOWN	Low
SANDYSTON TWP	Low
SPARTA TWP	Low
STILLWATER TWP	Low

Economic Impacts of Flooding

Economic impacts of flooding affect households, businesses and communities. The losses to households include personal items, household goods, vehicles, homes, and in some cases, lost wages or even lost jobs. Local businesses experience lost inventory, lost sales, and lost productivity and profits. Even firms not directly affected by flooding might lose sales if they were suppliers of goods and services to affected businesses or households. All aspects of public service delivery are affected. In some communities, wastewater and water facilities are compromised and must be restored. Affected municipalities need to repair roads and bridges, public lighting, public parks, and public buildings.

The community fiscal effects of infrastructure losses depend primarily on the amount of federal and state disaster assistance they obtain. Federal and state disaster assistance programs take the form of direct payments, grants, and no-interest or low-interest loans to individuals, businesses and communities. Under the Public Assistance Grant Program, FEMA awards grants to assist state and local governments and certain private nonprofit organizations with the response to and recovery from disasters. The program provides funding for debris removal, implementation of emergency protective measures and permanent restoration of infrastructure. The Individuals and Households Program can assist those affected flooding by providing temporary help with alternative housing and/or financial assistance with other disaster-related needs. Individual assistance can also be in the form of low-interest disaster loans from the U.S. Small Business Administration for homeowners, renters, businesses of all sizes, and non-profit organizations. Future studies may be able to begin to evaluate the economic impacts of past flood events to municipalities by tracking and comparing awarded Public Assistance, Individual Assistance and Small Business Loans by municipality.

In considering economic impacts of flooding, it would be remiss not to mention the impact to a community's tax base. Local property tax revenues decline if properties remain vacant, property values decline or affected properties are mitigated through acquisition.

Vulnerable Essential Facilities

For the purposes of this risk assessment, the label “essential facility” may refer to any of the following: hospitals and other medical facilities, police and fire stations, emergency operations centers, government and public buildings, water treatment facilities and institutions with vulnerable populations such as colleges, schools, hospitals and nursing homes.

Through the planning process of this Flood Mitigation Plan, the following essential facilities were found to be vulnerable to flooding. For many of these facilities, mitigation actions targeting the vulnerability of these facilities are included in each respective municipality's mitigation action plan.

Mercer

Trenton: Trenton Water Filtration Plant

Ewing: Ewing Sewage Pump Station, Villa Victoria Academy

Hopewell: Mercer County Correction Center

Hunterdon

Frenchtown: Frenchtown Sewer Plant

Stockton: Stockton Sewer Pump Station, Stockton Fire Department, Stockton Borough Hall

Warren

Phillipsburg: Phillipsburg WWTP, Lift Station

Sussex

Fredon Civic Center

Analyzing Land Use and Development Trends

Although this plan focuses on evaluating the vulnerability flooding to the current built environment, it is worthwhile to briefly discuss the importance of land use planning, zoning and sound development in order to limit the vulnerability to any future development. Planning tools such as a Natural Resource Inventory, zoning ordinance and Master Plan, environmental resource protection ordinances, and compact development patterns are all important tools for sustainable local land use planning. Communities can set polices or goals in their Master Plan that articulate how their community plans to manage/minimize the impacts of flooding. Municipalities can also enable ordinances to help mitigate both existing and potential impacts of flooding (e.g. Land Use/Zoning, Stream Corridor or other Buffer Ordinance, Woodland Conservation, Steep Slopes, Stormwater Management).

A build-out analysis can be used as a tool to predict what a community will look like in the future should development based on existing zoning, master plan, and implementation measures be completed at their full potential. New Jersey's state agencies employ multiple build-out analysis methodologies for varying purposes. The Department of Environmental Protection identifies build-out methodologies in its regulation of Water Quality Management Plans, including Wastewater Management and Stormwater planning. The Office of Smart Growth also utilizes a build-out analysis to help guide municipalities toward a community-supported vision. At either a community level or during a future study, this type of analysis may prove useful in defining the vulnerability of future development and buildings to flooding. In turn, such an analysis may encourage municipalities to strengthen their current land use and zoning ordinances.

In addition to vulnerability of the built environment to flooding, development can negatively impact flooding conditions downstream. Impervious surfaces are mainly constructed features such as rooftops, sidewalks, roads and parking lots covered by impenetrable materials such as asphalt, concrete, brick and stone. These materials repel water and act as a local barrier to infiltration which may affect groundwater recharge. Soils compacted by development and agricultural practices are also highly impervious. An increase in impervious surfaces decreases the amount of land through which precipitation can recharge groundwater aquifers. Water that cannot infiltrate into the ground increases the amount of overland flow, with the potential for an increase in soil erosion and flooding.

Impervious surface is expressed as a percentage of the total land area. In rural areas, the impervious surface may be only one or two percent, but increases to about 10% in low-density

developed areas to over 50% in higher-density communities. In industrial and commercial areas coverage can be as high as 70% and in regional shopping centers and dense downtown areas it is over 90%.

Some municipalities regulate and track the amount of impervious surface in their communities, others do not. As a means to help municipalities identify the amount of impervious cover change in their municipalities due to development practices, a simple analysis of impervious surface change was performed for municipalities in Mercer, Hunterdon, Warren and Sussex. The results of this analysis are available in Figure 4.2. The data source for this analysis was the “NJDEP 2002 Land Use/Land Cover (LU/LC)”. This data set includes impervious surface coverage information for both 1995 and 2002. The results of the analysis generate a comparison of impervious surface change, in terms of percentages, for the time period from 1995 to 2002.

As another means of identifying increased development by municipality, Figure 4.3 displays population change by municipality. This map displays population change in terms of percentage, for the time period from 1990 to 2000, based on data from the U.S. Census.

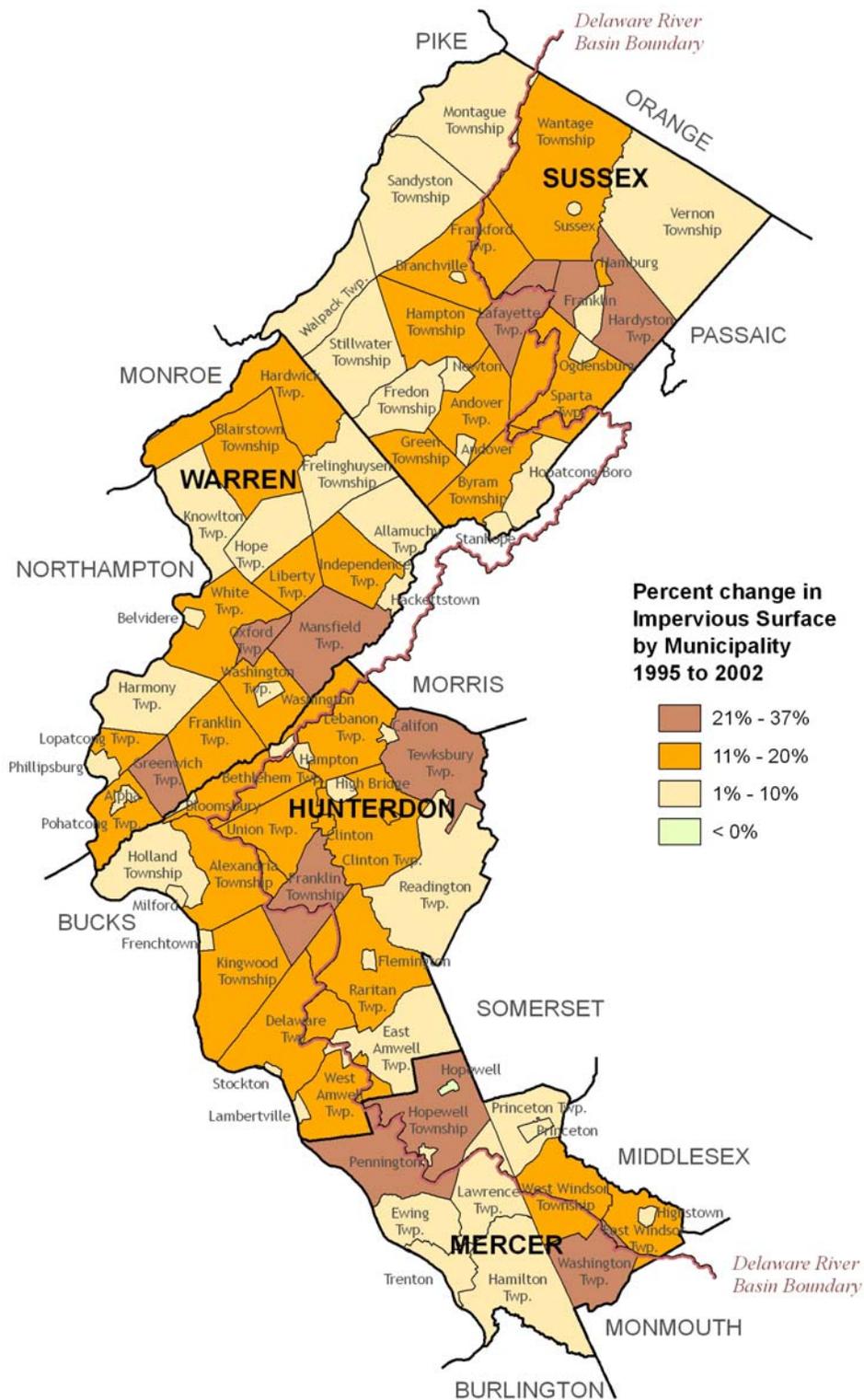


Figure 4-2: Percent Change in Impervious Surface

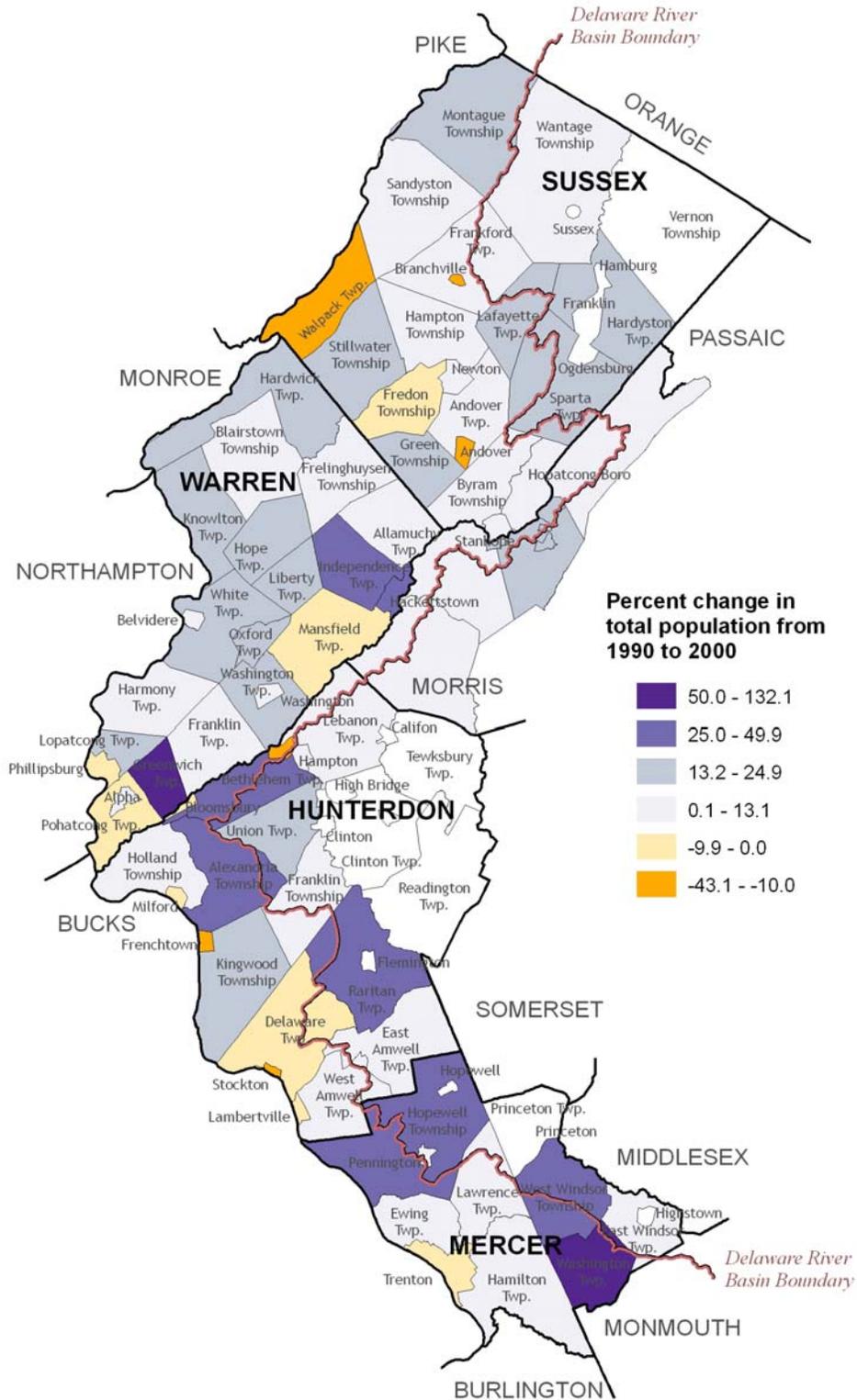


Figure 4-3: Percent Population Change

Section 5: Basinwide Mitigation Strategy

The Basinwide strategy consists of three interdependent components; the Delaware River Basin, the State of New Jersey, and the counties and local municipalities. This strategy is directed at the following two objectives of the Flood Mitigation Plan:

- Increase the coordination and cooperation among intergovernmental entities in carrying out flood mitigation; and
- Leverage a wide array of funding opportunities to implement actions;

Conducting risk management and mitigation planning at multiple scales helps to ensure that the “top down” and “bottom up” strategies are harmonized and that there is ownership of mitigation actions at all levels of government. As concluded by the Delaware River Basin Interstate Flood Mitigation Task Force, convened by the Governors of New York, New Jersey, Pennsylvania and Delaware, **“There is no one set of mitigation measures that will stop flooding along the Delaware, it is only through a combination of local and regional measures that resiliency to flooding in the basin will be improved.”**

Reducing flood loss is a responsibility shared by federal, interstate, state, and local agencies throughout the basin. One goal of the Delaware River Basin Compact, the enabling agreement creating the DRBC, is flood protection. After the 1955 flood, several options for flood protection were considered for the Basin. However, as the memory of the 1955 flood faded and almost 50 years elapsed between it and the recent major floods, flood mitigation was not a high priority within the Basin. After experiencing three major flood events in a 22 month period, the Governors of the four basin states – Delaware, New Jersey, New York and Pennsylvania – wanted to develop a strategy for flood mitigation and directed DRBC to organize a task force and develop an action plan. The Delaware River Basin Flood Mitigation Task Force was convened and developed 45 recommendations for flood mitigation that reflected the concerns of citizens, environmental groups and government officials among others.

Delaware River Basin Mitigation Strategy

The Delaware River Basin Commission was the obvious vehicle for developing flood loss reduction and mitigation strategies for the basin. In the Governors’ request for DRBC to convene a task force they wrote “[i]ndividually, the Basin states can move forward with policies and regulations to reduce and mitigate the impacts of flooding, but we believe that through coordinated effort on a regional basis, we can do more to reduce flood loss within the Basin than we could accomplish acting separately, on our own.”

Strategy

The Delaware River Basin Interstate Flood Mitigation Task Force was assembled in October 2006. It was comprised of 31 members from a geographically diverse array of government agencies (legislative, executive, federal, state and local) and not-for-profit organizations. The group identified a total of 45 consensus recommendations for a proactive, sustainable, and

systematic approach to flood damage reduction. The recommendations, identified in an Action Agenda forwarded to the governors in July 2007, were based upon a set of six guiding principles concerning floodplain restoration, floodplain protection, institutional and individual preparedness, local stormwater management and engineering standards, and the use of structural and non-structural measures. The guiding principles are reproduced below.

Guiding Principles

1. **Preserve and Restore Floodplains Where Possible** - to recognize, preserve and restore the beneficial functions of floodplains for hazard reduction, water quality enhancement, wetland protection, wildlife habitat, riparian corridors, recreation, environmental relief, aesthetics and greenway areas.

2. **Be Prepared for Floods** - by developing advanced floodplain mapping, detailed risk assessments, enhanced early warning systems, multiple emergency notification measures, understandable response plans, workable recovery plans, and ongoing storm monitoring.

3. **Help People Protect Themselves from Flood Hazards** - through public interaction and involvement, available flood information, community outreach and education, self-help measures, flood proofing options, affordable flood insurance, and emergency preparedness.

4. **Prevent Adverse Impacts and Unwise Uses in the Floodplain** - through appropriate regulation and land use, open land preservation, acquisition of structures and relocation assistance programs, relocation of infrastructure (such as wastewater disposal plants), multi-objective planning, prohibiting unacceptable encroachments, and establishing ongoing maintenance practices that preserve and enhance environmental functions.

5. **Prevent Adverse Impacts from Development and Redevelopment** – by preparing tributary and regional stormwater management plans, adopting appropriate engineering standards into local ordinances, consistently administering and enforcing ordinances and providing long-term maintenance of facilities.

6. **Acknowledge the Values of Structural Flood Control Measures** - after a careful analysis of the ecological, economic, long-term operation and maintenance, and social costs and benefits of all mitigation options; identify those situations where a combination of structural solutions, structural modifications, and non-structural solutions is the most beneficial option.

Organization of Interstate Flood Mitigation Task Force Report

To organize the recommendations, the Task Force decided to divide the recommendations into six priority management areas. Discussions of the six priority management areas are as follows:

Reservoir operations: The Task Force called for an evaluation of reservoir spill and discharge mitigation programs along with development of a flood analysis model to evaluate alternative reservoir operating plans and to assess the downstream effect of reservoir voids of different magnitudes. These recommendations call for releases that would reduce the likelihood and volume of spills from some basin reservoirs during storm events to help mitigate flooding.

Structural and non-structural measures: The Task Force called on policy-makers to assign higher priority and allocate greater funding to the acquisition of property and elevation and/or flood-proofing of structures within the floodplain. It offers strong support for state dam safety programs and recommends improved maintenance of other flood control structures. An evaluation of mitigation measures basinwide by the U.S. Army Corps of Engineers is recommended, to include an analysis of the ecological, economic, long-term operation and maintenance, and social costs and benefits of all flood mitigation options.

Stormwater management: The Task Force called for minimizing stormwater runoff from new development and reducing runoff from existing development through the implementation of watershed stormwater management plans, long-term maintenance of stormwater infrastructure (including detention ponds, inlets, catch basins, outfalls and other devices), the use of non-structural stormwater management options, expanded incentives for achieving stormwater management objectives, stronger enforcement of stormwater management regulations, and the development of stream restoration and debris removal guidelines.

Floodplain mapping: Because the Delaware River is an interstate waterway, coordination is needed for development of a seamless floodplain map that is consistent throughout the basin. The Task Force called upon the states to coordinate flood study and mapping updates, incorporate existing and planned development and residual risk zones into new maps, and re-define and re-map the floodway along the main stem and its tributaries.

Floodplain regulation: Currently, the regulations applicable to floodplain areas in the Delaware Basin vary widely. The Task Force urged that existing floodplain regulations be catalogued, evaluated and updated and that uniform regulation of floodplains within the basin be established. It further recommends that a coordinated education, outreach and training program about floodplain protection and regulation be undertaken, that a flood hazard disclosure requirement be imposed, that a repetitive loss reduction strategy be adopted and that riparian zones be defined in accordance with uniform standards basinwide.

Flood warning: The task force recommends that development of an advanced basinwide flood warning system proceed in a coordinated fashion. The existing system is comprised of flow gages, flash flood and flood forecasting, and education and outreach components. It is coordinated and funded by multiple organizations at the federal, state and local levels. The Task Force urges that the river gage network and its forecast points be evaluated, that rating tables be extended, that gages be flood hardened (i.e., able to withstand larger flood events), that flash flood forecasting be improved, that flood inundation maps be developed, that up-to-date Dam Emergency Action Plans be maintained, that a coordinated flood education and outreach program be developed and that a comprehensive program be undertaken to address coastal flooding.

Recommendations

During the public review phase of the draft recommendations, there was a broad based request for immediate action to mitigate future flooding impacts. To address this sense of urgency the Task Force has identified several core recommendations to enhance the basin's resiliency—its capacity to prepare for and recover from flooding. The following immediate actions were proposed:

- Establish areas of priority funding for acquisition, elevation, and flood proofing. (Action S-6)
- Develop an interoperable reservoir operating plan. (Action R-2)
- Develop and implement a consistent set of comprehensive floodplain regulations beyond minimum NFIP standards across the entire Delaware River Basin. (Action FR-2)
- Enable stormwater utilities – This approach benefits both water quality and quantity. In addition it reinforces the states’ existing momentum for stormwater management and control of nonpoint source pollution. (Action SM-2.3)

The Interstate Flood Mitigation Task Force concluded that no set of mitigation measures will entirely eliminate flooding along the Delaware River or its tributaries. However, the members believe that the combination of measures advocated in this report constitute a significant step in helping the Basin’s increasingly vulnerable riverine and coastal communities to prepare for, respond to, and rebound from natural disasters.

Table 5-1 presents an overview of the 45 recommendations developed by the task force. The recommendations are not in any prioritized order, but instead are organized by priority management area. More detailed information about each recommendation can be found in the Task Force Report on the DRBC web site.

Table 5-1: Delaware River Basin Flood Mitigation Task Force Recommendation Overview

Recommendation			Ongoing	Short-term (1-3 Years)	Long-term (4+ Years)	Resources Needed	Lead Agency
Reservoir Operations							
#1	R-1	Develop a Flood Analysis Modeling Tool	X			\$\$	DRBC
#2	R-2	Develop an Interoperable Reservoir Operating Plan		X		\$\$	DRBC
#3	R-3	Evaluate Discharge Mitigation Programs for Reservoirs	X			\$	DRBC
#4	R-4	Evaluate Snowpack Based Storage Management	X			\$	DRBC
#5	R-5	Publish Information on the Basin’s Existing Major Impoundments		X		\$	DRBC
#6	R-6	Evaluate Availability and Accuracy of Data		X		\$	DRBC
Structural and Non-Structural Measures							
#7	S-1	Fund a Comprehensive Flood Mitigation Study of the Entire Delaware River Basin			X	\$\$\$\$ per state	USACE
#8	S-2	Prioritize the Completion of State and Local Hazard Mitigation Plans	X			\$\$\$	State EMO's
#9	S-3	Ensure Financial Assistance for State, County and Municipal Flood Mitigation Projects	X			\$\$\$\$	State EMO's
#10	S-4	Provide Training for Local Officials to Maximize Use of Available Mitigation Funding		X		\$\$	DRBC
#11	S-5	Create Partnering Programs for Floodplain Acquisition		X		\$\$\$\$	State DEP's
#12	S-6	Establish Funding Priority Areas for Acquisition, Elevation, and Floodproofing		X		\$\$\$	Basin States
#13	S-7	Maintenance of Flood Control Structures, excluding dams		X		\$\$\$\$	State DEP's
#14	S-8	Dam Safety Programs	X			\$\$\$\$	State Dam Agencies
#15	S-9	Evaluate and Coordinate Flood Mitigation Plans and Strategies	X			\$\$\$	DRBC
Stormwater							
#16	SM-1	Develop Regional and Tributary-Based Watershed Stormwater Management Plans		X		\$\$ per 100sq. mi.	Basin States
#17	SM-2	Long-term Management of Stormwater Best Management Practices (BMPs) and Infrastructure	X			\$ per municipality	Basin States
#18	SM-3	Non-Structural Stormwater Management for New and Redevelopment	X			\$	Basin States
#19	SM-4	Enforcement of Existing Stormwater Standards and Regulations		X		\$	Basin States
#20	SM-5	Provide and Promote Incentives to Reduce Stormwater Runoff from Existing Development		X		-\$\$\$\$	Basin States
#21	SM-6	Develop and Maintain Precipitation and Streamflow Data	X			\$	USGS/NWS
#22	SM-7	Stream Restoration and Debris Removal Guidelines		X		\$	DRBC
#23	SM-8	Stormwater Management through Special Protection Waters Designation	X			\$	DRBC

\$ Key: \$ = < \$100,000 \$\$ = < \$500,000 \$\$\$ = < \$1,000,000 \$\$\$\$ = > \$1,000,000

**Table 5-1: Delaware River Basin Flood Mitigation Task Force (Continued)
Recommendation Overview**

Recommendation			Ongoing	Short-term (1-3 Years)	Long-term (4+ Years)	Resources Needed	Lead Agency
Floodplain Mapping							
#24	FM-1	Coordinated Flood Study and Mapping Updates	X			\$\$\$\$	Basin States
#25	FM-2	Incorporate Existing and Future Planned Development and Residual Risk Zones into New Mapping			X	\$\$\$\$	Basin States
#26	FM-3	Redefine and Remap the Floodway along the Delaware River Main Stem and its Tributaries			X	\$\$\$\$	Basin States
Floodplain Regulations							
#27	FR-1	Catalog, Evaluate and Update Existing Floodplain Regulations in the Basin		X		\$	DRBC
#28	FR-2	Develop a Coordinated Education, Outreach and Training Program		X		\$	DRBC
#29	FR-3	Repetitive Loss Reduction Strategy for the Basin		X		\$\$	FEMA
#30	FR-4	Flood Hazard Disclosure Requirements		X		\$	DRBC
#31	FR-5	Standardized Riparian Corridors			X	\$	DRBC
Flood Warning							
#32	FW-1	Inventory and Evaluate Precipitation Observing Stations in the Basin		X		\$	USGS
#33	FW-2	Evaluate River Gage Network		X		\$	USGS
#34	FW-3	Extend Rating Tables		X		\$	USGS
#35	FW-4	Flood Harden Gages at Key Forecast Locations			X	\$\$	USGS
#36	FW-5	Improve Flash Flood Forecasting			X	\$\$	NWS
#37	FW-6	Develop an Implementation Plan for the NWS Site Specific Model		X		\$	NWS
#38	FW-7	Evaluate River Forecast Points		X		\$	NWS
#39	FW-8	Provide River Forecasts with Confidence Level Information		X		\$	NWS
#40	FW-9	Develop Flood Forecast Inundation Maps		X		\$\$	NWS
#41	FW-10	Maintain Up-to-Date High Hazard Dam Emergency Action Plan (EAP) Documents	X			\$	DRBC
#42	FW-11	Establish a Coordinated Flood Warning Education and Outreach Program		X		\$	DRBC
#43	FW-12	Develop a Flood Coordination Mechanism		X		\$	DRBC/ Basin States
#44	FW-13	Ice Jam Monitoring and Communications Plan	X			\$	State EMS
#45	FW-14	Coastal Flooding Impacts			X	\$\$\$\$	MACOORA

\$ Key: \$ = < \$100,000 \$\$ = < \$500,000 \$\$\$ = < \$1,000,000 \$\$\$\$ = > \$1,000,000

Implementation

Since the Interstate Flood Mitigation Task Force developed its recommendations, federal, state and local governments, as well as other organizations, have begun their implementation. Known implementation activities, directly or indirectly related to Task Force recommendations, follow below along with scheduled deadlines and agency or organizational lead for the projects.

Reservoir Operations:

1. **Flood Analysis Model:** Development of the model is ongoing by a multi-agency project team that includes the USGS, USACE, NWS and DRBC. Agreements were finalized in June 2007 and work began in August 2007. The flood analysis model is on schedule to be completed in January 2009. The four basin states committed a combined total of \$500,000. The U.S. Geological Survey-Pennsylvania Water Science Center led the development of an interagency proposal, including additional funds and in-kind services from USGS, the National Weather Service and the U.S. Army Corps of Engineers totaling \$265,000. Total Project Cost = \$765,000.

The model will be capable of evaluating the effects of reservoir voids and release operations on downstream flood crests for different storm events. It will provide a tool to inform the development of discharge mitigation plans for 15 basin reservoirs.

2. **Spill Mitigation:** PPL and NYC have developed spill mitigation programs for their reservoir operations. Spill mitigation programs do not guarantee voids, but are designed to reduce the magnitude and frequency of spills at through the controlled release of greater volumes of water than would have been called for under past conservation release programs.
 - a. The PPL program is based on snowpack and the 48 hour precipitation forecast. The spill mitigation program for Lake Wallenpaupack was developed with input from floodplain residents along the Lackawaxen River and was implemented in 2007.
 - b. Spill mitigation at the NYC reservoirs was first conducted for Pepacton Reservoir in early 1996, with an effort to maintain a 5 bg void. More recently, spill mitigation was conducted at Pepacton Reservoir based on snowpack in the winter of 2005, when an approximate 11 bg void was achieved prior to the flood of April 2005. In 2006, spill mitigation for Neversink and Pepacton Reservoirs was based on snowpack and expected precipitation in 2006. In early 2007, spill mitigation at Cannonsville, Pepacton, and Neversink reservoirs was based on a temporary snowpack and a storage based rule curve, and most recently as of late 2007/2008, spill mitigation was included in the Flexible Flow Management Program (FFMP).
3. **Automatic Snowpack Monitors in the NYC Watershed:** In 2006, DRBC received \$22,000 through NOAA's automated flood warning system grant program to buy two automatic snowpack monitors for installation in the NYCDEP watershed. Soon after receiving the grant, NYCDEP found that the antifreeze used in the monitors to determine snow water equivalent leaked in some instances, so they discontinued that type of

monitor. DRBC held the funding while trying to figure out if there was a new type of sensor that could be used. In 2008, NYCDEP installed electronic load type sensors using the grant funds; the first in the Neversink watershed and the second in the Pepacton watershed. NYCDEP is responsible for maintenance and telemetry. These monitors are expected to supplement manual snow surveys working towards easier, quicker and more accurate snowpack data collection.

Structural and Non-Structural Measures:

1. Task 2 of the Multi-jurisdictional Use and Management of Water Resources for the Delaware River Basin by the Army Corps of Engineers: This study includes identification of flood prone areas within the Delaware Basin, development of a potential solution matrix (including both structural and non-structural solutions), application of the matrix to identified major damage centers (New Hope, Yardley, Easton and Upper Makefield PA; Lambertville, Stockton, Harmony and Belvidere NJ; and Rockland and Colchester, NY), updating stage-frequency relationships for main stem Delaware gages plus selected tributaries to reflect the recent floods, assembling stage-damage data for the damage centers on the Delaware River main stem and selected tributaries and conducting structure inventories at the identified damage centers with ground/first floor and zero damage elevations for all commercial/residential and industrial structures within the 100 year floodplain.
2. Northampton and Lehigh Counties received a \$1M in pre-disaster mitigation earmark funding (through FEMA's PDM program, FY-08) for flood mitigation in Northampton and Lehigh Counties. This funding will be used to complete high and medium priority projects, as identified by their Hazard Mitigation Plan.
3. New Jersey Blue Acres Program (Acquisition Funding): Governor Corzine signed into law the "Green Acres, Farmland, Blue Acres, and Historic Preservation Bond Act of 2007" which was presented to the voters and approved at the November 2007 election. The bond act will provide \$12M for the state to acquire, for recreation and conservation purposes, lands in the floodway of the Delaware River, Passaic River, and Raritan River, and their respective tributaries, that have been damaged by, or may be prone to incurring damage caused by storm-related flooding or that may buffer or protect lands from such damage.
4. New York State (Acquisition Funding): New York State is providing \$15.25M through the State Department of Communities and Development to buy out homes in flood-prone areas. Sullivan will receive \$4 million; Ulster, Orange and Delaware counties, \$2 million each. Other counties receiving money include: Broome, \$750,000; Chenango, \$750,000; Herkimer, \$750,000; Montgomery, \$750,000; Otsego, \$750,000; Schoharie, \$750,000; and Tioga, \$750,000. To qualify for the program, homes must be primary residences appraised at under \$250,000. Preference would be given to homes that have been flooded twice since April 1, 2004, and are appraised at under \$100,000. The county's emergency management director and a town building official will certify that homes qualify.
5. Federal Emergency Management Agency's Severe Repetitive Loss (SRL) program: Both State and local plans are a pre-requisite for Federal Emergency Management Agency's

Severe Repetitive Loss (SRL) program. In the first year of the program (2008), FEMA set aside \$160 million for properties nationwide.

- a. Pennsylvania, which has 243 properties on the SRL list, is slated to receive \$4.7 million in funding to be used towards acquisitions and elevations. PA municipalities (through PEMA) have a May 30 deadline to apply for SRL funds. 32 homes in Yardley Borough, the most in any town in Pennsylvania, qualify for funding under the Federal Emergency Management Agency's Severe Repetitive Loss (SRL) program. Along with Yardley, 57 other Bucks County properties are on the list, including 14 in Upper Makefield, 7 in Solebury, 6 in Lower Makefield, 4 in New Hope and 1 in Bristol Township.
 - b. In comparison, NJ is slated to be eligible to receive \$11.4M for its 590 SRL properties. While NJ has an approved State Plan, only two of its communities (and none in the basin) have FEMA-approved local hazard mitigation plans in place. Therefore, only properties in these two towns are eligible for FY-08 SRL funds.
6. Yardley Borough received hazard mitigation funding (under a separate FEMA grant program than SRL) to elevate five homes. Homeowners and business owners in Yardley also elevated 17 homes with individual funds, 14 of the 17 using \$30,000 of Increased Cost of Compliance (ICC) money from FEMA. Yardley Borough received federal funding for stormwater backflow preventors. Yardley Borough has also recently identified the debris that collects along staggered, abandoned bridge piers at the Yardley RR bridge as causing backwater effects. DRBC, PEMA, CSX and Yardley borough are investigating the possibilities of removing the debris and abandoned piers.
 7. Acquisition Funding, Town of Rockland, NY: The town has used a \$1 million grant through the FEMA PDM program to buy eight homes in Livingston Manor.
 8. Model programs on tributaries - such as the co-sponsoring by Bucks County, FEMA, and the NRCS has resulted in the successful elevation and acquisition of over 300 properties along the Neshaminy Creek.
 9. Multi-Jurisdictional Flood Mitigation Plan. FEMA has awarded the Delaware River Basin Commission (DRBC) a grant under the Flood Mitigation Assistance program for the preparation of a multi-jurisdictional Flood Mitigation Plan (FMP) for a possible 64 municipalities located within Sussex, Warren, Hunterdon and Mercer Counties that have boundaries either partially or entirely within the Delaware River drainage basin. This plan will be finalized in Spring 2008 and will provide the four counties with a valuable asset that could be incorporated into a future All-Hazards Plan.
 10. Dam Safety: New York State Department of Environmental Conservation (DEC) proposed new draft regulations that requires more dam inspections, regular maintenance, better recordkeeping, and emergency planning. Recent efforts to enhance the program include:
 - Additional staff: dam safety staffing has increased from three to 20 people statewide;

- Enforcement: DEC has issued formal complaints for nine dams, and has entered into Orders on Consent for remedial work at 10 dams;
 - Inspections: In recent years, DEC has completed inspections of all 389 high hazard dams in the state, and in 2007, completed more than 250 dam inspections;
 - Funding: \$15 million in Bond Act Dam Safety funds were awarded to help municipalities address dam safety deficiencies; and
 - Education and Training: Classes and seminars have been offered by DEC staff to dam owners and other stakeholders to help increase their knowledge and implementation of dam safety guidelines.
- a. In regards to the Emergency Action Plan, the new regulations state that within 12 months of the effective date of these regulations, all Class B and Class C (Intermediate and High Hazard) dam owners shall develop and submit an Emergency Action Plan to the department, the State Emergency Management Office, and the chief executive officer of the municipality in which the dam is located. The dam owner will also send the Emergency Action Plan to any other municipality within the inundation area.
 - b. In addition, NYCDEP has made a New York State Dams Inventory available that depicts the location of dams in the New York State Inventory of Dams. While the DEC tries to maintain an accurate inventory, this data should not be relied upon for emergency response decision-making. The inventory can be viewed through a google maps download (kmz file) at <http://www.dec.ny.gov/pubs/42978.html>

Stormwater Management:

1. New Jersey: Creation of Stormwater Utility Systems – S-1166 (Smith/D-17): Committee passed, referred to the Senate Budget and Appropriations Committee. Permits municipalities and counties to finance the creation, operation and maintenance of stormwater utility systems through the imposition of tax on residential and commercial properties.
2. Pennsylvania: Completing work on storm water legislation that will entirely revamp the authority and responsibility for planning and implementing a storm water management system.

Floodplain Mapping:

1. Updated Hydrologic Information for the Main Stem of the Delaware River: On May 2007, the USGS recommended flood magnitude and frequencies for the 8 gaging stations along the main stem Delaware River in New Jersey, New York, and Pennsylvania. These figures were developed by Bob Schopp, USGS NJ Water Science Center and Gary Firda, USGS NY Water Science Center. These figures were developed in consultation with the U.S Army Corps of Engineers Philadelphia District, FEMA Regions II and III, NJDEP-State NFIP Coordinator's Office and DRBC. USGS plans to post a web-based report documenting the assumptions that were made in determining these discharges. These updates discharges will be used in future mapping updates.

2. Updated Floodplain Study & Mapping Delineation: The NJDEP has set aside \$1,000,000 for the preparation of new floodplain delineations and associated mapping for the main stem of the Delaware River on the NJ side. On May 16, 2006, the NJDEP executed a Collaborative Technical Partnership (CTP) agreement with the Federal Emergency Management Agency (FEMA) Region II in order to leverage NJDEP funding with the current federal Flood Map Modernization Program resources. FEMA will also be contributing an additional \$2,500,000 dollars towards completion of this effort.

Medina Consultants, the flood mapping contractor, is currently in the process of performing field surveys of river cross-sections along a 126 miles reach of the main stem of the Delaware River. In addition, various stages of LiDAR acquisitions are planned for the four New Jersey counties along the Delaware River. LiDAR (Light Detection and Ranging) is an optical remote sensing technology that is being used to collect high-accuracy elevation data. The surveyed river cross-sections, LiDAR information and the updated hydrology will be incorporated into updated hydraulic modeling for preparation of new floodplain mapping along the New Jersey side of the Delaware. The goal of this mapping effort is to more accurately define the limits of the flood hazard area and associated base flood elevation.

3. The Corps of Engineers will be producing digital flood inundation maps for the main stem Delaware using existing data. These maps will be available through NWS AHPS website and to County Emergency Managers. Funding for this work was made possible by using the \$500,000 provided by the basin states for the flood analysis model as a local cost share to leverage federal funding. The mapping is expected to be completed by close of 2008.
4. Using FEMA funding, 160 high water marks in PA and NJ from the June 2006 in PA and NJ were collected by USACE and verified against existing flood insurance study flood profiles.
5. Flood mapping and stormwater mitigation work was conducted for the Pennypack watershed by the Center for Sustainable Communities at Temple. This higher precision mapping is a valuable planning tool for local officials for defining flood inundation and vulnerability of evacuation routes. It can also be used to administrate floodplain regulations if a community chooses to use it and FEMA approves.
6. The State of Pennsylvania is acquiring LIDAR data for the state. The remaining portion of the state to be collected is in the eastern portion of the state (Delaware River Basin). The collection of LiDAR has been funded, but funding for processing still needs to be allocated.
7. In response to the June 2006 flood, FEMA Region II is conducting a flood hazard analysis of the flooding sources identified in the Delaware River Basin in New York State. This includes but is not limited to the Delaware River from Port Jervis to Hancock, NY and portions of the Beaverkill, Willowemoc, East Branch, West Branch and Callicoon Creek. The scope of the effort includes: LiDAR acquisition, field survey of structure and wet sections, hydrologic and hydraulic modeling, and the development of

flood recovery maps. As of the beginning of August, the LiDAR has been flown, field surveys are underway, and the hydrologic analysis is being finalized.

Floodplain Regulations:

1. Updated Flood Hazard Area Control Act Rules – New Jersey: On November 5, 2007, the NJ Department of Environmental Protection adopted new Flood Hazard Area Control Act rules (N.J.A.C. 7:13), which incorporate more stringent standards for development in flood hazard areas and riparian zones adjacent to surface waters throughout the State.
2. In order to minimize the impacts of development on flooding, a 0% net-fill requirement now applies to all non-tidal flood hazard areas of the State. The new rules also expand the preservation of near-stream vegetation by implementing new riparian zones that are 50, 150 or 300 feet in width along each side of surface waters throughout the State. The riparian zone width depends on the environmental resources being protected, with the most protective 300-ft riparian zone applicable to waters designated as Category One and certain upstream tributaries.
3. Some of the other highlights of the new rule include allowing the use of Federal flood mapping in communities where no State flood mapping is available, and providing a simplified method to approximate flood depths in communities where no State or Federal flood mapping is available; requiring floor elevations and roadway surfaces to be set at least one foot above the State's flood hazard area design flood elevation (125% of the 100-year flow rate reported by FEMA) in order to provide increased flood protection for buildings and public roadways; creating 46 permits-by-rule and 16 general permits to both facilitate and encourage projects that have no adverse impact on flooding and the environment, including a permit-by-rule for elevating homes, which requires no prior NJDEP approval, and a free, expedited general permit for the reconstruction and elevation of homes damaged by flooding; and Amending the Coastal Permit Program rules (N.J.A.C. 7:7) and Coastal Zone Management rules (N.J.A.C. 7:7E) to incorporate equivalent flood protection and stream buffers to all waters and flood hazard areas Statewide.
4. A Subcommittee to DRBC's Flood Advisory Committee (FAC) has been established to examine the potential for more consistent floodplain management in the basin.

Flood Warning:

1. FY-08 Flood Warning Improvements: With DRBC assistance, and promotion by members of Congress (Sponsors: Dent, Holt Lautenberg, Menendez), \$235,000 in federal funds were directed to NOAA-NWS for work on improved flood warning in the Delaware River Basin. This will include an evaluation and improvement of existing precipitation and stream gage networks, flood hardening of some gages prioritized by USGS, implementation of flood inundation mapping into AHPS at flood forecast points and an education and outreach component.
2. NJDEP Upgrades to USGS Streamgaging Program: The NJDEP has committed funding for the upgrade, replacement, and addition of streamgages along the Delaware River.

Along the Delaware River, the scope of work includes the addition of high-data rate satellite transmitters to provide better aerial data coverage on a real-time basis and to develop flood data for use in design of flood control measures, major gage repairs in order to improve streamflow data accuracy, and the addition of raingages to aid the National Weather Service (NWS) in flood-forecasting and refinement of their radar estimates of precipitation. To date, major gage repairs and upgrades have been accomplished to the existing gages at the Delaware River at Montague, Riegelsville, and Trenton. In addition, a radar stage gage has been installed and a tipping-bucket rain gage has been re-installed at the Delaware River at Stockton and a radar stage and rain gage has been installed at the Delaware River at Lambertville.

Education/Outreach:

1. The Easton Flood Museum and Resource Center is currently in construction and will be devoted to educating the public on the causes and effects of floods and how communities can work together to prevent flooding and relieve flood damage. <http://www.floodproject.org/>
2. Pennsylvania is in the process of forming a PA chapter of the Association of State Floodplain Managers (ASFPM) to address the impacts of flooding and stormwater issues in Pennsylvania and the need to plan and educate PA residents on a watershed basis.
3. Both NJAFM and NYSFSMA, NJ and NY chapters of the Association of State Floodplain Managers (ASFPM), are active in addressing and educating sound floodplain management.

New Jersey Mitigation Strategy

The State of New Jersey recently received approval from FEMA on its updated State Hazard Mitigation Plan. The plan outlined four goals: Protect life, Protect property, Increase public preparedness, and Develop and maintain an understanding of risks. Details of the State Hazard Mitigation Plan can be found at www.njfflood.org.

After the 2005 flood event, then Acting Governor Richard J. Codey announced the formation of a statewide Flood Mitigation Task Force to study and implement measures to reduce future impacts of flooding in New Jersey Communities. On August 22, 2006, Governor Jon Corzine released the final report of the Flood Mitigation Task Force and proposed new Flood Hazard Area Control Act Rules in response to Task Force recommendations and chronic flooding.

In a letter dated March 21, 2008 to Carol Collier, Executive Director of the DRBC, Lisa Jackson, NJDEP Commissioner indicated that New Jersey agreed with the action agenda developed by the Delaware River Basin Interstate Flood Mitigation Task Force. She also noted that New Jersey's own Delaware River Flood Mitigation Task Force had presented 37 similar recommendations for flood damage reduction and mitigation.

New Jersey is in the process of implementing several of their task force recommendations. The findings and recommendations of New Jersey's Delaware River Flood Mitigation Task Force are reproduced below along with New Jersey's ongoing flood mitigation activities. The

full report can be accessed online at www.njflood.org.

Findings

The New Jersey Delaware River Flood Mitigation Task Force listed the following findings from their deliberations:

- The Floodplains Should Be Expected to Flood
- No one set of measures, alone or in combination, will stop or eliminate flooding in the Delaware River Floodplain.
- The potential for hurricanes to be more intense and more frequent means that the risks and foreseeable consequences of flooding are increasing in magnitude.
- Timely and accurate Flood Watches and Warnings issued by the National Weather Service (NWS) are critical to saving lives and property, and improvements in communications, and in precipitation and stream gage density and technology, are needed to support the NWS mission.
- Better planning, stricter protection of flood plains, increased efforts to restore disturbed and developed floodplain areas, and more rational rebuilding standards can significantly reduce economic loss to New Jersey from flooding when it occurs.
- The current patchwork of floodplain delineations, many of them long out of date, must be updated if risk reduction strategies are to be effective in reducing losses.
- The Delaware River Basin Commission’s (DRBC) “Recommendations to Address Flood Warning Deficiencies” must be fully implemented to provide the public with adequate response time and information as incorporated in the recommendations below.

Recommendations of the NJ Delaware River Flood Mitigation Task Force

The New Jersey Delaware River Flood Mitigation Task Force made the following recommendations:

1. Regulatory Protection of Flood Plains and Homes Must Be Strengthened
 - a. The State should develop updated flood inundation maps for the Delaware River.
 - b. The State should evaluate its existing flood hazard mapping in order to determine whether a more stringent standard should be used to define floodway boundaries.
 - c. Regulatory stream buffers of 300 feet should be established in flood-prone areas between tributaries and any new development.
 - d. The Delaware and Raritan Canal, currently a C1 candidate, should be reclassified on an expedited basis.
 - e. DRBC should extend the “Outstanding Basin Waters” classification to remaining segments of the non-tidal Delaware and its tributaries as a bulwark against additional development.
 - f. The State must adopt floodplain regulations consistent with the “No Adverse Impact” recommendations by the Association of State Floodplain Managers.

- g. Building rehabilitation and construction in New Jersey must be fully compliant and consistent with FEMA requirements under the National Flood Insurance Program (NFIP).
2. Mitigation and Control Measures Should Be Pursued
 - a. The State, in partnership with federal and local entities, should coordinate the implementation of improvements to flood forecasting and flood warning system capabilities.
 - b. The Task Force supports additional work by the US Army Corps of Engineers (USACE), the Federal Emergency Management Agency (FEMA), the US Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS), the NJ Office of Emergency Management (NJOEM) and the New Jersey Department of Environmental Protection (NJDEP) to conduct studies to determine the viability of Federal interest to construct or implement appropriate flood control mitigation measures. Any study should focus on local nonstructural and structural measures, and should not revisit the federal and state policy and funding decisions that terminated the proposed Tocks Island dam project.
 - c. Engineering controls and small-scale structural controls with significant benefits in specific tributaries or river segments should be identified. Nonstructural strategies should be given a priority during consideration of flood protection solutions.
 - d. Snowpack storage provides seasonal flood mitigation benefits downstream from reservoirs. The State should work through the DRBC's Flood Advisory Committee and the Parties to the 1954 Supreme Court Decree to foster multiparty snowpack storage agreements and to explore other opportunities for assessing the effectiveness of potential reservoir management changes.
 - e. Buy-outs of substantially damaged properties and floodplain restoration should be more readily available to property-owners in repetitive loss areas of the flood plain. An expanded Blue Acres program, in partnership with the USACE and FEMA should be established when the Garden State Preservation Trust Act (GSPT) is reauthorized.
 - f. It is important to maintain the structural integrity of the Delaware and Raritan Canal and to avoid increased flooding along its length. The NJ Water Supply Authority (NJWSA) should continue to work with the Delaware River towns to investigate and implement operational plans that may reduce flooding attributable to the Alexauken and Swan Creeks without adversely affecting the canal.
3. Planning and Additional Resources are Needed to Reduce Flood Risk
 - a. The State must develop a robust hazard mitigation program through the addition of staffing for the NJOEM Mitigation Unit, in order to qualify for an Enhanced State Hazard Mitigation Plan under FEMA guidelines. Additional resources would also allow NJ to be more aggressive in its approach to FEMA mitigation grants and would ensure proper oversight and management of all current and future mitigation projects.
 - b. The State must more effectively utilize available FEMA mitigation grant funding under the Hazard Mitigation Grant Program (HMGP), the Flood Mitigation Assistance Program (FMA), and the Competitive Pre-Disaster Mitigation (PDM-C) grant programs, so that available funding does not continue to remain unused, as it has in the past.

- c. The State needs to develop its in-house capabilities to promote local hazard mitigation planning throughout the state. Currently there is a severe limitation on the number of New Jersey communities since only two are eligible for HMGP and PDM-C project grants. NJDEP should develop a Statewide Flood Prevention Master Plan to inventory flood prone areas and assess community vulnerabilities.
 - d. The State's municipal authorities law must be amended to give municipalities the option of establishing a stormwater management utility or similar entity to manage and improve stormwater runoff from existing developments, and to facilitate access to the New Jersey Environmental Infrastructure Trust for local flood control projects.
4. Homeowners Need Focused Assistance Before and After Flooding
- a. FEMA, NJOEM, NJDEP, and local municipalities should improve coordination prior to and after flooding through homeowner assistance centers.
 - b. The services of the New Jersey Association for Floodplain Management (NJAFM) should be utilized for public training and community outreach activities.
 - c. NJDEP should adopt a permit-by-rule that will spare residents who rebuild their homes or other structures on residential property the expense and delay of the permitting process provided the project meets NFIP standards.
 - d. The NJOEM, in coordination with other agencies, should develop both a user-friendly publication and a web page that explain relevant funding sources and provide commonsense help to homeowners after a flood.
 - e. Realtors should be required to disclose at the time of sale whether a home is in a flood plain and whether it has had prior flood damage.

Implementation

The following represents a summary of some of the initiatives to mitigate Delaware River flooding that are currently being undertaken by the New Jersey Department of Environmental Protection (NJDEP).

Updated Flood Hazard Area Control Act Rules:

On November 5, 2007, the NJ Department of Environmental Protection adopted new Flood Hazard Area Control Act rules (N.J.A.C. 7:13), which incorporates more stringent standards for development in flood hazard areas and riparian zones adjacent to surface waters throughout the State. The Department has adopted these new rules to better protect the public from the hazards of flooding, preserve the quality of surface waters, and protect the wildlife and vegetation that exist within and depend upon such areas for sustenance and habitat.

To minimize the impacts of development on flooding, a zero percent net-fill requirement (which was previously implemented only in the Highlands Preservation Area and Central Passaic Basin) will now apply to all non-tidal flood hazard areas of the State. The new rules also expand the preservation of near-stream vegetation (previously protected within 25 or 50 feet of streams) by implementing new riparian zones that are 50, 150 or 300 feet in width along each side of surface waters throughout the State. The riparian zone width depends on the environmental resources being protected, with the most protective 300-ft riparian zone applicable to waters

designated as Category One and certain upstream tributaries. Certain waters supporting trout, or habitats of threatened or endangered species critically dependant on the watercourse to survive, or watercourses which flow through areas that contain acid-producing soil deposits, receive a 150-ft riparian zone.

Some of the other highlights of the new rule include allowing the use of Federal flood mapping in communities where no State flood mapping is available, and providing a simplified method to approximate flood depths in communities where no State or Federal flood mapping is available; requiring floor elevations and roadway surfaces to be set at least one foot above the State's flood hazard area design flood elevation in order to provide increased flood protection for buildings and public roadways; creating 46 permits-by-rule and 16 general permits to both facilitate and encourage projects that have no adverse impact on flooding and the environment, including a permit-by-rule for elevating homes, which requires no prior NJDEP approval, and a free, expedited general permit for the reconstruction and elevation of homes damaged by flooding; and Amending the Coastal Permit Program rules (N.J.A.C. 7:7) and Coastal Zone Management rules (N.J.A.C. 7:7E) to incorporate equivalent flood protection and stream buffers to all waters and flood hazard areas Statewide.

Updated Floodplain Study & Mapping Delineation:

The NJDEP has set aside \$1,000,000 to begin the preparation of new floodplain delineations and associated mapping for the main stem of the Delaware River. On May 16, 2006, the NJDEP executed a Collaborative Technical Partnership (CTP) agreement with the Federal Emergency Management Agency (FEMA) in order to leverage NJDEP funding with the current federal Flood Map Modernization Program resources. FEMA will also be contributing an additional \$2,500,000 dollars towards completion of this effort.

The NJDEP coordinated with USGS and FEMA on the development of updated hydrologic information for the main stem of the Delaware River. On May 2007, the USGS recommended flood magnitude and frequencies for the 8 gaging stations along the main stem Delaware River in New Jersey, New York, and Pennsylvania. These figures were developed by Bob Schopp, USGS NJ Water Science Center and Gary Firda, USGS NY Water Science Center and in consultation with the U.S Army Corps of Engineers Philadelphia District, FEMA Regions II and III, NJDEP-State NFIP Coordinator's Office and DRBC. The report, OFR 2008-1203 Flood Magnitude and Frequency of the Delaware River in New Jersey, New York, and Pennsylvania, can be accessed online at <http://pubs.er.usgs.gov/usgspubs/ofr/ofr20081203>.

Medina Consultants, the flood mapping contractor, is currently in the process of performing field surveys of river cross-sections along a 126 miles reach of the main stem of the Delaware River. In addition, various stages of LiDAR acquisitions are planned for the four counties along the Delaware River. The surveyed river cross-sections, the LiDAR information and the updated hydrology will be incorporated into updated hydraulic modeling for preparation of the new mapping. This state of the art new mapping will be a valuable resource during times of emergency and for the regulation of land use along the floodplain area. The goal of this mapping effort is to more accurately define the limits of the flood hazard area and associated base flood elevation. The anticipated date of completion for this mapping is 2009.

Flood Mitigation Feasibility Study:

The NJDEP has committed funding to be cost shared with the US Army Corps of Engineers (USACE) for the preparation of a feasibility study to evaluate possible flood mitigation options, including flood-proofing and removing or relocating structures within the floodplain of the Mid-Delaware River Basin. The Feasibility Cost Share Agreement between NJDEP and the USACE was signed on July 27, 2006. The NJDEP and USACE have met with Delaware River town residents and local officials to perform visual inspections and gather information on the 2004, 2005 and 2006 flooding. NJ continues to provide cost-share funding and the USACE continues to move forward on the study.

Upgrades to USGS Stream Gaging Program:

The NJDEP has committed funding for the upgrade, replacement, and addition of streamgages along the Delaware River. On June 9, 2006, the NJDEP signed a joint funding agreement with the United States Geological Survey (USGS) to provide various upgrades to streamgaging programs in NJ. Along the Delaware River, the scope of work includes the addition of high-data rate satellite transmitters to provide better aerial data coverage on a real-time basis and to develop flood data for use in design of flood control measures, major gage repairs in order to improve streamflow data accuracy, and the addition of raingages to aid the National Weather Service (NWS) in flood-forecasting and refinement of their radar estimates of precipitation.

To date, major gage repairs and upgrades have been accomplished to the existing gages at the Delaware River at Montague, Riegelsville, and Trenton. In addition, a radar stage gage has been installed and a tipping-bucket rain gage has been re-installed at the Delaware River at Stockton and a radar stage and rain gage has been installed at the Delaware River at Lambertville.

Develop a Flood Analysis Modeling Tool:

The NJDEP has committed funding to the DRBC for development of a flood analysis model. This model will allow the evaluation of existing reservoirs for flood mitigation purposes by providing data to evaluate the effects of various reservoir operating alternatives on flooding at locations downstream of the reservoirs. The scope of work for this project has been finalized and USGS has signed an agreement with DRBC on June 20, 2007. Development of the model will be by a multi-agency project team which will include participation of the National Weather Service (NWS), the USACE, and USGS. The flood analysis model is scheduled to be completed within eighteen months, or in January 2009.

Blue Acres Program for New Jersey:

Governor Corzine signed into law the “Green Acres, Farmland, Blue Acres, and Historic Preservation Bond Act of 2007” which was presented to the voters and approved at the November 2007 election. The bond act will provide \$12,000,000 for the state to acquire, for recreation and conservation purposes, lands in the floodway of the Delaware River, Passaic River, and Raritan River, and their respective tributaries, that have been damaged by, or may be prone to incurring damage caused by storm-related flooding or that may buffer or protect lands from such damage.

County/Local Mitigation Strategy

Municipal Specific Flood Mitigation Goals and Action Plans

Through this Plan, Counties and municipalities developed individual mitigation action plans. The goal of this plan was to empower and enable local jurisdictions to evaluate their history of flooding, their future risk of flooding and to develop a mitigation action plan upon implementation, would reduce future flood loss.

Although municipalities are often affected by similar rainfall events, the effect of those events differs by municipality. Flood loss depends on many local factors including slope and elevation, amount of built environment in the floodplain, land use, location of essential facilities and population.

Taking this into consideration, each municipality was tasked to individually evaluate their risk and vulnerability to flooding. As a result, each municipality developed their own flood profile, set of individual flood mitigation goals and considered any unique flood risk to their municipality. Municipal specific flood profiles and individual mitigation action plans are presented in Section 6.

Mitigation Categories

Each municipality and county considered a range of flood mitigation actions to determine the most effective action for their community that had the best chance of being realized. Mitigation actions were discussed in county level meetings in terms of the following 6 categories. These include Prevention, Property Protection, Public Information and Awareness, Emergency Services, Natural Resource Protection and Structural Projects.

It was agreed that no one set of mitigation measures would stop flooding, instead a combination of actions would need to be considered and implemented to improve a community's resilience to flooding. The six mitigation categories were derived from FEMA Guidance, State and Local Mitigation how-to-guide: Developing the Mitigation Plan. More detail on each of the categories is provided below.

Prevention

Preventative activities are intended to keep hazard problems from getting worse. They are particularly effective in reducing a community's future vulnerability, especially in areas where development has not occurred or capital improvements have not been substantial. Examples of preventative activities include:

- Planning and zoning
- Building codes
- Hazard mapping
- Open space preservation
- Floodplain regulations
- Stormwater management

- Drainage system maintenance
- Capital improvements

Property Protection

Property protection measures enable structures to better withstand flood events, remove structures from hazardous locations, or provide insurance to cover potential losses. Examples include:

- Acquisition
- Building elevation
- Relocation
- Structural Retrofits (i.e., flood proofing, elevate utilities, etc.)
- Stormwater Retrofits (i.e., backflow preventers, culvert resizing, etc.)
- Critical facilities protection
- Insurance

Public Information and Awareness

Public Information and awareness activities are used to inform and educate residents, elected officials, business owners, potential property buyers, and visitors of the flood hazard and mitigation techniques they can use to protect themselves and their property. Examples of measures used to educate and inform the public include:

- Outreach and education
- Training
- Speaker series, demonstration events
- Real estate disclosure

Emergency Services

Although not typically considered a mitigation technique, emergency services minimize the impact of a hazard on people and property. Actions taken immediately prior to, during, or in response to a hazard event include:

- Warning systems; Reverse 9-1-1
- Search and rescue
- Evacuation planning and management

Natural Resource Protection

Natural resource protection activities reduce the impact of hazards by preserving or restoring the function of natural systems. Examples of such natural systems include floodplains and wetlands. Natural resource protection serves the dual purpose of protecting lives and property while enhancing environmental goals such as improved water quality or recreational opportunities. Examples include:

- Floodplain protection

- Riparian buffers
- Erosion and sediment control
- Stream corridor restoration
- Watershed management
- Wetland restoration
- Habitat preservation

Structural Projects

Due to a host of economic, environmental and political reasons, flood management has been historically moving away from large scale flood control projects. Although, in some cases, structural solutions such floodwalls, dams, engineered conveyances and control structures may be warranted after a careful analysis of the ecological, economic, long-term operation and maintenance, and social costs and benefits is performed. Structural projects are usually cost-shared between federal and local sponsors and managed or maintained by local public works staff. Examples include:

- Levees, dikes, or floodwalls
- Detention and retention basins
- Channel modification
- Stormwater Retrofits
- Maintenance of existing flood control structures

Prioritization Process

Each participating municipality independently identified and prioritized their mitigation actions contained in their specific action plan (contained in Section 6). Municipalities were provided with instructions and a copy of the STAPLEE matrix contained in FEMA’s “How-to Guide #3: Developing the Mitigation Plan” FEMA 386-3. STAPLEE is an acronym for Social, Technical, Administrative, Political, Legal, Economic and Environmental criteria used in the evaluation process. Each of the seven STAPLEE evaluation criteria includes a number of sub-criteria for consideration. For example, included in the “Social” criteria are two considerations: “Community Acceptance” and “Effect on Segment of Population.” See Appendix C for the STAPLEE Action Evaluation chart that contains the considerations used for all seven (7) STAPLEE criteria.

Each municipality scored each action with a plus (+) for favorable or minus (-) for less favorable, in every category. The considerations were first combined into a ranking for each STAPLEE criteria. Then, a priority ranking of High, Medium or Low was assigned to each action. These rankings are contained in each Municipal Flood Profile and Mitigation Action Plan, as well as, the following Tables 5-2 – 5-5.

Mitigation Action Tables

The following tables, Tables 5-2 – 5-5, present Municipal Mitigation Actions by County organized by Action Category. Over 160 mitigation actions are contained in these tables.

Table 5-2: Mercer County: Municipal Mitigation Actions by Action Category

1. Prevention (Policy/Ordinances/Studies/Enforcement)				
Municipality	Mitigation Action	Responsible Party	Estimated Cost	Priority
Hamilton Township	Flood Damage Prevention	Engineering, Planning, Inspections & Land Use	Staff time	High
Trenton City	Get into FEMA's Community Rating System	Trenton Department of Inspections	Staff time	High
Trenton City	Ongoing coordination and involvement with other agencies to maximize mitigation efforts and use of funds	Trenton Office of Emergency Management	Staff time	Medium
2. Property Protection (Acquisition, Elevation, Flood proofing)				
Municipality	Mitigation Action	Responsible Party	Estimated Cost	Priority
Hamilton Township	Property Acquisition	Engineering, Planning, and Inspections, administration	\$500,000	High
Hopewell Township	Elevate utilities	Homeowners	\$20,000 per home	Medium
Hopewell Township	Elevate properties	Homeowners	\$100,000 per home	Medium
Trenton City	Selective acquisition and demolition of highly flood prone residential or commercial properties	Trenton Department of Housing and Economic Development	Dependant on funding	Medium
Trenton City	Acquire and demolish flood prone property on Taylor Street	Trenton Department of Housing and Economic Development or Inspections Department	Acquisition per structure: \$700,000; demolition \$800,000; remediation \$600,000	High
Trenton City	Acquire and demolish flood prone property on Amtico Square	Trenton Department of Housing and Economic Development	Acquisition per structure: \$700,000; demolition \$800,000; remediation \$600,000	High
Trenton City	Elevate mechanical and electrical equipment in flood prone residential structures	Trenton Department of Inspections	Estimated \$5,000 to \$10,000 per residential structure	High
Trenton City	Assess FEMA RLPs and SRLPs throughout the city to identify mitigation candidates	Trenton Department of Inspections	\$25,000 - \$50,000	High
Trenton City	Purchase and/or flood detention at the Freight Yards	Trenton Department of Housing and Economic Development	Acquisition remaining: \$45,000; detention: \$500,000-\$1,000,000; demolition: \$600,000; site remediation: \$5M	High
3. Public Information and Awareness				
Municipality	Mitigation Action	Responsible Party	Estimated Cost	Priority
Hamilton Township	Public education and outreach	OEM, Engineering, Planning, and Inspections	\$10,000	High

Table 5-2: Mercer County: Municipal Mitigation Actions by Action Category (continued)**4. Emergency Services**

Municipality	Mitigation Action	Responsible Party	Estimated Cost	Priority
Ewing Township	Power Grid Separation	PSE&G	\$150,000	High
Ewing Township	Individual location shut off	PSE&G	N/A	High
Hamilton Township	Flood Threat Recognition System	NJOEM, Hamilton Township Dept. of Engineering, Planning & Inspections and Dept. of Public Works	\$250,000	High
Hamilton Township	Advanced Flood Warning System	NJOEM, Hamilton Township Engineering and Dept. of Public Works	\$400,000	High

5. Natural Resource Protection (Floodplain protection, Stream Corridor Restoration, Open space)

Municipality	Mitigation Action	Responsible Party	Estimated Cost	Priority
Lawrence Township	Stream cleaning/clearing of Five Mile Run	Lawrence Township	\$75,000	Medium
Lawrence Township	Stream stabilization behind Lawrence Shopping Center	Private property owner	Not known at this time	Medium
Pennington Borough	Land purchase	Borough Council	\$300,000	High

6. Structural Projects

Municipality	Mitigation Action	Responsible Party	Estimated Cost	Priority
Ewing Township	Backflow prevention valves	NJDOT	unknown	High
Hamilton Township	Retrofit of Greenwood Avenue	NJDOT Region 3 Maintenance Office	\$25,000	Medium
Hopewell Township	Inspection of canal banks	New Jersey Water Supply Authority	N/A	High
Hopewell Township	Raise canal bank	New Jersey Water Supply Authority, NJDEP, D&R Canal Commission	\$250,000	High
Lawrence Township	Analysis of Route 206 at Notre Dame	NJDOT	\$50,000	High
Lawrence Township	Analysis of Bakers Basin Road at Route 1	NJDOT	\$50,000	High
Lawrence Township	Analysis of Princeton Pike culvert near Fairfield Avenue	NJDOT	\$50,000	High
Trenton City	Daylighting the Assunpink from South Broad Street to Warren Street	Trenton Department of Housing and Economic Development/Department of Inspections	To be determined	Medium
Trenton City	Portable Flood Barrier Study and Implementation	Department of Inspections/Fire Department/Civic Associations	To be determined	Medium
Trenton City	Detailed flood vulnerability study of the Trenton Water Filtration Plant	City of Trenton Department of Public Works	\$100,000-\$150,000	Medium
Trenton City	Flood protection at Trenton Water Filtration Plant	City of Trenton Department of Public Works	To be determined, likely over \$1M	Medium

Table 5-3: Hunterdon County: Municipal Mitigation Actions by Action Category**1. Prevention (Policy/Ordinances/Studies/Enforcement)**

Municipality	Mitigation Action	Responsible Party	Estimated Cost	Priority
Delaware Township	Stream Corridor Ordinance	Township Committee	\$3,000	High
Delaware Township	Update Stormwater Regulations	Waste Water Management Committee	\$2,000	High
Delaware Township	Flood review of all new construction	Floodplain Coordinator	\$500	High
Franklin Township	Maintain guidelines for steep slopes and flood prone areas	Planning Board and Building Dept.	N/A	Medium
Kingwood Township	Complete All Hazards Mitigation Plan	Kingwood Township	\$1,000	High

2. Property Protection (Acquisition, Elevation, Flood proofing)

Municipality	Mitigation Action	Responsible Party	Estimated Cost	Priority
Frenchtown Borough	Relocation of electric panels at Public Works garage and sewer plant	Borough	\$20,000	High
Frenchtown Borough	Relocation of Sewer Plant	Borough	\$3-5M	High
Kingwood Township	Elevate Homes	Kingwood Township OEM	\$5M	High
Kingwood Township	Property Acquisition	Kingwood Township OEM	\$5M	High
Lambertville City	Assist residents and business owners with elevation applications	City Council	\$250,000	High
Lambertville City	Analyze properties north of Cherry Street for structural elevation	City Council	To be determined	Medium
Raritan Township	Kuhl Road elevation	Township, county	\$1.5 M	High
Raritan Township	Copper Hill Road elevation and bridge replacement	Township, county	\$280,000	High
Raritan Township	Hampton Corner Road elevation and bridge replacement	Township, county	\$330,000	High
Stockton Borough	Residential property acquisition	Floodplain Administrator	\$1 M	High
Stockton Borough	Flood proof sewer pump station	Sewer Authority	\$25,000	High
Stockton Borough	Relocate Fire Department	Planning Board	\$750,000	Medium
Stockton Borough	Flood proof Borough Hall	Floodplain Administrator	\$25,000	Low

3. Public Information and Awareness

Municipality	Mitigation Action	Responsible Party	Estimated Cost	Priority
East Amwell Township	Community education for flood preparedness	East Amwell Township	To be determined	High
Lebanon Township	Public education	Lebanon Township	Minimal direct cost	Medium
Stockton Borough	Public awareness program	Stockton OEM	\$500	Medium

Table 5-3: Hunterdon County: Municipal Mitigation Actions by Action Category (cont'd)**4. Emergency Services**

Municipality	Mitigation Action	Responsible Party	Estimated Cost	Priority
East Amwell Township	Upgrade community notification system and township web site	East Amwell Township	To be determined	Medium

5. Natural Resource Protection (Floodplain protection, Stream Corridor Restoration, Open space)

Municipality	Mitigation Action	Responsible Party	Estimated Cost	Priority
Alexandria Township	Open space along the Delaware	To be determined	To be determined	High
Delaware Township	Analysis of local watersheds	Princeton Hydro	\$8,000	High
Franklin Township	Place rip-rap at face of stream adjacent to roadway	Franklin DPW	\$2,000	High
Franklin Township	Remove sediment and vegetation from roadside culverts	Franklin DPW and/or sub-division developer	Depends on extent, \$10,000 estimate	Medium
Franklin Township	Check for waterway obstructions (ie fallen trees, large debris, etc.)	Franklin DPW/landowners	Varies, \$1,000 per obstruction estimate	Medium
Hampton Borough	Storm Creek bed clean-up	Franklin DPW	Free	High
West Amwell Township	Preserve open space and farmland	To be determined	To be determined	Medium

6. Structural Projects

Municipality	Mitigation Action	Responsible Party	Estimated Cost	Priority
Frenchtown Borough	Install backflow prevention plugs on drainage pipes under towpath and at sewer plant	Frenchtown Borough	\$25,000	High
Frenchtown Borough	Raise level of the D&R towpath to prevent backflow of Delaware River over towpath	NJ State (DEP, D&R Canal Commission)	To be determined	Medium/ Low
Hampton Borough	Route 31 Retention Pond	NJDOT	To be determined	Medium
Lambertville City	Install a backflow prevention device storm sewer behind CVS Pharmacy that surcharges adjacent to the Canal Studios building	City Council	\$75,000.00	High
Lambertville City	Install backflow prevention device within Niece Lumberyard to mitigate backflow of Ely Creek	City Council	\$120,000	High
Lambertville City	Install flood gate and lift station at Swan Creek	City Council	\$8 million	High
Lambertville City	Study of sanitary sewerage backflow during flooding events	Lambertville Sewer Authority	\$500,000	High
Milford Borough	Wet well	Borough of Milford	To be determined	Medium
Stockton Borough	Levee (river wall) improvement plan	Governing body	\$5 M	High
Stockton Borough	Backflow prevention on storm drain outlets	Storm Water Management Coordinator	\$50,000	Medium

Table 5-4: Warren County: Municipal Mitigation Actions by Action Category

1. Prevention (Policy/Ordinances/Studies/Enforcement)				
Municipality	Mitigation Action	Responsible Party	Estimated Cost	Priority
Belvidere Township	Decommission lower dam	TBD	To be determined	Medium
Blairstown Township	Change ordinance to request BFE of at least one foot above	Blairstown Township	\$100	High
Frelinghuysen Township	Maintenance of stormwater facilities (non-functioning retention pond)	To be determined	To be determined	TBD
Warren County	Decommission the Lower Dam of the Pequest River	NJDEP/USACE	Unknown	High
Pohatcong Township	Adopt new flood damage prevention ordinance	Township Council	\$5,000.00	High
Pohatcong Township	Review development ordinances including density of development and stormwater management requirements	Land Use Board and Township Council	\$5,000.00	Medium
2. Property Protection (Acquisition, Elevation or Flood proofing)				
Municipality	Mitigation Action	Responsible Party	Estimated Cost	Priority
Belvidere Township	Elevation	TBD	To be determined	High
Blairstown Township	Elevate utilities in homes in flood prone areas	Homeowners	5,000 to 10,000 per home	High
Frelinghuysen Township	Analyze the properties in a portion of town for structural elevation	TBD	To be determined	TBD
Frelinghuysen Township	Elevation of flood-prone structures	TBD	To be determined	TBD
Harmony Township	Acquire 10 properties on Goat Farm Road	Township Committee	\$2,500,000	High
Knowlton Township	Mitigation of Severe Repetitive Loss Properties	Knowlton Township	To be determined	High
Knowlton Township	Elevate utilities and secure oil tanks	Property owners	To be determined	High
Independence Township	Assess elevations of critical facilities identified as being within the 100 year floodplain of the Pequest River	Township Committee	\$10,000	Medium
Oxford Township	Assess elevations of critical equipment in the wastewater treatment plant and plan corrective action	PRMUA	\$10,000 (assessment)	Medium
Pohatcong Township	Elevation of flood-prone residences	Property owners	\$50,000 - \$100,000 per structure	High
3. Public Information and Awareness				
Municipality	Mitigation Action	Responsible Party	Estimated Cost	Priority
Hardwick Township	Education through seminars and discussions	TBD	To be determined	Medium

Table 5-4: Warren County: Municipal Mitigation Actions by Action Category (cont'd)**4. Emergency Services**

Municipality	Mitigation Action	Responsible Party	Estimated Cost	Priority
Allamuchy Township	Create an emergency plan in case of dam failure or an uncontrolled release of stored water	TBD	To be determined	High
Hardwick Township	Continue Early Warning by use of Emergency Operation Plan	OEM	To be determined	High
White Township	Early Warning	Township	\$15,000	High

5. Natural Resource Protection (Floodplain protection, Stream Corridor Restoration, Open space)

Municipality	Mitigation Action	Responsible Party	Estimated Cost	Priority
Belvidere Township	Reroute creek banks to channel water away from residential areas	TBD	To be determined	TBD
Belvidere Township	River and creek bank replacement	TBD	To be determined	TBD
Belvidere Township	Dredging	TBD	To be determined	TBD
Blairstown Township	Removing debris along Paulinskill River	DPW and DEP	\$100,000.00	High
Franklin Township	Remove debris from the Musconetcong and other waterways	NJDEP	\$100,000	Medium
Hackettstown	Remove downed trees and debris from Musconetcong and small streams.	Hackettstown OEM	To be determined	Low/ Medium
Independence Township	Remove debris from sections of the Pequest	NJDEP	\$100,000	High
Mansfield Township	Remove or thin out debris on Musconetcong River	TBD	To be determined	TBD
Pohatcong Township	Landscape Block 97, Lots 53 & 54 which are in the riparian zone of the Delaware River	Rutgers Forest Restoration Program	\$20,000	Low
Warren County	Dredge lower portion of the Pequest River	NJDEP/USACE	Unknown	Medium
Warren County	Desnag the Pequest, Paulinskill, and Delaware River	NJDEP	Unknown	Medium
White Township	Remove debris from tributaries	DEP, DPW	\$100,000	High
White Township	Keep entrance from tributaries to the Delaware River clear to prevent backup	DEP, federal	\$100,000	High

Table 5-4: Warren County: Municipal Mitigation Actions by Action Category (cont'd)**6. Structural Projects**

Municipality	Mitigation Action	Responsible Party	Estimated Cost	Priority
Belvidere Township	One-way valve	To be determined	To be determined	TBD
Belvidere Township	Reroute creek banks	To be determined	To be determined	TBD
Blairstown Township	Install backflow suppressors	DPW	\$20,000	Medium
Blairstown Township	Levy along Paulinskill River at Paulinskill Fields	Contractor and DEP	\$30,000	Medium
Blairstown Township	Channeling or walls built along Blair Creek	Contractor and DEP	TBD	Medium
Franklin Township	Attenuate Stormwater with a section of the Morris Canal	Township Committee	\$270,000	High
Frelinghuysen Township	Construction of barriers to protect flood-prone	To be determined	To be determined	TBD
Hackettstown	Install storm drain basins and larger storm pipes in area of East Prospect Street	Hackettstown Department of Public Works	\$51,000	Medium
Lopatcong Township	Sewer Line Modification	Lopatcong/Phillipsburg	\$625,000	High
Oxford Township	Use Furnace Lake and dam as a detention basin to attenuate stormwater	NJDEP	\$30,000	High
Phillipsburg Town	Modifications to Lift Station on Riverside Way	Town of Phillipsburg	\$500,000	High
Phillipsburg Town	Modifications to WWTP on S. Main Street	Town of Phillipsburg	\$500,000	High
Phillipsburg Town	Modifications to Street and Retaining Wall on Riverside Way	Town of Phillipsburg	\$400,000	High
Phillipsburg Town	Provide for an Engineering Feasibility Study of the Lopatcong Creek to determine Mitigation Actions to Prevent Backflow of Creek when the Delaware River is at Flood Stage	Town of Phillipsburg	\$200,000	High
Phillipsburg Town	Install Backflow Prevention on Stormwater Discharges to the Delaware River and Lopatcong Creek	Town of Phillipsburg	\$500,000 - \$1,000,000	High
Pohatcong Township	Install a pipe with backflow prevention device under railroad from River Road to the Delaware River	Township Council	\$150,000	Medium
Pohatcong Township	Install backflow prevention device on several existing pipes/culverts that discharge to the Delaware River	Township Council	\$300,000	Medium
Pohatcong Township	Construct a stormwater detention basin along to Mountain Road to control runoff from the mountain	Dept. of Agriculture, Soil Conservation Service	\$250,000 - \$350,000	Medium
Pohatcong Township	Study the impact of the removal of the Musconetcong River dams on flooding	Musconetcong Watershed Assoc., USACE	\$300,000	Medium

Table 5-5: Sussex County: Municipal Mitigation Actions by Action Category**1. Prevention (Policy/Ordinances/Studies/Enforcement)**

Municipality	Mitigation Action	Responsible Party	Estimated Cost	Priority
Fredon Township	Support new Master Plan with ordinances as detailed therein	Fredon Township	\$20,000	Low
Frankford Township	Mountain Snowmelt and Rain Runoff Analysis	State, County, Local	\$1M +	Medium to High
Fredon Township	Dam Analysis	Fredon Township	Staff time	Medium
Town of Newton	Dam Analysis	Town of Newton/ Private Property Owners	To be determined	High
Town of Newton	Enforce Municipal Ordinances and Town Master Plan	Town of Newton	N/A	Medium
Stillwater Township	Create County GIS Coverage for Dams and Inundation Areas	To be determined	To be determined	High
Sparta Township	Dam Analysis	Private Dam Owners	To be determined	High

2. Property Protection (Acquisition, Elevation or Flood proofing)

None Identified

3. Public Information and Awareness

Municipality	Mitigation Action	Responsible Party	Estimated Cost	Priority
Montague Township	Public Awareness	County OEM, township	\$1,000	Medium
Sandyston Township	Public awareness	County	To be determined	Medium

4. Emergency Services

Municipality	Mitigation Action	Responsible Party	Estimated Cost	Priority
Fredon Township	Provide power to shelter at Civic Center	Fredon Township	\$65,000	Low
Montague Township	Warning system installation along flood areas on River Road	Municipality	\$50,000	Low to Medium

5. Natural Resource Protection (Floodplain protection, Stream Corridor Restoration, Open space)

Municipality	Mitigation Action	Responsible Party	Estimated Cost	Priority
Andover Borough	Klymers Brook Mitigation	John Risko, Robert Smith, chair	\$10,000	Low
Branchville Borough	Cleanout brooks	Branchville Borough	\$50,000	High
Branchville Borough	Removal of old railroad culvert in brook	Branchville Borough	To be determined	High
Fredon Township	Protect Whittemore Pond from new development	Fredon Township	\$100,000	High

Table 5-5: Sussex County: Municipal Mitigation Actions by Action Category (cont'd)**5. Natural Resource Protection (Floodplain protection, Stream Corridor Restoration, Open space) continued**

Municipality	Mitigation Action	Responsible Party	Estimated Cost	Priority
Montague Township	Clean up existing debris in the Benekill River	Flood Mitigation Committee and USACE	\$500,000 - \$700,000	High
Town of Newton	Moore's Brook Stream Cleaning and Desnagging	Town of Newton	To be determined	High
Sparta Township	Stream Restoration - Sparta Glen Brook	County, township	To be determined	High
Sparta Township	Stream Restoration - Walkill River @ Station Park	Sparta Township	To be determined	Medium
Stillwater Township	Bank and Slope Stabilization - Paulinskill River @ Kohlbocker Road	To be determined	To be determined	High
Stillwater Township	Channel Modification and Bank stabilization - Neldon's Brook Stream Cleaning	To be determined	To be determined	High
Town of Newton	Moore's Brook Stream Cleaning and Desnagging	Town of Newton	To be determined	High
Sparta Township	Stream Restoration - Sparta Glen Brook	County, township	To be determined	High
Sparta Township	Stream Restoration - Walkill River @ Station Park	Sparta Township	To be determined	Medium
Stillwater Township	Bank and Slope Stabilization - Paulinskill River @ Kohlbocker Road	To be determined	To be determined	High
Stillwater Township	Neldon's Brook Stream Cleaning, Channel Modification and Bank Stabilization	To be determined	To be determined	High

6. Structural Projects

Municipality	Mitigation Action	Responsible Party	Estimated Cost	Priority
Andover Borough	Install catch basin on Washer Farm	Andover Borough Building and Grounds Department	\$65,000 (2006 dollars)	Medium
Andover Borough	Re-direct runoff from Route 206 near Whitehall Road to a catch basin	Andover Borough Streets and Roads Department	\$13,000	High
Branchville Borough	Repair Small Pond Dam	Branchville Borough	To be determined	High
Byram Township	Little Paint Drainage Improvements	Byram Township	\$75,000	High
Byram Township	Lackawanna Dam improvements	Byram Township, Lake Lackawanna Investment Corp.	To be determined	High
Fredon Township	Upgrade drain at intersection of Pond Place and Slate Ridge	Fredon Township	\$10,000	High
Fredon Township	Mitigate Runoff from Newton Memorial Hospital	Newton Township	Unknown	Medium
Montague Township	Ice Flow Channel correction in the Benekill River	USACE	\$500,000 - \$1,000,000	High
Montague Township	Elevate River Banks along the Delaware and Benekill Rivers	Flood Mitigation Committee	To be determined	Low

Table 5-5: Sussex County: Municipal Mitigation Actions by Action Category (cont'd)**6. Structural Projects - continued**

Municipality	Mitigation Action	Responsible Party	Estimated Cost	Priority
Town of Newton	Upgrade of Merriam Avenue School Stormwater Pump Facility	Town of Newton/ Board of Education	To be determined	High
Town of Newton	Stormwater Drainage Improvements in west end section of town	Town of Newton/ County of Sussex	To be determined	High
Town of Newton	Stormwater Drainage Improvements - Route 206 in the area of the Merriam Avenue Intersection	NJDOT	To be determined	High
Sparta Township	Re-direct stormwater in the area of Hopkins Corner Road and Valley Manor Drive	Sparta Township	To be determined	High

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Section 6: Flood Profile and Mitigation Action Plan by Jurisdiction

Mercer County:

Participating municipalities in Mercer County include Ewing, Hamilton, Hopewell, Lawrence, Pennington and Trenton.



The entire western portion of Mercer County lies along the Delaware River. Mercer County was affected by the June 2006, April 2005, September 2004, and September 1999 flooding events. Impacted infrastructure has included the wells and pumps that provide water to the workhouse. These were flooded by the back up of Moore's Creek secondary to the Delaware River rising. This flooding has required removal and overhaul of the pumps, flushing and testing of the wells to insure water quality. In addition, the County lost several sections of dock from the Waterfront Park over two of the floods.

Flood Response:

To help prepare the citizenry for flood events, the county has developed an Emergency Notification System that can be used to notify residents of impending floods. Prior to a flood event, the county shares information with local OEMs and County departments, prepares EOC for Operations, and issues notifications as requested by local OEMs. During a flood event, the county is responsible for coordinating response efforts of the locals, requesting resources from the State EOC, and collecting data for the Public Damage Assessments. After a flood event, Mercer County helps with the recovery work, completing financial paperwork to track expenses during and after the event, assists FEMA and state liaisons, and, if needed, distribution of supplies to local municipalities.

During past flooding events, Mercer County has received response assistance from FEMA, NJDEP, and NJOEM. Afterwards, the county has received clean-up and recovery help from FEMA, NJDEP, NJOEM, Red Cross, the Salvation Army, Fire, and EMS services. Mercer County has benefited from FEMA's Public Assistance Grant Program.

Mercer County does have a community emergency notification system to help disseminate information during an event.

County Mitigation Statement:

Mercer County pledges to support the mitigation goals and actions of their municipalities to the best of their ability.

County Mitigation Actions:**1. ACTION: Develop data for a hydro-network for Mercer County**

Description/Background: This would be used to model/predict flooding at county roadway intersections and segments. There are county roadway intersections and segments that could benefit from flood mitigation measures although no specific measures at specific locations have yet been identified. Before specific mitigation measures are identified, a planning analysis that uses an updated hydro-network to predict specific flood locations is needed to substantiate and then estimate project scope, measures, and costs.

Hazard: Flooding

Existing or new assets: Existing

Existing mechanism through which action will be implemented: County jurisdiction over county roads

Responsible Organization: County

Target Completion Date: 2008/2009

Estimated Cost: \$50,000

Potential Funding Sources: None

Priority: High

2. ACTION: Open Space Acquisition

Description/Background: The County has an open space acquisition program that

follows the goals and objectives of the Mercer County Open Space and Recreation Plan. Generally, the acquisition goals look to preserve contiguous lands to protect ecologically sensitive areas and stream corridors.

Hazard: Flooding

Existing or new assets: New/Existing

Existing mechanism through which action will be implemented: County Open Space Acquisition Program

Responsible Organization: County

Target Completion Date: Ongoing

Estimated Cost: To be determined

Potential Funding Sources: Open Space Preservation Trust Fund

Priority: High

5. ACTION: Removal of the abandoned piers directly upstream of the Yardley-West Trenton Railroad Bridge across the Delaware River,

Description/Background: Debris builds up during high water events at the upstream face of the piers at the Yardley-West Trenton Railroad Bridge across the Delaware River, and at abandoned upstream piers at the site. The bridge is owned by CSX. The existing bridge was constructed between 1911 and 1913 by the F.W. Talbot Construction Company for the Philadelphia and Reading Railroad. This replaced the original bridge, built by the North Pennsylvania Railroad in 1874. The brownstone piers of the original bridge remain in place. The removal of the debris and abandoned piers could reduce backwater and offer an upstream flood mitigation benefit.

Hazard: Flooding

Existing or new assets: New/Existing

Existing mechanism through which action will be implemented: To be determined

Responsible Organization: DRBC/ CSX

Target Completion Date: Dependant on feasibility study and funding

Estimated Cost: To be determined

Potential Funding Sources: To be determined

Priority: Medium

**Mitigation Action Plan
of Participating Jurisdictions
for Mercer County**

Jurisdiction	Page Number	Status
Mercer County	119	3 actions submitted
Ewing Township	125	3 actions submitted
Hamilton Township	128	7 actions submitted
Hopewell Township	134	4 actions submitted
Lawrence Township	137	5 actions submitted
Pennington Borough	140	1 action submitted
City of Trenton	141	12 actions submitted

Mercer County: Municipal Mitigation Actions by Action Category

1. Prevention (Policy/Ordinances/Studies/Enforcement)				
Municipality	Mitigation Action	Responsible Party	Estimated Cost	Priority
Hamilton Township	Flood Damage Prevention	Engineering, Planning, Inspections & Land Use	Staff time	High
Trenton City	Get into FEMA's Community Rating System	Trenton Department of Inspections	Staff time	High
Trenton City	Ongoing coordination and involvement with other agencies to maximize mitigation efforts and use of funds	Trenton Office of Emergency Management	Staff time	Medium
2. Property Protection (Acquisition, Elevation, Flood proofing)				
Municipality	Mitigation Action	Responsible Party	Estimated Cost	Priority
Hamilton Township	Property Acquisition	Engineering, Planning, and Inspections, administration	\$500,000	High
Hopewell Township	Elevate utilities	Homeowners	\$20,000 per home	Medium
Hopewell Township	Elevate properties	Homeowners	\$100,000 per home	Medium
Trenton City	Selective acquisition and demolition of highly flood prone residential or commercial properties	Trenton Department of Housing and Economic Development	Dependant on funding	Medium
Trenton City	Acquire and demolish flood prone property on Taylor Street	Trenton Department of Housing and Economic Development or Inspections Department	Acquisition per structure: \$700,000; demolition \$800,000; remediation \$600,000	High
Trenton City	Acquire and demolish flood prone property on Amtico Square	Trenton Department of Housing and Economic Development	Acquisition per structure: \$700,000; demolition \$800,000; remediation \$600,000	High
Trenton City	Elevate mechanical and electrical equipment in flood prone residential structures	Trenton Department of Inspections	Estimated \$5,000 to \$10,000 per residential structure	High
Trenton City	Assess FEMA RLPs and SRLPs throughout the city to identify mitigation candidates	Trenton Department of Inspections	\$25,000 - \$50,000	High
Trenton City	Purchase and/or flood detention at the Freight Yards	Trenton Department of Housing and Economic Development	Acquisition remaining: \$45,000; detention: \$500,000-\$1,000,000; demolition: \$600,000; site remediation: \$5M	High
3. Public Information and Awareness				
Municipality	Mitigation Action	Responsible Party	Estimated Cost	Priority
Hamilton Township	Public education and outreach	OEM, Engineering, Planning, and Inspections	\$10,000	High

4. Emergency Services				
Municipality	Mitigation Action	Responsible Party	Estimated Cost	Priority
Ewing Township	Power Grid Separation	PSE&G	\$150,000	High
Ewing Township	Individual location shut off	PSE&G	N/A	High
Hamilton Township	Flood Threat Recognition System	NJOEM, Hamilton Township Dept. of Engineering, Planning & Inspections and Dept. of Public Works	\$250,000	High
Hamilton Township	Advanced Flood Warning System	NJOEM, Hamilton Township Engineering and Dept. of Public Works	\$400,000	High
5. Natural Resource Protection (Floodplain protection, Stream Corridor Restoration, Open space)				
Municipality	Mitigation Action	Responsible Party	Estimated Cost	Priority
Lawrence Township	Stream cleaning/clearing of Five Mile Run	Lawrence Township	\$75,000	Medium
Lawrence Township	Stream stabilization behind Lawrence Shopping Center	Private property owner	Not known at this time	Medium
Pennington Borough	Land purchase	Borough Council	\$300,000	High
6. Structural Projects				
Municipality	Mitigation Action	Responsible Party	Estimated Cost	Priority
Ewing Township	Backflow prevention valves	NJDOT	unknown	High
Hamilton Township	Retrofit of Greenwood Avenue	NJDOT Region 3 Maintenance Office	\$25,000	Medium
Hopewell Township	Inspection of canal banks	New Jersey Water Supply Authority	N/A	High
Hopewell Township	Raise canal bank	New Jersey Water Supply Authority, NJDEP, D&R Canal Commission	\$250,000	High
Lawrence Township	Analysis of Route 206 at Notre Dame	NJDOT	\$50,000	High
Lawrence Township	Analysis of Bakers Basin Road at Route 1	NJDOT	\$50,000	High
Lawrence Township	Analysis of Princeton Pike culvert near Fairfield Avenue	NJDOT	\$50,000	High
Trenton City	Daylighting the Assunpink from South Broad Street to Warren Street	Trenton Department of Housing and Economic Development/Department of Inspections	To be determined	Medium
Trenton City	Portable Flood Barrier Study and Implementation	Department of Inspections/Fire Department/Civic Associations	To be determined	Medium
Trenton City	Detailed flood vulnerability study of the Trenton Water Filtration Plant	City of Trenton Department of Public Works	\$100,000-\$150,000	Medium
Trenton City	Flood protection at Trenton Water Filtration Plant	City of Trenton Department of Public Works	To be determined, likely over \$1M	Medium

Ewing Township, Mercer County:

Location:

Ewing Township is located along the eastern border of Mercer County immediately north of Trenton City. As of 2000, the township reported 35,707 people, 15.60 square miles of land, and 12,924 housing units. It is bordered by Lawrence Township to the east, Hopewell Township to the north, Upper Makefield (PA) and Lower Makefield (PA) Townships to the west, and the City of Trenton to the south.



Geology:

The township lies in the Piedmont Plateau, which is part of the Appalachian Province. This area is characterized by rolling hills with elevations ranging from 20 feet near the Delaware River to 200 feet near the northwestern boundary of the township.

Hydrology:

The *Delaware River* flows along the western border of Ewing Township.

The *Jacobs Creek* flows southwestward from Hopewell Township to its confluence, the Delaware River. It drains the northwest part of Ewing Township.

The *Ewing Creek* flows westward and originates in the southern part of Hopewell Township and drains the northern part of Ewing Township. Its confluence is the Jacobs Creek.

The *Shabakunk Creek* and *West Branch of the Shabakunk* are located in the eastern part of Ewing Township and is a tributary for the Assunpink Creek. It drains the eastern part of Ewing Township.

Recent Flood History:

Major roadways are located within the floodplain which can cause transportation difficulties during major flooding events. Approximately 25 homes plus apartment buildings near River Road flood during storm events. Only one home receives first floor damage and has since installed pumps. Most flooding is the result of backed up storm sewers. Ewing wants to install uni-direction flap gates on the storm sewer outlet pipes to help prevent stormwater back-ups. When Ewing is affected by flooding, the waters flow downhill into Trenton City.

Ewing is forced to shut off power to the entire township during flood events even if flooding is localized. The municipality is currently working with Public Service Electric and Gas Company (PSE&G) to change the electrical grid system so the township can limit the amount of houses that go without electricity.

Ewing was affected by the June 2006, April 2005, September 2004, and June 1996 floods. During June 2006, the Delaware River flooded River Road from Afton Avenue to Wilburtha Road, and the Delaware's waters backed into the Ewing storm drains. Nine basements were flooded and power was lost to the entire township. The Ewing Sewage Pump Station and the

Villa Victoria Academy were also affected by flood waters. The Trenton Water Works Filtration plant flooded, contaminating water supply in Ewing and causing low water pressure for fire department use. Public utilities were preventatively shut down. During the April 2005 flood, 15 houses sustained basement damage and during the September 2004 flooding event, 9 houses sustained basement damage.

The June 1996 flood was particularly costly for Ewing. The Delaware River and Shabakunk Creek flooded Olden Ave., Lower Ferry Road, and River Road between Afton Avenue to Wilburtha Road. Twenty-six basements flooded and eight buildings sustained structural damage. Two homes sustained first floor damage. Roads, bridges, and lift stations were affected as well.

Ewing wants to add a river gage upstream so that the township can better anticipate flooding events. The township currently utilizes stormwater basins to help detain flood waters and has ongoing acquisitions.

Unique Flood Risk to Municipality:

Primary concern is the river backing up into storm drainage collection system during high water events.

Local Flood Mitigation Planning Committee:

Jack Ball	Mayor
Dave Thompson	Township Administrator
Bert Steinmann	Council Vice President
Kathy Wollert	Council Woman
Chief Robert Coulton	Emergency Management Coordinator
Capt. Dave Morgan	Deputy EMC
William Erney Jr.	Local Floodplain Admin.
Ted Forst	Stormwater Management Coordinator
Angelo Capuano	Public Works Supervisor
Sam Hedrick	Building Code Official
Bob Mannix	Township Engineer
Jamie Sunyak	Township Planner
Richard Owens	Planning Board
Richard Dey	Zoning Board
Kate Tuttle	Flooded Property Owner
Diane Capriglione	Flooded Property Owner
Sue Sabarro	Business Owner

Ordinances/Plans Reviewed:

Flood Damage Prevention Ordinance; Ewing Township Flood Mitigation Plan; Delaware River Basin Flood Mitigation Task Force Report January 20, 2007; history of past flood problems in Ewing Township; concerns, ideas, and suggestions of residents and flood mitigation members.

Outreach: New Jersey Department of Transportation, Public Service Electric and Gas, City of Trenton, Delaware River Basin Commission, County of Mercer

First Public Meeting: 6/13/2007**Advertisement for Meeting:** *Trenton Times Newspaper* 5/31/2007**Questionnaire Distribution:**

Code Enforcement staff hand-delivered questionnaires in areas impacted by past flooding.

Public Response:

1. General comments received noted that primary flooding is caused by water backup through drainage pipes. Suggestions were given as to installing gates, valves, or backflow preventers to eliminate the initial flooding. The committee has reviewed the ideas and is researching.
2. The following additional comments or suggestions were made:
 - a. Stop development along the river
 - b. Dredge river
 - c. Maintain waterways and control flood gates
 - d. Divide utility grid in flood areas

Flood Mitigation Goals:

1. Flood damage prevention through township codes and ordinances
2. Property acquisition and open space conservation along stream corridors and flood prone areas
3. Public education and outreach – provide information on flood insurance, flood protection, flood map information, and early warning programs
4. Hold an annual event to highlight flood mitigation and identify flood hazard areas to the public
5. Regularly update emergency action plans and review list of essential facilities
6. Enforce higher building code standards for any developments in flood hazard areas
7. Split the electric power grid, separate by those that are directly impact by flooding and those that are not. Until item 7 is addressed, during early stages of flood alert, pull electric meters by PSE&G personnel
8. Install valves or back flow preventors on drainage lines along Route 29.
9. Review and improve evacuation procedures

Ewing Mitigation Actions:**1. ACTION: Installation of backflow prevention valves on stormwater outfalls to Delaware River**

Description/Background: During storm events, water from the river backs up through the outfall pipes and the stormwater collection system. This results in roadway and property flooding, requires the shutdown of utilities, and the evacuation of residents. The outfalls are under state jurisdiction and it is the township's understanding that NJDOT is currently studying all the outfalls, and will then install the backflow prevention valves.

Hazard: Flooding

Existing or new assets: Existing

Existing mechanism through which action will be implemented: Work with NJDOT on study, implementation, and installation of the backflow valves

Responsible Organization: NJDOT

Target Completion Date: Immediately

Estimated Cost: unknown

Potential Funding Sources: State of New Jersey

Priority: High

2. ACTION: Power Grid Separation

Description/Background: Prior to projected storms with predicted flooding, the township immediately shuts off the power to the areas that have a history of flooding. This method impacts many residents who do not have flooding problems. The idea is to isolate the areas directly impacted by the flooding and minimize disruption of power.

Hazard: Flooding/Power Shutoff

Existing or new assets: Existing

Existing mechanism through which action will be implemented:

Work with PSE&G on the study and the implementation of power grid alignment

Responsible Organization: PSE&G

Target Completion Date: June 2008

Estimated Cost: \$150,000

Potential Funding Sources: PSE&G, Ewing Township, State funding

Priority: High

3. ACTION: Individual location shut off

Description/Background: During the most recent flood event, Ewing had public service pull the meters on only the houses and commercial buildings which were directly impacted by flooding. This was the best method at the time to shut down power only to those affected.

Hazard: Flooding

Existing or new assets: Existing

Existing mechanism through which action will be implemented: Continue working with PSE&G for individual disconnection of meter pulls

Responsible Organization: PSE&G

Target Completion Date: Immediately

Estimated Cost: no fee

Potential Funding Sources: n/a

Priority: High

Hamilton Township, Mercer County:

Location:

Hamilton Township is located in the southwest corner of Mercer County. It is home to over 90,000 people in 40.37 square miles. It is bordered by the City of Bordentown and Townships of Bordentown, Chesterfield, and North Hanover to the south; Upper Freehold Township to the southeast, Washington and West Windsor Townships to the east and northeast, Lawrence Township to the north, and the City of Trenton to the west.



Geology:

Hamilton Township is located on the Atlantic Coastal Plain. Its topography is gently rolling. Marsh areas in the township are confined to the Great Bear Swamp, which covers the northernmost portion, including the Assunpink Creek and Miry Run Flood Plains. Pleistocene sands and gravels overlie all of the older formations except in deeper stream valleys where there may be silt, sand and gravel.

Hydrology:

The *Assunpink Creek* flows through the northern portion of Hamilton Township. The creek flows westward and turns southwest as it approaches the City of Trenton with its confluence at the Delaware River. The Assunpink drains the northern half of the township. Along the creek are ponds and small lakes. Two tributaries to the Assunpink in the Township are *Miry Run* and *Pond Run*.

The *Delaware River* is located in the southwestern part of this township.

The *Crosswicks Creek* drains the southern portion of Hamilton Township. The creek forms the southern township and county border and drains into the Delaware River at the southwestern township limit. *Pleasant Run*, *Doctors Creek* and *Back Creek* are tributaries to Crosswicks Creek.

The *Shady Brook* drains a few square miles of the west central portion of the township. This waterway enters drainage systems in the township and is discharged into the Delaware River.

Recent Flood History:

Hamilton Township has been historically affected by the events of June 2006, September 1999, July 1975 and August 1971. Many transportation routes in the Township cross waterways, which slows discharge and causes pooling behind transportation structures. To help mitigate flooding, there are 10 floodwater retarding structures and a 2.4 mile flood control channel. In addition, culverts under the D&R canal have been reconstructed to increase flow capacity. There is also a storm water diversion dam at Shady Brook.

During the June 2006 flood, Duck Island and the Lamberton Road area were flooded by the Delaware River. No structures were affected. During September 1999, the Assunpink flooded the Whitehead and Cornell Heights areas. About 12 residential structures incurred basement flooding and 8 structures incurred first floor flooding. In July 1975, the Assunpink, Miry Run, Pond Run, North Branch, and Shady Brook all flooded from a tropical storm. Over 800 residences incurred both basement and first floor flooding. Transportation networks and schools were affected as well. Since the event in 1975, Hamilton has installed flood control structures such as dams and stream channel improvements. In August 1971, the Assunpink, Miry Run, Pond Run, North Branch, and Shady Brook flooded and over 650 residential structures incurred basement and first floor flooding damage. Roads, schools, businesses, and transportation networks were temporarily closed.

Unique Flood Risk to Municipality:

Impassable roads and flooding basements are the major risks and impacts. There are also minor impacts such as nuisances and inconvenience.

Local Flood Mitigation Planning Committee:

Lloyd J. Jacobs	Director, EP & I
Richard Balgowan	Director, DPW
Allen Schectel	Township Planner
Haig Kasabach	Planning Board Member
Ata Bonna	Senior Engineer-Hydraulics/Flood Plain Coord.
Walt Bronek	OEM
Ray Lumio	Township Construction Official
Lt. Richard Herrick	OEM Coordinator
Thomas E. Dunn	Township Engineer

Ordinances/Plans Reviewed:

Flood Damage Prevention Ordinance, Stormwater Control Ordinance, Stream Buffer Conservation Zone Ordinance, flood insurance studies, Emergency Action Plan & Operations and Maintenance Manual Dam Site #8, Damage Assessment History from past storm events, Flood Boundary Maps

Outreach: Planned: City of Trenton, Ewing Township, West Windsor, East Windsor, Washington Township, Lawrence, County of Mercer, Friends of the Marsh, Delaware Riverkeepers

First Public Meeting: 10/23/2007

Advertisement for Meeting: 10/17/2007 *Trentonian*

Questionnaire Distribution:

Letters signed by the Mayor with questionnaire were sent to twelve hundred (1200) residents in the documented flood prone areas of the township 10/12/2007. The residents were also notified of the public meeting in the letter. Forty eight (48) responses from residents were received. Of these, 26 have flood insurance, 24 responded that they have sustained flood damages that warranted insurance claims, but none of those that responded were either designated as Repetitive Loss (RL) or Severe Repetitive Loss (SRL) properties.

Public Response:

1. Residents expressed concern about the high cost of flood insurance. They hoped that the new mitigation plan in concert with the township's participation in the Community Rating System (CRS) could be translated into cost reduction and savings.
2. Regular stream channel and storm drain maintenance through cleaning, trees and debris removal, and bank stabilization. At least three complaints were made against overgrown stream channels and blocked drains.
3. Stream channel improvements and widening culvert openings at street and road crossings.
4. Dredging of ponds and streams in densely built residential neighborhoods.
5. Retrofitting storm drain inlets on streets and highways. There was one particular complaint in the neighborhood of Greenwood Avenue (State Highway # 33) between

Norway and Greenwood Avenues. The complainant asserted that there are no curbs in this section, and the roadway is high enough to dump runoff from Norway to Greenwood Avenue over the sidewalk.

6. Property acquisition and creation of more open spaces and halting any future developments within flood hazard areas.

Flood Mitigation Goals:

1. Flood damage prevention enforcement through township codes and ordinances
2. Property acquisitions and open space conservation along stream corridors and flood prone areas
3. Public education and outreach- providing information on flood insurance, flood protection, flood map information and early warning programs
4. Annual event to highlight flood mitigation and identify flood hazard areas to the public
5. Regularly update emergency action plans and review list of essential facilities
6. Enforce higher building code standards for any developments in flood hazard areas
7. Continue and expand Hamilton's participation in the Community Rating System
8. Reduce the number of repetitive loss properties to zero and minimize the number of flood prone structures and facilities
9. Enhance the quality of life, promote public safety awareness, and preserve open space in the floodplain

Hamilton Mitigation Actions:

1. ACTION: Flood Damage Prevention

Description/Background: The flood prone areas are in the older sections of the township that lie along the lower reaches of Pond Run, Miry Run, Assunpink Creek, and Shady Brook. The newer sections of the township are almost entirely without incidence. These areas are benefiting from enforcement of the township's codes and ordinances. Hamilton participates in the Community Rating System (CRS) and vigorously enforces the Phase II Stormwater Regulations. These actions along with structural changes to the stream channels have contributed to better floodplain management in the township.

Hazard: Flooding

Existing or new assets: Existing/New

Existing mechanism through which action will be implemented: Enforcement of township codes and ordinances

Responsible Organization: Engineering, Planning, Inspections & Land Use

Target Completion Date: Upon adoption of plan

Estimated Cost: Staff time

Potential Funding Sources: Department budget

Priority: High

2. ACTION: Public education and outreach

Description/Background: An educated and informed public is an integral part of any successful mitigation plan. The township has an enviable public education and outreach program through the participation in the CRS program and compliance with the Phase II Stormwater Regulation Municipal Stormwater Permit program.

Hazard: All hazards

Existing or new assets: Existing/New

Existing mechanism through which action will be implemented: Emergency Management

Responsible Organization: OEM, Engineering, Planning, and Inspections

Target Completion Date: Upon adoption of plan

Estimated Cost: \$10,000

Potential Funding Sources: Hazard Mitigation Grant Program

Priority: High

3. ACTION: Property Acquisition

Description/Background: The township lists 5 repetitive loss properties and 2 severe repetitive loss properties. The actual number could be higher if every person who has experienced flooding and flood damage on more than one occasion had filed a claim. Flood proofing is an attractive alternative to acquisition, but the township is convinced that acquisition would also satisfy an open space program and would definitely eliminate the repetitive loss and severe damages.

Hazard: Flooding

Existing or new assets: Existing

Existing mechanism through which action will be implemented: Floodplain management

Responsible Organization: Engineering, Planning, and Inspections, administration

Target Completion Date: 1 year from adoption of plan

Estimated Cost: \$500,000

Potential Funding Sources: Flood Mitigation Assistance Grant, Hazard Mitigation Grant Program, Pre-Disaster Mitigation Program Grant, Repetitive Flood Claims Grant, State, etc.

Priority: High

4. ACTION: Retrofit of Greenwood Avenue

Description/Background: In the neighborhood of Greenwood Avenue (State Highway # 33) between Norway and Johnston Avenues, there are no curbs in this section and the roadway is high enough to dump runoff from Norway to Greenwood Avenue over the sidewalk. This causes flooding hazards to properties fronting the Greenwood Avenue section.

Hazard: Flooding

Existing or new assets: Existing

Existing mechanism through which action will be implemented: NJDOT Maintenance Program

Responsible Organization: NJDOT Region 3 Maintenance Office

Target Completion Date: To be determined upon plan approval

Estimated Cost: \$25,000

Potential Funding Sources: Flood Mitigation Assistance, NJDOT, Pre-Disaster Mitigation Program Grant

Priority: Medium

5. ACTION: Stream channel improvements

Description/Background: Stream channel and storm drain improvements are needed in the areas of Shady Brook. Permitting needs to be addressed with NJDEP.

Hazard: Flooding

Existing or new assets: Existing

Existing mechanism through which action will be implemented: Township of Hamilton Stream Maintenance Program

Responsible Organization: NJDEP, Township of Hamilton Engineering & Public Works

Target Completion Date: To be determined upon plan approval

Estimated Cost: Unknown at this time

Potential Funding Sources: FEMA, USCOE, Pre-Disaster Mitigation Program Grant, NJDEP

Priority: High

6. ACTION: Flood Threat Recognition System

Description/Background: The identification of flood hazards and the related factors and parameters is paramount for flood hazards mitigation and management. Up to date flood maps, zoning maps, and topographic maps are all necessities. The Township of Hamilton will update these maps and prepare an inventory of road crossings and culvert openings within the township.

Hazard: Flooding

Existing or new assets: Existing and new developments

Existing mechanism through which action will be implemented: Office of Emergency Management and Public Works Inspections and maintenance programs.

Responsible Organization: OEM, EP&I and DPW

Target Completion Date: To be determined upon plan approval.

Estimated Cost: \$250,000

Potential Funding Sources: Pre-Disaster Mitigation Program Grant, USACOE, FMA

Priority: High

7. ACTION: Advance Flood Warning System

Description/Background: The OEM, Engineering and Public Works have always delivered the goods during flooding situations. An elaborate and up to date Advance Flood Warning System is required for effective flooding forecast, education, and outreach programs.

Hazard: Flooding

Existing or new assets: Existing

Existing mechanism through which action will be implemented: OEM

Responsible Organization: OEM, Engineering, Public Works.

Target Completion Date: To be determined upon plan approval

Estimated Cost: \$400,000

Potential Funding Sources: FMA, USACOE, Pre-Disaster Mitigation Program Grant, State of New Jersey

Priority: High

Hopewell Township, Mercer County:

Location:

Hopewell Township is located in the northwestern corner of Mercer County. It is home to 16,105 people living in 5,629 housing units in 58.66 square miles. It is bordered by Ewing and Lawrence Townships to the south, Montgomery Township to the east, East Amwell Township to the north, and Upper Makefield Township (PA) to the west.



Geology:

The township lies in the Piedmont Plateau, which is part of the Appalachian Province. This area is characterized by nearly level lowlands, occasional ridges and low hills, and is underlain by shale. The relatively flat topography of the river terrace is found right along the Delaware River.

Hydrology:

The *Delaware River* flows along the western border of Hopewell Township.

Moore's Creek and *Fiddlers Creek* are both tributaries to the Delaware in the northern part of the township.

The *Jacobs Creek* flows southwestward in western Hopewell Township to its confluence, the Delaware River. The *Woolsey Creek* flows westward and is located in the southern part of Hopewell Township. It is a tributary to Jacobs Creek.

Approximately 50% of Hopewell Township is located in the Raritan River Watershed. Both *Beden Brook* and the *Stony Brook* are tributaries to the Millstone River. *Beden Brook* is located in the northwestern part of the township. The *Stony Brook* originates in East Amwell to the north and flows through Hopewell into Lawrence Township. Tributaries to the *Stony Brook* in Hopewell include *Woodsville Creek*, *Baldwins Creek*, *Lewis Brook* and the *Honey Branch*.

Recent Flood History:

This municipality is affected by waters from the D&R Canal spilling over its banks along a 100' – 150' length of the D&R Canal onto Rt. 29. The flooding inundates the pump station that services the Mercer County Correction Center with well water. The Mercer County Correction Center is a short-term jail facility that confines both men and women and has bed space for 880 inmates with Minimum, Medium and Maximum-security classifications. During flood events that cause overflow from the canal, emergency services are unable to reach the facility and water supply (including fire suppression) to the facility must be suspended.

During flooding events, the Delaware River, the D&R Canal, Jacobs Creek, and Moore's Creek flood River Drive, Route 29 (River Road), and Pleasant Valley Road. Approximately 6 – 10 houses flood along River Drive in Titusville, with the water rising to about 3" – 4" in the first floor. Repetitive flooding occurs in approximately 6 of those houses, especially where the road elevation drops. The average assessed value of the structures is \$400,000.

Historic Roller Mill becomes inundated when Jacobs Creek backs up.

Unique Flood Risk to Municipality: The D&R feeder canal spills over flooding portions of Route 29.

Local Flood Mitigation Planning Committee:

Judy Niederer	Committee Member
Robert Miller	Zoning Officer
Herbert Hinkle	Flooded Property Owner
George Meyer	EMC
Paul Pogorzelski	Administrator/Engineer
Vincent Piacente	Resident

Ordinances/Plans Reviewed: Flood Damage Prevention, Floodplain

Outreach:

First Public Meeting: 05/21/2007

Advertisement for Meeting: Hopewell Valley News, local cable channel, and web site during the month of May

Questionnaire Distribution: Police officers distributed to residents of Titusville, questionnaires also available at library and municipal building.

Public Response:

1. Questions about NYC reservoirs
2. Residents want to know the real cause of the flooding
3. Wanted more information about elevating utilities, elevating properties, and acquiring properties
4. Concern was expressed regarding the integrity of D&R Feeder Canal banks and about the possibility of raising the banks to prevent flooding near Pleasant Valley Road.

Flood Mitigation Goals:

1. Provide assistance to residents desiring to elevate utilities
2. Provide assistance to residents desiring to elevate properties
3. Request appropriate authorities to ensure integrity of canal bank
4. Request appropriate authorities to raise canal bank in low spot

Hopewell Mitigation Actions:

1. ACTION: Inspection of canal banks

Description/Background:

Hazard: Flooding

Existing or new assets: Existing

Existing mechanism through which action will be implemented: New Jersey Water Supply Authority engineers

Responsible Organization: New Jersey Water Supply Authority

Target Completion Date: 6 months

Estimated Cost: No cost unless deficiencies are identified

Potential Funding Sources: N/A

Priority: High

2. ACTION: Raise canal bank

Description/Background: It is desired to raise the berm on the canal for the distance that it floods Route 29. Benefits such as uninterrupted water supply, fire suppression and emergency access would be realized at the Mercer County Correction Center.

Hazard: Flooding

Existing or new assets: Existing

Existing mechanism through which action will be implemented: New Jersey Water Supply Authority

Responsible Organization: New Jersey Water Supply Authority, NJDEP, D&R Canal Commission

Target Completion Date: 1 year

Estimated Cost: \$250,000

Potential Funding Sources: New Jersey Water Supply Authority, NJDEP, D&R Canal Commission

Priority: High

3. ACTION: Elevate utilities

Description/Background: Especially in the area of Titusville

Hazard: Flooding

Existing or new assets: Existing

Existing mechanism through which action will be implemented: Homeowner action with local assistance

Responsible Organization: Homeowners

Target Completion Date: 1 year

Estimated Cost: \$20,000 per home

Potential Funding Sources: Private funding, possible federal assistance

Priority: Medium

4. ACTION: Elevate properties

Description/Background: Especially in the area of Titusville

Hazard: Flooding

Existing or new assets: Existing

Existing mechanism through which action will be implemented: Homeowner action with local assistance

Responsible Organization: Homeowners

Target Completion Date: 5 years

Estimated Cost: \$100,000 per home

Potential Funding Sources: Private funding, possible federal assistance

Priority: Medium

Lawrence Township, Mercer County:

Location:

Lawrence Township is located in central New Jersey's Mercer County. It is bordered by Hopewell Township to the north, Ewing Township and the City of Trenton to the west, Princeton and West Windsor Township to the east, and Hamilton Township to the south. Lawrence Township is home to 29,159 people within 22.18 square miles.



Geology:

The northern and western parts of the township lie within the Piedmont region. This area consists of gently undulating and moderately sloping uplands with relatively narrow floodplains. The eastern portion of the township is located on the coastal plain. This area is fairly flat with wide flood plains. The dividing line between these two regions lies near and along Princeton Pike.

Hydrology:

The *Shipetaukin Creek* originates in the west-central portion of Lawrence Township and merges with several small tributaries as it flows northeast and then southeast to its confluence, the Assunpink Creek.

The *Shabakunk Creek* is located in the western part of Lawrence Township and is a tributary for the Assunpink Creek. The creek flows in an easterly direction and drains much of Lawrence Township.

The *Assunpink Creek* forms much of the southern corporate limits of Lawrence Township. The creek flows westward and turns southwest as it approaches the City of Trenton.

Recent Flood History:

Lawrence Township was affected by Hurricane Floyd in September 1999. Five Mile Run flooded Pine Knoll Drive and the Shabakunk flooded Meriline Avenue, Altamawr Avenue, Zoar Street, and Fairfield Avenue at Princeton Pike. Bakers Basin Road at Route 1 also flooded. It is unknown how many properties were affected, but all of them sustained basement damage.

Baskers Basin Road at Route 1, Princeton Pike north of Lewisville Road, Princeton Pike south of Fairfield Avenue, and Route 206 at Notre Dame High School routinely flood. Nineteen properties have been acquired since 2005 with funding from the New Jersey Department of Environmental Protection Flood Control Program. The township would be interested in the community telephone notification system if funding becomes available.

Unique Flood Risk to Municipality: The 3 significant areas of flooding over roads involve state roads (Route 206, Route 1) and county structures (culvert on Princeton Pike). Lawrence is also impacted by flow and sediment from Ewing Township, which contributes to decreased capacity in local tributaries and in Colonial Lake.

Local Flood Mitigation Planning Committee:

Bob Ireland	Public Works
Jack Oakley	Deputy EMC
Brenda Kraemer	Assistant Municipal Engineer
Richard Krawczun	Municipal Manager
Dale Robbins	Director Emergency Management
Christine Altomari	Environmental Resource Committee

Ordinances/Plans Reviewed: Land Development Ordinance, available police reports regarding road closures

Outreach: Lawrence Township Council, Environmental Resource Committee

First Public Meeting: 05/16/2007

Advertisement for Meeting: *Lawrence Ledger* (05/3/2007), *Trenton Times* (05/5/2007), *Lawrence Ledger* article (05/10/2007)

Questionnaire Distribution: Mailed to flood-prone residents, available on web site, available through engineering department

Public response:

1. Two residents were interested in acquisition; however, Lawrence Township already received funding for acquisition so the inquiries were handled under the current program.
2. One resident expressed concern about Colonial Lake; however, Lawrence Township maintains a dredging maintenance program and no further projects are planned for this area.
3. Two other residents were interested in future stream cleaning projects.

Flood Mitigation Goals:

1. Analysis of Route 206 at Notre Dame (flooding over road)
2. Analysis of Bakers Basin Road at Route 1 (flooding over road)
3. Analysis of Princeton Pike, south of Fairfield Avenue (flooding over road)
4. Stream cleaning/clearing of 5 Mile Run
5. Stream stabilization behind Lawrence Shopping Center

Lawrence Mitigation Actions:**1. ACTION: Analysis of Route 206 at Notre Dame****Description/Background:**

Hazard: Flooding over road

Existing or new assets: Existing

Existing mechanism through which action will be implemented: Various agency coordination

Responsible Organization: NJDOT

Target Completion Date: 5 years

Estimated Cost: \$50,000

Potential Funding Sources: NJDOT

Priority: High

2. ACTION: Analysis of Bakers Basin Road at Route 1**Description/Background:****Hazard:** Flooding over road**Existing or new assets:** Existing**Existing mechanism through which action will be implemented:** Various agency coordination**Responsible Organization:** NJDOT**Target Completion Date:** 5 years**Estimated Cost:** \$50,000**Potential Funding Sources:** NJDOT**Priority:** High**3. ACTION: Analysis of Princeton Pike culvert near Fairfield Avenue****Description/Background:****Hazard:** Flooding over road**Existing or new assets:** Existing**Existing mechanism through which action will be implemented:** Various agency coordination**Responsible Organization:** NJDOT**Target Completion Date:** 5 years**Estimated Cost:** \$50,000**Potential Funding Sources:** Mercer County**Priority:** High**4. ACTION: Stream cleaning/clearing of Five Mile Run****Description/Background:****Hazard:** Debris, silt in stream**Existing or new assets:** Existing**Existing mechanism through which action will be implemented:** Not known at this time**Responsible Organization:** Lawrence Township**Target Completion Date:** 3 years**Estimated Cost:** \$75,000**Potential Funding Sources:** Not known at this time**Priority:** Medium**5. ACTION: Stream stabilization behind Lawrence Shopping Center****Description/Background:****Hazard:** Downstream erosion**Existing or new assets:** Existing**Existing mechanism through which action will be implemented:** Not known at this time**Responsible Organization:** Private property owner**Target Completion Date:** Not known at this time**Estimated Cost:** Not known at this time**Potential Funding Sources:** Not known at this time**Priority:** Medium

Pennington Borough, Mercer County:

Location:

Pennington Borough is located in the northwestern portion of Mercer County and is home to 2,696 people within .96 square miles.



Geology:

The township lies in the Piedmont Plateau, which is part of the Appalachian Province. This area is characterized by nearly level lowlands, occasional ridges and low hills, and is underlain by shale.

Hydrology:

Only one-third of the municipality drains into the Delaware River, the other two-thirds are located within the Raritan River watershed. Rainwater is the primary cause of flooding within the borough.

Recent Flood History:

Flood events caused by the overtopping of streams are rare in Pennington. Pennington was affected in 1999 flooding when rainwater flooded King George Road and inundated both sewage lift stations and the generator at Sked Street. In addition, rains washed out the head wall at the Department Public Works office.

Unique Flood Risk to Municipality: None

Local Flood Mitigation Planning Committee:

Mark Blackwell	Planning Board Member
Don Fetzer	Engineer
Gene Dunworth	Administrator

Ordinances/Plans Reviewed: Stormwater regulations from the state

Outreach:

First Public Meeting: 09/10/2007

Advertisement for Meeting: Hopewell Valley News 08/2007

Questionnaire Distribution:

Public Response:

Flood Mitigation Goals:

1. Prevent basement flooding

Pennington Mitigation Actions:

1. ACTION: Land purchase

Description/Background:

Hazard: Flooding

Existing or new assets: Existing

Existing mechanism through which action will be implemented: Borough Council/Open Space

Responsible Organization: Borough Council

Target Completion Date: Early 2008

Estimated Cost: \$300,000

Potential Funding Sources: Borough Open Space, green acres

Priority: High

City of Trenton, Mercer County:

Location:

The City of Trenton is located in the southwestern portion of Mercer County. It is the capitol of New Jersey and is home to 85,403 people within an area of 8.15 square miles. It is bordered to the north by Ewing and Lawrence Townships, Hamilton Township to the east, the Townships of Lower Makefield (PA), Falls (PA) and Borough of Morrisville to the west.



Geology:

Trenton lies within the Piedmont and Coastal Plain regions. The division of these two regions occurs along the Assunpink Creek. Elevations range from 15 feet at the Delaware River to 110 feet along the northern border with West Trenton.

Hydrology:

The *Assunpink Creek* flows right through the center of Trenton. The creek flows through a rock bottom channel with a top width of 70 feet. There are several closed culverts going under streets, parking lots, buildings and long railroads. From Stockton Street to Pond Run, there is a natural channel that is 50 feet wide, except where bridges and buildings form a side wall.

The *Delaware and Raritan Canal* also passes through Trenton. From the northwest part of the city the canal flows southeast, paralleling the Delaware River. It then makes a 90 degree turn and heads northeast paralleling the Assunpink Creek. The canal was designed with spillways to discharge excess flows

The *Delaware River* creates the western border of Trenton.

Recent Flood History:

Trenton has had many major floods caused by tropical storms, thunderstorms and high runoff. The major areas that flood occur along the Assunpink Creek and Delaware River. The Trenton stormwater infrastructure flowed directly to the Delaware River before Route 29 was constructed. When Route 29 was constructed, the municipal system was bisected and junctioned into the stormwater system associated with the roadway (owned by NJDOT). When the river overflows its banks, the water runs along Route 29 and compounds the flooding problem.

The April 2005 and June 2006 are the only times that the Delaware River has overflowed its banks in Trenton since the flood of 1955.

During the June 2006 event, the Delaware River overflowed its banks and backed into the storm sewers. Gold Run Creek also overflowed and sent water throughout Trenton. During the June 2006 event, Clearfield Avenue, Riverside Drive, Columbia Avenue, Mt. Vernon Avenue, Bloomfield, Lee, Newell, LeClede, Lipton, and Westminster flooded in the Island section. In Glen Afton, Sanhican Drive, Morningside Drive, Aberfeldy, Afton, LaBarre, River Drive, and Riverside Avenue flooded. Two hundred and seventy one homes incurred basement damage. In addition, the New Jersey State House Parking Garage was flooded and the River's Edge Nursing home was evacuated. There was substantial damage to electrical and heating systems and the pumps in the sewer lift station were damaged.

In April of 2005, the Delaware River overflowed its banks and backed into Trenton's sewer system. Two hundred homes sustained basement damage. The same roads were flooded as in June of 2006.

In September 2004, Assunpink Creek flooded, but the Delaware River did not overtop its banks in Trenton. There was stormwater backflow. In addition to the previously mentioned flooding areas, Mulberry Street, Webster, Fillmore, Ferry Street, Taylor, Bridge Street, Artisan Street, Prospect Street, and Parkside Avenue also sustained flood damage. 200 homes incurred basement damage.

September 1999 brought Hurricane Floyd and heavy rains that caused the Assunpink to flood. 184 private dwellings sustained basement damage and 30 sustained first floor damage. After the event, several properties were acquired and demolished decreasing Trenton's tax base. There was also road damage.

Flood Mitigation History:

The Assunpink Creek Watershed Work Plan was created in 1964 to help mitigate flooding problems along the creek. This included the construction of 10 flood water retarding structures and 2.4 miles of flood control channel. Also the culverts under the Delaware and Raritan Canal have been reconstructed to increase flow capacities and lower flood stages west of the canal.

There are 176 repetitive loss properties and 6 severe repetitive loss properties in Trenton. Since 2001, there have been 34 property acquisitions funded by FEMA and NJ hazard mitigation grants. Due to the closeness of buildings and use of varied building materials including stone masonry, it would be difficult and expensive to elevate properties in Trenton. There are several people interested in acquisition.

The Island section of Trenton contains about 170 structures that are prone to basement flooding. Many residents do not want to move and are against the installation of a flood wall that would negatively affect the riverside view. According to municipal representatives, residents may be amenable to having houses elevated, although there were several homes constructed of stone/masonry and these would be very costly to elevate. In general, elevation of houses in this area appears to be problematic. The houses are of varying types and styles of

construction and they are close together which would cause construction difficulties. The Army Corps of Engineers recommends looking into the installation of a berm. The city has encouraged residents to raise their utilities.

The Glen Afton section of Trenton, across Route 29 from the Island, contains approximately 225 structures were affected by flooding, including 100 rental units in an apartment complex. Flood waters from Ewing Township come southbound down River Road, turn left on Afton Avenue and take a right onto Morningside Drive, all the while flooding properties. 225 structures flood including about 100 rental properties. These properties are worth \$250,000 to \$400,000.

There is a floodwall in place on that part of the river by the State House. The adjacent parking garage to the State House floods through NJDOT-owned storm drains carrying backflow from the river.

Unique Flood Risk to Municipality:

In recent history, the most significant cause of flooding from the Delaware in Trenton is not from overbank events, but surcharge from storm sewers when the river reaches relatively low elevations compared to the overtop height of the bank. Several neighborhoods that border the river, including the Island and Glen Afton sections, have endured repeated flooding from this source. A few other areas of the City have also experienced surcharge-related flooding, but these two areas are clearly the most frequently affected. High water surface elevations on the Delaware also limit the discharge potential from the Assunpink and other tributaries, sometimes contributing to upstream (backwater) flooding.

NJDOT has cleaned out the stormwater system associated with Route 29 and is evaluating the installation of backflow preventers to about 50 existing outfall structures from the vicinity of Waterfront Park to the Ewing Township line. The NJDOT investigative work is being led by James Purcell, P.E., of Medina Consultants and includes the performance of field investigations, survey of existing conditions, evaluation of the drainage system, and recommended solutions for prevention of backwater flow from the Delaware River into the stormwater systems on Route 29 and the immediate vicinity.

In 2007, a Tideflex valve was installed on the Sanhican outfall located on the north end of the Trenton Island to help prevent future flooding from high river stages up to a point prior to overtopping of the river banks. This backflow preventer will be effective between river flow elevations of approximately 18 feet (equivalent to less than a 2-year storm event) and approximately 32 feet (about a 50-year storm event). The Sanhican outfall and associated system is an urban drainage system bordered by the Delaware River on the south and the Delaware and Raritan Feeder Canal to the north, and extends from Sullivan Way to the east along Route 29 (a.k.a Sanhican Drive) then along Morningside Drive to La Barre Avenue to the west. The Sanhican drainage system services a drainage area of 49 acres.

Local Flood Mitigation Planning Committee:

Leonard Pucciatti	Director, Dept. Public Inspections
Andrew Carten	Director of Planning

Monifa Banks-Harrison	Senior Systems Analyst
Eric Jackson	Director of Public Works
Dennis Keenan	Former Fire Director
Trish Long	Department of Planning
Joseph McIntyre	General Superintendent Water/Sewer
Fran Goeke	Municipal Engineer

Ordinances/plans reviewed: Master Plan, Floodplain Management, Building Construction, Zoning and Land Development

Outreach: DRBC, Ewing Township (police), Hamilton Township (police), Red Cross, Board of Education, Mercer County, Capital Health Systems, St. Francis Hospital, Trenton EMS, Trenton Police Department, NOAA, D&R Commission, Army Corp of Engineers, FEMA region II, NJ State Police, Trenton Council Civic Associations, Joint Toll Bridge Commission, Trenton Communication, PSE&G, Verizon, Trigen, NJ Transit, Glen Afton Civic Association, Island Civic Association

First Public Meeting: 05/18/2007

Advertisement for Meeting: Newspaper

Questionnaire Distribution:

Public Response:

1. There were questions regarding the accuracy of FEMA claims databases and why it was used. (To show the flood prone areas).
2. Will projects in Lambertville affect Trenton? (They will look at downstream affects before doing anything).
3. Should other projects upstream of the city be included in the plan? (No, because they are out of city jurisdiction).
4. Which is a priority for the city, residential or commercial mitigation projects? (Residential.)
5. Can we include portable flood barriers in the plan? (Yes. They didn't know if FEMA would fund it, but that doesn't mean it should be taken out.)

Flood Mitigation Goals:

1. Ensure that Trenton, its citizens, assets and operations, have the best possible protection from the future effects of natural hazards.

Trenton Mitigation Actions:

1. **ACTION: Elevate mechanical and electrical equipment in flood prone residential structures**

Description/Background: Residences in the Island and Glen Afton sections of Trenton are highly susceptible to flooding from storm sewer surcharge when the Delaware River reaches relatively low elevations (well below the overbank elevation). Although the State and City have recently instituted measures that may alleviate these risks, their efficacy is not yet proven. Given the highly repetitive nature of these damages, it is likely that they will continue to some degree even if the structural measures are effective. The cost of moving mechanical and electrical equipment in a standard residence is estimated at between \$5,000 and \$10,000 per house. As discussed earlier, the estimated average flood insurance claim in these areas is in the same cost range.

Hazard: Flooding

Existing or new assets: Existing

Existing mechanism through which action will be implemented: TBD

Responsible Organization: Trenton Department of Inspections

Target Completion Date: TBD pending availability of matching funds

Estimated Cost: Estimated \$5,000 to \$10,000 per residential structure

Potential Funding Sources: FEMA, HMGP, FMA, PDM, or SRL

Priority: High

2. **ACTION: Assess FEMA RLPs and SRLPs throughout the city to identify mitigation candidates**

Description/Background: Assess FEMA repetitive loss and severe repetitive flood loss properties throughout the City to identify specific properties or areas that are at the most risk. FEMA and the National Flood Insurance Program (NFIP) maintain detailed records of flood insurance payments. Trenton has numerous properties that are classified as either repetitive loss or severe repetitive loss. Several kinds of FEMA mitigation grants are available for actions that reduce these risks – such properties are a high priority to FEMA, and as such are likely to be successful candidates for mitigation grants. The purpose of this action is to perform more detailed assessments of these properties than is possible in the context of this plan, in order to determine the range and feasibility of potential mitigation activities. This action will include performing benefit-cost analysis of alternatives once properties and projects have been identified. This action will include contacting homeowners and homeowners' associations to determine the level of interest and cooperation. The Mayor's Flood Committee may offer a good operational model to do this.

Hazard: Flooding

Existing or new assets: Existing

Existing mechanism through which action will be implemented: TBD

Responsible Organization: Trenton Department of Inspections

Target Completion Date: Unknown, likely to start within 1 year

Estimated Cost: Likely between \$25,000 and \$50,000

Potential Funding Sources: Most likely City

Priority: High

3. **ACTION: Purchase and/or flood detention at the Freight Yards**

Description/Background: This 35-acre site in Trenton was formerly occupied by railroad freight yards. It has extensive impermeable surfaces throughout, mostly concrete, and will require extensive environmental remediation before it can be returned to natural landscape. Because of the expanses of impermeable land, there is a fairly high potential for areas south and east of this site to flood from overland flows from this site. At least once in the past, the major rail line on the east coast (which carries large amounts of freight, and is part of the northeast Amtrak corridor) has flooded, causing interrupted rail service, with huge economic impacts. There are several possible mitigation projects related to this site, including purchase of the property (this will not be independently cost-effective because a simple purchase will not eliminate flooding) and providing on-site water impoundment/detention as a means to alleviate flooding on other sites. This would require an engineering study to determine the effectiveness of such a measure.

Hazard: Flooding

Existing or new assets: Existing

Existing mechanism through which action will be implemented: TBD

Responsible Organization: Trenton Department of Housing and Economic Development

Target Completion Date: Ongoing

Estimated Cost: Acquisition remaining: \$45,000; detention: \$500,000-\$1,000,000; demolition: \$600,000; site remediation: \$5 million

Potential Funding Sources: FEMA grant programs, NRCS

Priority: High

4. ACTION: Acquire and demolish flood prone property on Taylor Street

Description/Background: These commercial properties are located on Taylor Street. These buildings have been subjected to severe flooding as recent as the April, 2007 event. This project is to purchase and demolish these buildings, then remediate the site and return it to open space uses. This is a case where FEMA mitigation program funds could potentially be used for the acquisition and demolition, and other sources of funding could be identified to pay for project elements that are not strictly related to mitigation. It may also be feasible for FEMA mitigation funds to be used to pay for the entire project, depending on the cost effectiveness of the action. A detailed risk assessment and benefit cost analysis will be required for the project to be submitted to FEMA for consideration.

Hazard: Flooding

Existing or new assets: Existing

Existing mechanism through which action will be implemented: TBD

Responsible Organization: Trenton Department of Housing and Economic Development or Inspections Department

Target Completion Date: TBD

Estimated Cost: Acquisition per structure: \$700,000; demolition \$800,000; remediation \$600,000

Potential Funding Sources: FEMA grant programs

Priority: High

5. ACTION: Acquire and demolish flood prone property on Amtico Square

Description/Background: This site is located on the west side of the Assunpink Creek. This project is to acquire the building and site, demolish the building and return the site to a natural floodplain. This is a case where FEMA mitigation program funds could potentially be used for the acquisition and demolition, and other sources of funding could be identified to pay for project elements that are not strictly related to mitigation. It may also be feasible for FEMA mitigation funds to be used to pay for the entire project, depending on the cost effectiveness of the action. A detailed risk assessment and benefit cost analysis will be required for the project to be submitted to FEMA for consideration.

Hazard: Flooding

Existing or new assets: Existing

Existing mechanism through which action will be implemented: TBD

Responsible Organization: Trenton Department of Housing and Economic Development

Target Completion Date: TBD

Estimated Cost: Acquisition: \$700,000; demolition \$800,000; remediation \$600,000

Potential Funding Sources: FEMA grant programs

Priority: High

6. ACTION: Get into FEMA's Community Rating System

Description/Background: This action is to perform all the necessary steps for the City of Trenton to enter into FEMA's Community Rating System (CRS). The CRS is a program that offers reduced NFIP flood insurance rates for communities that meet certain criteria. These extend from simple activities such as promulgating information about floods and building codes, to more complex requirements related to enforcement of floodplain regulations, and numerous activities between. A CRS Plan is a requirement for entry into the program, and this plan may partly satisfy that criterion, but there are several additional steps needed for qualification.

Hazard: Flooding

Existing or new assets: Existing/New

Existing mechanism through which action will be implemented: TBD

Responsible Organization: Trenton Department of Inspections

Target Completion Date: TBD

Estimated Cost: Staff Time

Potential Funding Sources: City of Trenton

Priority: High

7. ACTION: Ongoing coordination and involvement with other agencies to maximize mitigation efforts and use of funds

Description/Background: This action is simply to remain engaged with various organizations (such as the Delaware River Basin Commission, among others) in order to ensure that the City is staying aware of potential mitigation opportunities and is ensuring the maximum use of mitigation funds and projects.

Hazard: Flooding

Existing or new assets: Existing/New

Existing mechanism through which action will be implemented: TBD

Responsible Organization: Trenton Office of Emergency Management

Target Completion Date: Ongoing

Estimated Cost: Staff Time

Potential Funding Sources: City of Trenton

Priority: Medium

8. ACTION: Portable Flood Barrier Study and Implementation

Description/Background: A small scale hydrologic study of the Glen Afton and Island communities to assess feasibility of the portable flood barrier devices. If proven that the devices are an effective flood barrier, then the City can proceed with a more detailed assessment of the cost and practicality of using the devices. After the cost and practicality is established, then the cost affecters can be identified and validated.

Hazard: Flooding

Existing or new assets: Existing/New

Existing mechanism through which action will be implemented: TBD

Responsible Organization: Department of Inspections/Fire Department/Civic Associations

so effective training of devices occurs

Target Completion Date: TBD

Estimated Cost: To be determined based on site specific conditions (e.g. how many linear feet would be required for devices to be effective for redirecting water and protecting individual homes).

Potential Funding Sources: City Budget

Priority: Medium

9. ACTION: Selective acquisition and demolition of highly flood prone residential or commercial properties

Description/Background: This project is to identify, acquire and demolish highly floodprone commercial or residential properties in the City. The National Flood Insurance Program has established special designations for very floodprone properties: repetitive loss and severe repetitive loss. Trenton has properties in both categories. Although being so designated does not necessarily mean that specific properties would qualify for purchase/demolition through FEMA grant programs, the fact that they are in this category suggests that they may be good candidates. This project is related to High Priority Project No. 2 (above), because identifying such properties and testing the cost effectiveness of purchasing them is a precursor to determining the kinds of projects and the specific properties that would be eligible. There are also issues of the federal/local match requirements that would have to be addressed, as well as the requirement that any participation in mitigation activity must be voluntary.

Hazard: Flooding

Existing or new assets: Existing

Existing mechanism through which action will be implemented: TBD

Responsible Organization: Trenton Department of Housing and Economic Development

Target Completion Date: Unknown; depends on availability of funds, identification of appropriate properties.

Estimated Cost: Depends on specific property; unknown until properties are identified.

Potential Funding Sources: FEMA, HMGP, PDM, FMA, SRL

Priority: Medium

10. ACTION: Detailed flood vulnerability study of the Trenton Water Filtration Plant

Description/Background: The Trenton Water Filtration Plant is located immediately adjacent to the Delaware River, on the west side of Route 29. The plant is currently vulnerable to flood damage in low-probability events (500-year return interval and higher, estimated) Although it would likely require a flood in excess of a 500-year event on the Delaware to flood the plant, this is clearly a high consequence scenario in which about a quarter million citizens would lose access to clean potable water, fire suppression capabilities would be severely hindered, and losses to businesses extreme. This project is to perform a detailed study of flood risk to the facility, to ascertain the probability of flood damages, the likely outcome, as well as a preliminary conceptual study to develop potential mitigation options.

Hazard: Flooding

Existing or new assets: Existing

Existing mechanism through which action will be implemented: TBD

Responsible Organization: City of Trenton Department of Public Works

Target Completion Date: Not yet determined, but likely by 2009

Estimated Cost: Expected \$100,000-\$150,000

Potential Funding Sources: possibly City of Trenton/EPA

Priority: Medium

11. ACTION: Flood protection at Trenton Water Filtration Plant

Description/Background: This project is to construct a flood protection structure at the Trenton Water Filtration Plant to prevent damage and loss of function at the plant that would result from very high flood stages on the Delaware River, which abuts the plant. The specifics of such an effort will be known only after a detailed risk assessment and preliminary scoping exercise. Nevertheless, the plant would clearly be at risk if water surface elevations on the Delaware reach extreme levels. The potential direct damages to the plant and lost function would certainly be in the millions of dollars under certain circumstances.

Hazard: Flooding

Existing or new assets: Existing

Existing mechanism through which action will be implemented: TBD

Responsible Organization: City of Trenton Department of Public Works

Target Completion Date: TBD

Estimated Cost: TBD, likely over \$1 million

Potential Funding Sources: TBD, looking for outside sources

Priority: Medium

12. ACTION: Daylighting the Assunpink from South Broad Street to Warren Street

Description/Background: This project is to open (daylight) the Assunpink Creek from South Broad Street to Warren Street. The project has been under discussion as a flood mitigation measure by the City of Trenton and various state and federal agencies. With respect to the potential for using FEMA grant program funding for all or part of this project, it is necessary to first definitively determine the status of the project, particularly as it relates to what agencies or programs may be used to fund it. The flood mitigation effects of the project will also have to be identified before it can be considered as part of a FEMA application (bearing in mind that there may be other sources of financial support that are not related to FEMA). The first part of this action is to undertake a more detailed examination of the project as it currently stands, to identify what agencies are involved, if the overall project is potentially eligible for FEMA funding support, and if the entire project is not, if there are sub-elements that may qualify. The second part of the project is to perform a preliminary risk assessment to determine if the project or a sub-project is likely to be cost-effective from a flood mitigation standpoint. The third part of the project is to undertake a mitigation project based on the results of these reviews.

Hazard: Flooding

Existing or new assets: Existing/New

Existing mechanism through which action will be implemented: TBD

Responsible Organization: Trenton Department of Housing and Economic Development/Department of Inspections

Target Completion Date: TBD

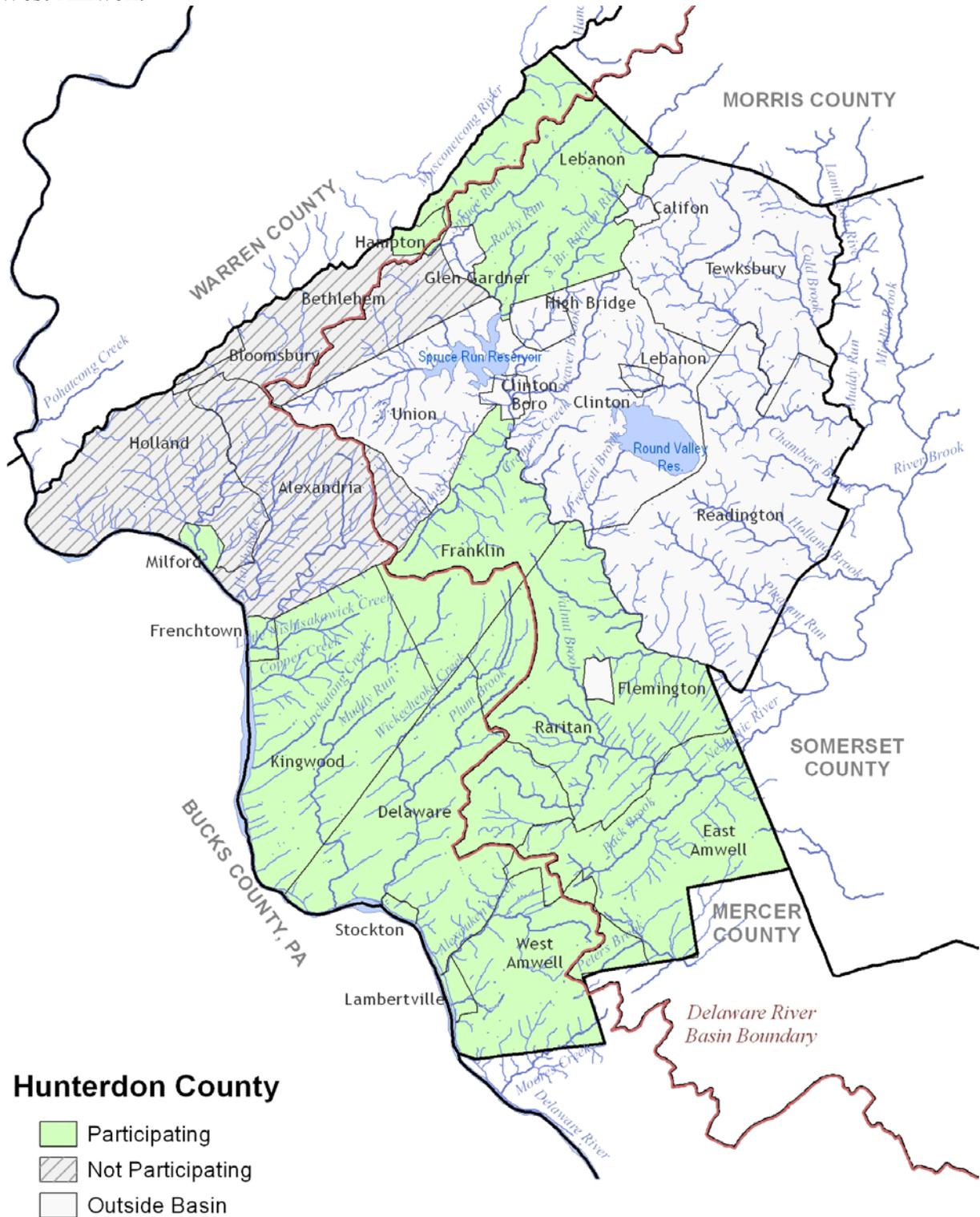
Estimated Cost: A study is likely to cost at least \$100,000; project costs would depend on the specific action.

Potential Funding Sources: FEMA, other public agencies

Priority: Medium

Hunterdon County:

Participating municipalities in Hunterdon County include Delaware, East Amwell, Franklin, Frenchtown, Hampton, Kingwood, Lambertville, Lebanon Township, Milford, Raritan, Stockton and West Amwell.



The entire western portion of Hunterdon County lies along the Delaware River. Hunterdon County was affected by the June 2006, April 2005, September 2004, and September 1999 flooding events. Although there have been county roads and bridges that have been affected by flooding, no essential county facilities have been impacted by these events.

Hunterdon County Flood Response:

To help prepare the citizenry for flood events, the county puts out newspaper articles and press releases. The county monitors the weather and river heights and relays this information to the municipal coordinators and provides information to the public. During a flood event, the county is responsible for continued weather and river height monitoring, emergency response, and providing assistance to municipality and state emergency services. After a flood event, Hunterdon County helps with the recovery work, completing financial paperwork to track expenses during and after the event, and assists FEMA and state liaisons.

During past flooding events, Hunterdon County has received response assistance from FEMA, NJDEP, and NJOEM. Afterwards, the county has received clean-up and recovery help from FEMA, NJDEP, NJOEM, Red Cross, the Salvation Army, Fire, and EMS services. Hunterdon County has benefited from FEMA's Public Assistance Grant Program.

Hunterdon County hosts a community emergency notification system called Community Alert Network to help disseminate information during an event. The county currently has a limited public awareness campaign and would like to expand its reach.

County Mitigation Statement:

Hunterdon County pledges to support the mitigation goals and actions of their municipalities to the best of their ability.

County Mitigation Actions:

1. ACTION: Public outreach and education

Description/Background:

Hazard: Flooding

Existing or new assets: TBD

Existing mechanism through which action will be implemented: Newspapers, pamphlets, seminars

Responsible Organization: Hunterdon County OEM

Target Completion Date: Ongoing

Estimated Cost: \$10,000

Potential Funding Sources: Operating Budget Item

Priority: TBD

Mitigation Action Plan of Participating Jurisdictions for Hunterdon County

Jurisdiction	Page Number	Status
Hunterdon County	151	1 action submitted
Delaware Township	156	4 actions submitted
East Amwell Township	159	2 actions submitted
Franklin Township	161	4 actions submitted
Frenchtown Borough	164	4 actions submitted
Hampton Borough	169	2 actions submitted
Kingwood Township	171	3 actions submitted
Lambertville City	174	6 actions submitted
Lebanon Township	179	1 action submitted
Milford Borough	181	1 action submitted
Raritan Township	183	3 actions submitted
Stockton Borough	185	7 actions submitted
West Amwell Township	190	1 action submitted

Hunterdon County: Municipal Mitigation Actions by Action Category

1. Prevention (Policy/Ordinances/Studies/Enforcement)				
Municipality	Mitigation Action	Responsible Party	Estimated Cost	Priority
Delaware Township	Stream Corridor Ordinance	Township Committee	\$3,000	High
Delaware Township	Update Stormwater Regulations	Waste Water Management Committee	\$2,000	High
Delaware Township	Flood review of all new construction	Floodplain Coordinator	\$500	High
Franklin Township	Maintain guidelines for steep slopes and flood prone areas	Planning Board and Building Dept.	N/A	Medium
Kingwood Township	Complete All Hazards Mitigation Plan	Kingwood Township	\$1,000	High
2. Property Protection (Acquisition, Elevation, Flood proofing)				
Municipality	Mitigation Action	Responsible Party	Estimated Cost	Priority
Frenchtown Borough	Relocation of electric panels at Public Works garage and sewer plant	Borough	\$20,000	High
Frenchtown Borough	Relocation of Sewer Plant	Borough	\$3-5M	High
Kingwood Township	Elevate Homes	Kingwood Township OEM	\$5M	High
Kingwood Township	Property Acquisition	Kingwood Township OEM	\$5M	High
Lambertville City	Assist residents and business owners with elevation applications	City Council	\$250,000	High
Lambertville City	Analyze properties north of Cherry Street for structural elevation	City Council	To be determined	Medium
Raritan Township	Kuhl Road elevation	Township, county	\$1.5 M	High
Raritan Township	Copper Hill Road elevation and bridge replacement	Township, county	\$280,000	High
Raritan Township	Hampton Corner Road elevation and bridge replacement	Township, county	\$330,000	High
Stockton Borough	Residential property acquisition	Floodplain Administrator	\$1 M	High
Stockton Borough	Flood proof sewer pump station	Sewer Authority	\$25,000	High
Stockton Borough	Relocate Fire Department	Planning Board	\$750,000	Medium
Stockton Borough	Flood proof Borough Hall	Floodplain Administrator	\$25,000	Low
3. Public Information and Awareness				
Municipality	Mitigation Action	Responsible Party	Estimated Cost	Priority
East Amwell Township	Community education for flood preparedness	East Amwell Township	To be determined	High
Lebanon Township	Public education	Lebanon Township	Minimal direct cost	Medium
Stockton Borough	Public awareness program	Stockton OEM	\$500	Medium

4. Emergency Services				
Municipality	Mitigation Action	Responsible Party	Estimated Cost	Priority
East Amwell Township	Upgrade community notification system and township web site	East Amwell Township	To be determined	Medium
5. Natural Resource Protection (Floodplain protection, Stream Corridor Restoration, Open space)				
Municipality	Mitigation Action	Responsible Party	Estimated Cost	Priority
Alexandria Township	Open space along the Delaware	To be determined	To be determined	High
Delaware Township	Analysis of local watersheds	Princeton Hydro	\$8,000	High
Franklin Township	Place rip-rap at face of stream adjacent to roadway	Franklin DPW	\$2,000	High
Franklin Township	Remove sediment and vegetation from roadside culverts	Franklin DPW and/or sub-division developer	Depends on extent, \$10,000 estimate	Medium
Franklin Township	Check for waterway obstructions (ie fallen trees, large debris, etc.)	Franklin DPW/landowners	Varies, \$1,000 per obstruction estimate	Medium
Hampton Borough	Storm Creek bed clean-up	Franklin DPW	Free	High
West Amwell Township	Preserve open space and farmland	To be determined	To be determined	Medium
6. Structural Projects				
Municipality	Mitigation Action	Responsible Party	Estimated Cost	Priority
Frenchtown Borough	Install backflow prevention plugs on drainage pipes under towpath and at sewer plant	Frenchtown Borough	\$25,000	High
Frenchtown Borough	Raise level of the D&R towpath to prevent backflow of Delaware River over towpath	NJ State (DEP, D&R Canal Commission)	To be determined	Medium/ Low
Hampton Borough	Route 31 Retention Pond	NJDOT	To be determined	Medium
Lambertville City	Install a backflow prevention device storm sewer behind CVS Pharmacy that surcharges adjacent to the Canal Studios building	City Council	\$75,000.00	High
Lambertville City	Install backflow prevention device within Niece Lumberyard to mitigate backflow of Ely Creek	City Council	\$120,000	High
Lambertville City	Install flood gate and lift station at Swan Creek	City Council	\$8 million	High
Lambertville City	Study of sanitary sewerage backflow during flooding events	Lambertville Sewer Authority	\$500,000	High
Milford Borough	Wet well	Borough of Milford	To be determined	Medium
Stockton Borough	Levee (river wall) improvement plan	Governing body	\$5 M	High
Stockton Borough	Backflow prevention on storm drain outlets	Storm Water Management Coordinator	\$50,000	Medium

Delaware Township, Hunterdon County:

Location:

Delaware Township is located on the western border of central New Jersey in southwestern Hunterdon County. The township is home to 4,478 people living in 37.03 square miles. It is bordered by the Townships of Solebury (PA) and Plumstead (PA) to the west, the Townships of Kingwood and Franklin to the north, the Townships of Raritan and East Amwell to the east, and by the Township of West Amwell and City of Lambertville to the south.



Geology:

The township lies in the Piedmont Plateau, which is part of the Appalachian Province. This area is characterized by nearly level lowlands, occasional ridges and low hills, and is underlain by sedimentary rock. The relatively flat topography of a river terrace is found along the Delaware River. Elevations range from 43 feet at the Delaware River to 550 feet at the northern corner of the township.

Hydrology:

The *Delaware River* flows along the western border of the Township of Delaware.

The *Alexauken Creek* has its headwaters in the central part of the Township of West Amwell to the south and flows generally northwest to a point just south of the center of Delaware Township's southern boundary. From this point it flows southwest to its confluence with the Delaware River. The Alexauken Creek drains the southern part of Delaware Township.

The *Brookville Creek* begins in the southwestern part of the township and flows southwest to its confluence with the Delaware and Raritan Canal.

The *Wickecheoke Creek* has its headwaters in the Township of Raritan and flows generally southwest. It enters Delaware Township near its northern corner and continues through the township to the Delaware River. It reaches the Delaware and Raritan Canal and the Delaware River at the Prallsville Mills to the north of Stockton, NJ. The *Plum Brook* is a tributary to the Wickecheoke.

The *Lockatong Creek* has its headwaters in the southwestern part of Franklin Township and flows through Kingwood and Delaware Township to its confluence with the Delaware. The Wickecheoke Creek originates in Raritan Township, New Jersey and flows through Croton and Locktown. Turning south, it cuts through a low ridge, is joined by Plum Brook and cuts through a second, slightly larger ridge to the west of Sergeantsville.

Also present in Delaware Township are the Dunkard Creek and Rose Creek.

In the Raritan River Watershed, the *Third Neshanic River* begins in the eastern part of the township and flows generally southeast. The Third Neshanic River becomes a major tributary to the Neshanic River.

Recent Flood History:

Delaware Township was recently impacted by flooding on July 21, 2006 and during the three major mainstem floods of June 2006, April 2005 and September 2004. In July 2006, heavy rainfall caused Dunkard Creek and Rose Creek to flood 8 buildings: 5 sustained basement damage and 3 sustained first floor damage. Between 25% and 50% of the township was affected by flood waters, which contained residential, agricultural, and government properties. Covered Bridge Road, Lower Creek Road, Rittenhouse Road, Sandbrook Road, and Dunkard Church Road were flooded and the sewage authority and 2 historic homes were adversely affected. Erosion, sediment deposition, altered stream flow and debris caused financial strain on the community and hindered emergency services.

The June 2006 and April 2005 events caused the Delaware River, the D&R Canal, Rose Creek, and the Delaware tributaries to flood. Between 25% and 50% of the township was affected, wells were contaminated, and major roadways were impassible, preventing emergency assistance. Route 29 (which runs along the D&R Canal), Lower Creek Road, Upper Creek Road, the Upper Creek Road Extension along the Wickecheoke River and Quarry Road and Federal Twist Road near the D&R Canal were flooded in June 2006 and April 2005. During the April 2005 flood, Raven Rock Road near the Lockatong River was also flooded and oil tanks and sewage contaminated both soil and well water. There are on-going property acquisitions along the Wicheokee and Lockatong Creeks, which will be earmarked for open space preservation. At least one home in the community is interested in acquisition or elevation.

Unique Flood Risk to Municipality:

Several residences are flooded by Delaware River. Residences of Lower Creek Road, Covered Bridge Road, Britton Road, Brookville-Hollow Road, Seabrook Road, Grafton Road, Rittenhouse and Dogwood Drive are flooded during heavy rains and stormwater run-off.

Local Flood Mitigation Planning Committee:

Bruce Mast	EMC/Chief of Police
Harry Sheperd	Deputy EMC
Richard Madden	Committee Member
Jay Trstensky	Director of Public Works
Phil Izzo	Construction Official
James Drummond	Town Historian
Robert Streilein	Flooded Property Owner
Leslie Sauer	Waste Water Manager
Ron Bond	Planning/Zoning
Robert Miller	Floodplain Coordinator
Peter Turek	Municipal Engineer
Michelle Trivigno	Tax Assessor
Diane Soriero McDaniel	T/A Construction
Linda McKeegan	Flooded Property Owner

Ordinances/Plans Reviewed:

Stormwater Management Ordinance, stormwater analysis study of Rose Creek watershed,
Stream Corridor Ordinance

Outreach:

Lower Delaware Regional Watershed Coordinating Council, D&R Canal Commission

First Public Meeting Date: 5/29/07

Date and Method of Advertisement for Meeting:

Announced at township meetings, listed in meeting agendas

Questionnaire Distribution Method:

Mailed to flood impacted residents and businesses, advertised in local newspaper and available on web site, at municipal offices, police station, or by calling the township

Public Response:**Flood Mitigation Goals:**

1. Protect existing and new development by adopting and enforcing a stream corridor ordinance and by updating the current Stormwater Management regulations
2. Educate residents about flood risks
3. Conduct analysis of local watersheds
4. Reduce flooding along Lower Creek Road

Delaware Mitigation Action Plan:**1. ACTION: Stream Corridor Ordinance**

Description/Background: Delaware Township wants to adopt and enforce a new stream corridor ordinance to help protect new and existing developments within the township.

Hazard: Flooding

Existing or new assets: New

Existing mechanism through which action will be implemented: Zoning

Responsible Organization: Township Committee

Target Completion Date: 2008/2009

Estimated Cost: \$3000

Potential Funding Sources: Delaware Township

Priority: High

2. ACTION: Update Stormwater Regulations

Description/Background: Delaware Township wants to update current stormwater management regulations to minimize areas that are affected by stormwater runoff during extreme rain events.

Hazard: Drainage, new construction

Existing or new assets: Existing/New

Existing mechanism through which action will be implemented: Engineering

Responsible Organization: Waste Water Management Committee

Target Completion Date: 2008/2009

Estimated Cost: \$2000

Potential Funding Sources: Delaware Township

Priority: High

3. ACTION: Flood review of all new construction

Description/Background: Delaware Township wants to ensure that new building construction minimizes flood risk.

Hazard: Flooding

Existing or new assets: New

Existing mechanism through which action will be implemented: Floodplain Coordinator

Responsible Organization: Floodplain Coordinator

Target Completion Date: Ongoing

Estimated Cost: \$500/year

Potential Funding Sources: Delaware Township

Priority: High

4. ACTION: Analysis of local watersheds

Description/Background: Starting with the Rose Creek watershed, Delaware Township will contract Princeton Hydro to analyze the watersheds and make recommendations for flood mitigation.

Hazard: Flooding

Existing or new assets: Existing/New

Existing mechanism through which action will be implemented: Township Committee

Responsible Organization: Princeton Hydro

Target Completion Date: 2008/2009

Estimated Cost: \$8000

Potential Funding Sources: Delaware Township

Priority: High

East Amwell Township, Hunterdon County:**Location:**

East Amwell Township is a community of 4,455 people located in the southeastern corner of Hunterdon County. The 28.72 square mile township is bordered by the Delaware Township to the west, by Hopewell Township to the southeast, West Amwell Township to the southwest, Raritan Township to the northwest, and Hillsborough Township to the northeast. The majority of the township is located in the Raritan River Watershed, with the extreme western part of this township located in the Delaware River Basin.

**Geology:**

The township lies in the Piedmont Physiographic Province. The northern part of the township is in the Raritan Valley Lowland region with rolling plain, while the southern part of the township lies in the Sourland Mountain region with relatively flat mountaintops that are higher. The underlying rock is primarily Brunswick shale. The elevations range from 100 feet at the Neshanic River to 560 feet in the southeastern part of the township.

Hydrology:

Over 90% of East Amwell primarily drains to the Raritan River Watershed, but a small northwestern portion of the township drains to the Delaware River.

The *Neshanic River*, a tributary to the South Branch of the Raritan River, flows through the northern portion of the township. The *Back Brook* is a tributary to the Neshanic River has its headwaters near Rocktown in eastern East Amwell Township.

The *Stony Brook* exists in the township and lies within the Stony Brook/Millstone Watershed.

Recent Flood History:

Although flooding is not a usual occurrence, heavy rainfall caused by tropical storms and hurricanes sometimes produces flooding conditions. During Hurricane Floyd in September 1999, the Raritan River flooded a small part of East Amwell. 18 single family homes sustained basement damage and 10 sustained first floor damage. The average assessed value of these homes was \$425,000. Hurricane Floyd also caused flood damage to the city municipal building.

Unique Flood Risk to Municipality: None

Local Flood Mitigation Planning Committee:

Tim Matheny	Township Administrator
C.J. Soos	OEM
Larry Tatsch	Governing Body
George Howell	Public Works
Dennis O'Neal	Engineer
Stu Doddy	Planning/Zoning/Code Enforcement
Terri Stahl	Municipal Clerk

Ordinances/Plans Reviewed:

Files and municipal records, photographs and reports related to flooding incidents, floodplain maps, Flood Management Ordinance

Outreach:

First Public Meeting Date: November 8, 2007

Date and Method of Advertisement for Meeting:

Questionnaire Distribution Method: Township web site

Public Response:

1. Comments about roads after flooding events
2. Summaries of damage incurred in June 2006 and September 1999

Flood Mitigation Goals:

1. Better community notification
2. Better flood preparation

East Amwell Mitigation Action Plan:

1. ACTION: Upgrade community notification system and township web site

Description/Background:

Hazard: Flooding
Existing or new assets: Existing
Existing mechanism through which action will be implemented:
Responsible Organization: Township
Target Completion Date: 2009
Estimated Cost: To be determined
Potential Funding Sources: To be determined
Priority: High

2. ACTION: Community education for flood preparedness

Description/Background:
Hazard: Flooding
Existing or new assets: Existing
Existing mechanism through which action will be implemented:
Responsible Organization: Township
Target Completion Date: Ongoing
Estimated Cost: To be determined
Potential Funding Sources: To be determined
Priority: Medium

Franklin Township, Hunterdon County:

Location:

Franklin Township is located in the central part of Hunterdon County, approximately 9 miles north of Flemington, New Jersey. It is home to 2,990 people, and comprises 22.92 square miles. Within the township lie the historic villages of Quakertown and Pittstown. Franklin is bordered by Alexandria Township to the west, Kingwood Township to the southwest, Delaware Township to the south, Raritan Township to the east, Clinton Township to the northeast, the Town of Clinton to the north, and Union Township to the northwest.



Geology:

The township lies in the Piedmont Plateau, which is part of the Appalachian Province. This area is characterized by nearly level lowlands, occasional ridges and low hills, and is underlain by shale and sandstone. Elevations range from 140 feet in the eastern part of the township to 706 feet just southeast of Quakertown, New Jersey.

Hydrology:

Franklin is comprised of both the Delaware River watershed (40%) and the Raritan River watershed (60%).

The southern half of the township drains to the Delaware River. There are no major water bodies that drain into the Delaware River situated in Franklin Township, however, there are

several small tributaries that feed the *Lockatong Creek* and *Muddy Run* in Kingwood Township which then drain into the Delaware River.

The *Capoolong Creek* drains northeast into the *South Branch of the Raritan River*.

Recent Flood History:

Franklin Township was recently affected by the June 2006, April 2005, September 2004, and September 1999 flood events. During the 2004, 2005, and 2006 floods, the South Branch Raritan River and the Capoolong Creek flooded agricultural lands and caused minor road damage. The September 1999 event caused more substantial damage to the community as 30 structures with an average assessed value of \$400,000 sustained basement damage. Critical roads and a county bridge were also affected. After the event, about 20 culverts were cleaned and regraded, rip rap was replaced, debris and sediment was removed and a survey of privately owned retention and detention basins was performed.

During the past flood events, Hamden River Road, the bottom of Spring Hill Road (the portion adjacent to the South Branch Raritan), Kingtown Road (around the Capoolong Creek), Sidney Road, Pittstown/Everittstown Road, and Landsdown Road were flooded.

Unique Flood Risk to Municipality: A dam condition at Spruce Run or Round Valley Reservoirs could impact floodplain areas.

Local Flood Mitigation Planning Committee:

George Reichert	Floodplain Admin./Stormwater Manger/Deputy OEM Coord.
Ken Mandoli	Emergency Management Coordinator
Alan Dilley	DPW Supervisor
Bruce Studier	Environmental Commission

Ordinances/Plans Reviewed:

Chapter 199 -Flood Damage Prevention, Ordinance 220 Article IV Floodplain Regulations, Municipal Chapter 296 Stormwater Control

Outreach:

South Branch Watershed Association, Rural Awareness (Municipal Historical Group)

First Public Meeting Date: 4/17/07

Date and Method of Advertisement for Meeting: Newsletter and ordinance notice

Questionnaire Distribution Method:

Notice at township building and drive-by canvassing

Public Response:

1. There are no residential structures exposed to first floor conditions in the floodplain, but some crawlspaces and basements are exposed.
2. There are some small sheds and barns that are located within the floodplain, although this is limited.

Flood Mitigation Goals:

1. Maintain a policy of no development in the floodplains
2. Stabilize and protect drainage pipes, culverts, and public roads adjacent to waterways

Franklin Mitigation Action Plan:

1. **ACTION: Maintain guidelines for steep slopes and flood prone areas**
Description/Background: The ordinances address prohibiting development in sensitive areas.
Hazard: Flooding/erosion
Existing or new assets: Existing/New
Existing mechanism through which action will be implemented: Municipal Ordinances
Responsible Organization: Planning Board and Building Dept.
Target Completion Date: In place and ongoing
Estimated Cost: N/A
Potential Funding Sources: N/A
Priority: Medium

2. **ACTION: Place rip-rap at face of stream adjacent to roadway**
Description/Background: Occasional high water events have caused localized erosion. These efforts will address exposed areas and mitigate the concerns.
Hazard: Flooding/erosion
Existing or new assets: Existing
Existing mechanism through which action will be implemented: Regular maintenance and ordinances
Responsible Organization: DPW
Target Completion Date: Fall 2007
Estimated Cost: \$2,000
Potential Funding Sources: Municipal budget
Priority: High

3. **ACTION: Remove sediment and vegetation from roadside culverts**
Description/Background: Sediment can build-up at drainage structure outlets. Therefore, excess material will be removed.
Hazard: Flooding
Existing or new assets: Existing/New
Existing mechanism through which action will be implemented: Regular Maintenance
Responsible Organization: DPW or sub-division developer
Target Completion Date: Ongoing
Estimated Cost: Depends on extent; \$10,000 estimate
Potential Funding Sources: N/A
Priority: Medium

4. **ACTION: Check for waterway obstructions (fallen trees, large debris, etc.)**
Description/Background: Obstructions may be causing a dam condition near important drainage components (swales, culverts, bridges, etc.). Therefore, obstructions will be searched for and removed.
Hazard: Flooding
Existing or new assets: Existing
Existing mechanism through which action will be implemented: Post storm survey
Responsible Organization: DPW/Landowners

Target Completion Date: Ongoing
Estimated Cost: Varies; \$1,000 per obstruction estimate
Potential Funding Sources: Municipal budget/private expense
Priority: Medium

Frenchtown Borough, Hunterdon County:

Location:

The Borough of Frenchtown is a one-square mile municipality located along the Delaware River on the western border of central New Jersey in southwestern Hunterdon County. It is bordered by Tinicum Township (PA) to the west, Alexandria Township to the north, and Kingwood Township to the east and south. The borough is home to 1,499 people within 1.34 square miles.



Geology:

The borough lies in the Piedmont Plateau, which is part of the Appalachian Province. This area is characterized by nearly level lowlands, occasional ridges and low hills, and is underlain by sedimentary rocks. The elevations range from 94 feet at the Delaware River to 330 feet at the borough's eastern corporate limits.

Hydrology:

The *Delaware River* flows along the western border of the Borough of Frenchtown.

The *Little Nishisakawick Creek* has its headwaters in northwestern Kingwood Township and flows generally southwest through the southern half of Frenchtown to its confluence with the Delaware River, approximately 200 feet downstream from the mouth of the Nishisakawick Creek.

The *Nishisakawick Creek*, a tributary to the Delaware, has its headwaters in the central part of the Township of Alexandria and flows generally southwest, entering Frenchtown at its northwestern corner. It flows southwest through town to its confluence with the Delaware River in the southwestern corner of the borough at Trenton Avenue/Route 29.

Recent Flood History:

Frenchtown experienced flooding in 1996, 2004, 2005 and 2006. In 1996 an ice jam broke and the River rose to 20-21'.

An old railroad right of way runs along the Delaware River and is currently used as a bike path and is owned by NJDEP Parks and Forestry. That embankment protects most of Frenchtown from any water that might overtop the bank of the River. Water from the River has only come over the bike path once. It did so in 1955 (during the flood of record) at the lowest point in the path. When the River backs up the Creeks, it goes through large culverts under the bike path. (NJDEP is responsible for the bike path, as well as the culverts.)

Flood waters from the Delaware River back up Nishisakawick Creek and Little Nishisakawick Creek, as well as the storm sewers and small culverts under the railroad embankment.

Distinct areas flood:

- The treatment plant at the end of River Rd and along River Rd.
- The area next to Nishisakawick Creek, generally bounded by Hawk St., Trenton Ave., River Rd and Bridge St.
- The area between Bridge and 3rd Streets, and the bike path and Harrison Rd
- Along Railroad Ave.

During the June 2006 storm, 68 houses incurred basement damage; 11 due to the Delaware River, 17 due to back-up through the towpath drainage pipes, and 40 by the Nississackaway Creek. Thirty (30) homes incurred first floor damage. The sewer plant's filtration unit and the pump station on River Road also flooded (the plant itself doesn't flood). The Railroad Avenue and the Frenchtown-Uhlerstown bridges were inundated with water, became impassible, and sustained damage due to mud and debris. Riverbank and road erosion was substantial and household heating oil was washed into the Delaware River. In addition, debris clogged the Nississackaway Creek, which has narrowed the opening of the creek where it enters the Delaware River.

During the April 2005 event, essential facilities were affected. The Post Office closed for 35 days due to severe flooding in its main floor, lobby and work areas, and the Fire Department and Emergency Response teams incurred equipment loss and damage.

Since Frenchtown is a rural community with a small tax base and municipal budget, the recent flooding has been a financial hardship on the township as it has been for many Delaware River townships. Commercial property owners also incur serious economic setbacks during flood events. Not only does flooding affect some businesses directly with water inundation, but all businesses in the borough are affected by road closures. When the bridges are closed for flooding and related repairs, weekend tourists, upon which Frenchtown businesses depend, cannot reach the borough. Frenchtown Borough works to more quickly re-open bridges and roads to traffic after flood events.

Flood Mitigation:

There are 3 properties that are undergoing elevation as of 2007. In January 2007, three applications were submitted to FEMA for acquisition. More property owners are interested in elevation and acquisition, but the borough is worried about the loss of tax ratables, aesthetics and character of the town if homes, especially if the historic homes were purchased and demolished. Homeowners also have difficulties securing funding and obtaining permits for acquisitions and elevations.

Frenchtown is currently looking to purchase flood-control plugs to control backflow of the Delaware River through drainage pipes underneath the towpath and is also in the process of developing a community telephone notification system. Frenchtown also hopes to build up the

towpath/bike path with stone to elevate the natural barrier and increase flood protection to 150 residences and businesses. In addition, the borough wants to install a one-way valve on the storm drains running beneath the towpath from the river to the residential area at 2nd Street. This measure will help ameliorate flooding for approximately 25 properties. In order to lessen flooding along the Nississackaway, the borough would like to install flood gates and remove accumulated debris from the creek.

Unique Flood Risk to Municipality:

Flooding occurs in Frenchtown for multiple reasons and from multiple sources. First, properties located immediately on the Delaware River (River Road, Washington Street) flood from elevated River levels. Second, other areas (Trenton Avenue, Front, Lott, Hawk Streets) flood from the Nississackaway Creek from its waters and back up from the River. Third, several properties (Railroad Ave and intersecting numbered streets like lower 2nd through lower 5th) flood from back up of the Delaware River through drainage pipes under the Delaware River Canal towpath.

Due to the small size and limited Borough resources and staff, responding to a flood emergency is more difficult and the related economic costs are a larger proportion of total borough budget than other larger municipalities.

Local Flood Mitigation Planning Committee:

Adam Liebttag	Council Member
Ken Arata	Resident
Tom Senn	Resident
Jerry Becker	Resident
Ron Sworen	Mayor
Sue Adipietro	Resident
Anne Glaser	Resident

Ordinances/Plans Reviewed:

Flood Control Ordinance, emergency management plans, data from flood events

Outreach:

First Public Meeting Date: 5/31/2007

Date and Method of Advertisement for Meeting:

5/24/2007 Delaware Valley News and agenda posted at Borough Hall

Questionnaire Distribution Method: bulk mailing to all residents

Public Response:

1. Questions about NYC reservoirs
2. Support for a Reverse 911 system
3. Support for emergency management information to be posted on a borough web site
4. Suggestions for keeping in touch with NOAA web site for weather information preceding flooding events
5. Interest in installing a flood gage on the Frenchtown-Uhlerstown Bridge that would provide cresting and river level data
6. Two residents state that elevation/buyouts are not viable options as elevation is expensive, state permits are required, as well as borough approval. In addition, there will

be a negative cumulative aesthetic impact of elevating, acquiring and demolishing homes (many of which are historic) within the borough.

7. One resident expressed concern that what happens upriver may have negative affects downriver. For instance, preventing the Delaware River from backing up through the towpath and flooding Railroad Ave and 2nd through 5th Streets may cause additional flooding pressure on the lower portion of town near the Creek and Trenton Ave.
8. Many residents expressed support for dredging the Nissisackaway Creek and parts of the Delaware River where it flows into the creeks. While this could improve the flow of the creek and river in flood-prone locations and improve aesthetics, some residents expressed concern that dredging could have a negative impact on the environment and habitats. The Borough is concerned with obtaining and paying for the appropriate permits from the state.

Flood Mitigation Goals:

1. Improve notification and early warning system to residents. Improved communication will allow better planning and prevention by residents and businesses, notify residents and businesses of how to stay in touch with the borough and emergency management resources, and provide updates during flood events
2. Reduce or prevent back flow of Delaware River along towpath through drainage pipes.
3. Reduce or prevent damage and down time at Public Works and Sewer Plant facilities due to river flooding
4. Reduce or prevent damage to homes and businesses on Trenton Avenue, Front and Lott Streets, which suffer flooding from Nissisackaway Creek elevation and backup from Delaware River
5. Protect Borough infrastructure at the Sewer Plant, Public Works facility, pumping stations in Creek Park and on River Road
6. Preserve towpath and prevent erosion of towpath and river bank; prevent or contain erosion of creek bank in Creek Park

Frenchtown Mitigation Action Plan:

1. **ACTION: Relocation of electric panels at Public Works garage and sewer plant**
Description/Background: Borough Council is obtaining proposals for electrical work to be completed, will award to vendor according to law. Borough staff will oversee and coordinate onsite work with appropriate code inspectors, etc.
Hazard: Flooding
Existing or new assets: Existing
Existing mechanism through which action will be implemented: Borough Council and Borough Staff
Responsible Organization: Borough
Target Completion Date: 2007-2008
Estimated Cost: \$20,000
Potential Funding Sources: Grant or self-funded
Priority: High

2. ACTION: Relocation of Sewer Plant

Description/Background: Borough recognizes need to expand and/or build new wastewater treatment plant to serve expanding Borough needs (aside from flooding). Design and construction of new sewer plant is in initial planning stages.

Hazard: Flooding

Existing or new assets: Existing/New

Existing mechanism through which action will be implemented:

Responsible Organization: Borough

Target Completion Date: 2008-2010

Estimated Cost: \$3-5 million

Potential Funding Sources: Grants & Loans from State and Federal Gov't, Borough funds

Priority: High, but long term

3. ACTION: Raise level of the D&R towpath to prevent backflow of Delaware River over towpath

Description/Background: Raising the height of the towpath would increase protection of more than 20 properties impacted by back flow of the River.

Hazard: Flooding

Existing or new assets: Existing

Existing mechanism through which action will be implemented:

Responsible Organization: NJ State (DEP, D&R Canal Commission)?

Target Completion Date: Open

Estimated Cost: To be determined

Potential Funding Sources: State

Priority: Medium to Low

4. ACTION: Install backflow prevention plugs on drainage pipes under towpath and at sewer plant

Description/Background: Borough Council and Sewer Committee are exploring “backflow plugs” to prevent back flow of River through drainage pipes in towpath. An additional backflow plug will be installed at Sewer Plant. Borough staff and Council are working to identify mechanical options, engineering to fit plugs into the pipes. If the plugs are removable, staff responsibility will be defined to determine who installs plugs during a flood event.

Hazard: Flooding

Existing or new assets: Existing

Existing mechanism through which action will be implemented:

Responsible Organization: Borough

Target Completion Date: 2007/2008

Estimated Cost: \$25,000

Potential Funding Sources: Grant or self-funded

Priority: High

Hampton Borough, Hunterdon County:

Location:

Hampton Borough is located along the northwestern border of Hunterdon County. There are 1,546 people living within the borough’s 1.54 square miles. It is bordered by Lebanon Township to the north, Bethlehem Township and Borough of Glen Gardner to the south, and Washington Township to the west.



Geology:

The borough is located in the Reading Prong of the New England Uplands province (Highlands of New Jersey). The area is moderately rugged and characterized by approximately parallel, somewhat irregular ridges intervening valleys all trending northeast. The borough is located in the valley and underlain by marine sediments. The ridges around the borough rise 500 to 1,000 feet above the valley floor, which is around 350 feet at its lowest point.

Hydrology:

The *Musconetcong River* forms the northern border of this borough. It originates at Lake Hopatcong and flows northwest. After flowing through Lake Musconetcong, the river flows southwest forming the border of Hunterdon and Warren Counties until it joins the Delaware River in Reigelsville, New Jersey.

Recent Flood History:

Hampton was affected by flooding in June 2006, April 2005, September 2004, and September 1999. The Musconetcong and Storm Water Creek flooded Borough Park and properties adjacent to Storm Water Creek from Lackawanna, Bowlby, and Main Street to Box Culvert. During a typical flooding event, 10 structures incur basement damage.

Unique Flood Risk to Municipality: None

Local Flood Mitigation Planning Committee:

Rob Walton	Mayor
Jeff Tampier	OEM
Bob Sheridan	Environmental Committee Chair

Ordinances/Plans Reviewed:

Outreach:

First Public Meeting Date: 10/8/2007

Date and Method of Advertisement for Meeting:

9/18/2007 Post at Borough Hall, 9/26/2007 Borough Newsletter

Questionnaire Distribution Method: Questionnaires were delivered by hand to all residents affected by local flooding.

Public Response:

1. Three responses were received expressing no interest in aid
2. The 3 reported only minor flooding in basements and washed out driveways

Flood Mitigation Goals:

Improved Storm Water Management

Hampton Mitigation Action Plan:**1. ACTION: Storm Creek bed clean-up**

Description/Background: The storm creek begins at the outlet of a storm water pipe on the south side of Lackawanna Street near Route 31. It traverses Lackawanna, Bowlby Street as it travels north between the back yards of homes facing Main Street until it crosses Main Street and is continued in buried concrete pipes. The creek has become filled with tree limbs, natural debris and garbage. They plan to use prison labor to clean by hand all debris and move stones from the bottom of the bed to the top, thus deepening and widening the creek. While this work will be completed in September 2007, it will need annual maintenance to keep it clear.

Hazard: Flooding

Existing or new assets: Existing

Existing mechanism through which action will be implemented: DPW Administration

Responsible Organization: DPW

Target Completion Date: September 2007 & annual maintenance

Estimated Cost: Free

Potential Funding Sources: NJ DOC labor

Priority: High

2. ACTION: Route 31 Retention Pond

Description/Background: The state DOT will be widening and improving Route 31 as part of a project to replace the bridge of the NJ Transit rail line. As part of this project the DOT is constructing a water retention pond near the south corner of Lackawanna Street and Route 31. Much of the water that falls on Route 31 finds its way into the municipal storm water creek described in the first action above. As part of this DOT project, nearly all water on Route 31 will be directed into this retention pond.

Hazard: Flooding

Existing or new assets: New

Existing mechanism through which action will be implemented: DOT Construction Project

Responsible Organization: DOT

Target Completion Date: 2009

Estimated Cost: TBD

Potential Funding Sources: TBD

Priority: Medium

Kingwood Township, Hunterdon County:

Location:

The Township of Kingwood is located on the western part of Hunterdon County and is home to 3,782 people. The 35.81 square mile township is bordered by the Delaware River. Kingwood is bordered by Tincum Township (PA) and Plumstead Township (PA) to the west, the Townships of Frenchtown and Alexandria to the north, Franklin Township to the east, and Delaware Township to the south.



The oft-flooded village of Byram is located directly on the Delaware River and contains approximately 40 homes within Kingwood Township.

Geology:

The township lies in the Piedmont Plateau, which is part of the Appalachian Province. This area is characterized by nearly level lowlands, occasional ridges and low hills, and is underlain by sedimentary rock. The relatively flat topography of the river terrace is found along the Delaware River. Elevations range from 57 feet at the Delaware River to 570 feet in the south-central part of the township.

Hydrology:

The *Delaware River* flows along the western border of the Kingwood Township.

The *Little Nashisakawick Creek* originates in the northern portion of the township until it enters Frenchtown Borough.

The *Copper Creek* and *Warford Creek* are both tributaries to the Delaware that are entirely located within Kingwood.

The *Locketong Creek* has its headwaters in the southwestern part of Franklin Township and flows generally southwest through Kingwood Township, and into Delaware Township. The Locketong Creek and its tributaries drain most of the township.

The *Muddy Run* is a tributary to the Locketong. It has its headwaters in the east-central region of the township and generally flows southwest to its confluence with the Locketong Creek.

Recent Flood History:

The Byram section of Kingwood was affected by the June 2006, April 2005, September 2004, September 1999, and January/February 1996 flooding events. Each of the flooding events was caused by the Delaware River and affected only a small portion of the township. During events, it is estimated that 40 privately-owned structures sustain basement damage, and that 35-40 buildings sustain first floor damage. While no essential facilities were affected by the recent flooding events, a small number of private wells and septic tanks were contaminated. Repetitive flood loss properties are located along the Delaware River (Old River Road) in southern

Kingwood and in or near Byram (Byram Lane).

Two major causes of flooding are the very low elevation of the area, causing the bank to get overtopped by the Delaware River, compounded by rainwater coming off of Route 29 and the old railroad track right of way. Sometimes the water from the highway and the railroad collects in the low areas of Byram before the river floods it.

Flood Mitigation:

In 1997, homeowners began funding their own property elevations. Approximately four to five home elevations have been completed. There are at least 8-10 more owners interested in elevation, although lack of funding is preventing follow through.

Unique Flood Risk to Municipality:

Only a small portion of Kingwood Township experiences repetitive flooding. The Byram community has been severely flooded and properties have suffered significant repetitive damage in the last three floods. Property values range from \$600K - \$700K, with one valued at \$1.6M.

Local Flood Mitigation Planning Committee:

James Burke	Mayor/Planning Board/LEMC
Mary Macconnell	Clerk, DEP/EMC
Thomas Decker	Engineer/Stormwater Mngmt Coord.
Michael DeSapio	Zoning Officer/Floodplain Admin
Wayne Degan	Construction Official
Joseph Zdrodowski	Chair Flooded Property Owners
Jerry Fechter	Flooded Property Owner
Jolene Cooper	Flooded Property Owner
Nina Altschiller	Flooded Property Owner
Richard Desvernine	Flooded Property Owner (moved)
Fred Mount	Flooded Property Owner

Ordinances/Plans Reviewed:

Lambertville's All Hazard Mitigation Plan, Army Corps study for floodwater abatement plan, zoning ordinances were modified to facilitate elevating residences and DRBC flood maps

Outreach:

Lambertville, Frenchtown, Holland Township, Harmony Township, Delaware River Basin Commission, Federal Emergency Management Agency, Rep. Rush Holt, local school

First Public Meeting: 7/2006

Advertisement for Meeting:

Announced at meeting, Delaware Valley News article 9/4/2007

Questionnaire Distribution: local volunteers

Public Response:

1. Complaints about the time it has taken to develop the plan to petition FEMA for funds. Citizens are interested in how the process can be accelerated.
2. Resentment for NJDEP regarding restrictions and permits required. This has abated due

- to changes made by NJDEP in granting approval to take remedial action.
3. Most residents in Byram community want to elevate their homes, but cannot afford to do so with their own resources.
 4. Some residents chose not to wait for FEMA and elevated their homes using their own funds.

Flood Mitigation Goals:

1. Have over 50% of Byram residents elevate their homes.

Kingwood Mitigation Action Plan:**1. ACTION: Complete All Hazards Mitigation Plan**

Description/Background: The All Hazards Mitigation Plan for Kingwood Township is in progress. It may be necessary to enlist professional help to complete the document. The technical assistance required is minimal.

Hazard: Flooding

Existing or new assets: Existing/New

Existing mechanism through which action will be implemented: NJOEM

Responsible Organization: Kingwood Township

Target Completion Date: Fall 2007/2008

Estimated Cost: \$1,000

Potential Funding Sources: FEMA, NJ Green Acres

Priority: High

2. ACTION: Elevate Homes

Description/Background: The questionnaire submitted recently to the property owners indicated that more than 80% of the homeowners now wish to elevate their homes providing that they receive assistance from FEMA and NJ Green Acres.

Hazard: Flooding

Existing or new assets: Existing

Existing mechanism through which action will be implemented: NJOEM

Responsible Organization: Kingwood Township OEM

Target Completion Date: Ongoing

Estimated Cost: \$5,000,000

Potential Funding Sources: FEMA, NJ Green Acres

Priority: High

3. ACTION: Property Acquisition

Description/Background: Some property owners are considering having FEMA acquire their homes as it may not be economically feasible to elevate their homes (built on slab, location subject to river debris, structure not suitable for elevation, etc.).

Hazard: Flooding

Existing or new assets: Existing

Existing mechanism through which action will be implemented: NJOEM

Responsible Organization: Kingwood Township OEM

Target Completion Date: Ongoing

Estimated Cost: \$5,000,000

Potential Funding Sources: FEMA, NJ Green Acres
Priority: High

City of Lambertville, Hunterdon County:

Location:

The City of Lambertville is located in southwestern Hunterdon County along the Delaware River and on the western border of West Amwell Township. Lambertville is home to 3,868 people within 1.25 square miles. It is bordered by the Borough of New Hope (PA) and the Township of Solebury (PA) to the west, by the Township of Delaware to the north, and the Township of West Amwell on the east and south.



Geology:

The borough lies in the Piedmont Plateau, which is part of the Appalachian Province. This area is characterized by nearly level lowlands, low hills and is underlain by sedimentary rocks. The elevations range from 40 feet at the Delaware River to 340 feet in the extreme southeastern corner of the city.

Hydrology:

The *Delaware River* flows along the western border of the City of Lambertville.

The *Swan Creek* (~3 mi² drainage area) flows northwest as it enters the city and joins the *Swan Creek Tributary* about 1,000 feet inside the city limits then flows west into the Delaware River. Swan Creek drains the southern part of the city. Both portions of these streams have steep channels with high velocities during flood events.

The *Alexauken Creek* (15 mi² drainage area) has its headwaters in the central part of West Amwell Township and flows generally west along the northern border of Lambertville to the Delaware River.

The *Ely Creek* is located to the northern part of Lambertville.

Recent Flood History:

Major flooding on the Alexauken Creek, Ely Creek and Swan Creek results from backwater from the Delaware River causing overflow in their lower reaches. They also occasionally experience flash flooding, which causes high channel velocities and resultant scour and erosion.

The municipality experienced major flooding events in September 2004, April 2005 and June 2006, resulting in millions of dollars of damage. The flooding of 2005 was 6" higher than the other two flooding events. The highest event in 2005 was estimated to be a 75 year flood event by the town's municipal engineer.

Lambertville was also affected by Tropical Storm Floyd in September 1999 which caused flooding to homes and businesses at the intersections of North Main Street and Elm and Buttonwood Streets. The Lambertville Public School was also affected and flood-proof doors have since been installed at the school. In addition, five dams were damaged upstream of Lambertville including Amwell Dam Nos. 1-3 on the Alexauken Creek and Lambertville Dam Nos. 1 and 2, which are part of the Lambertville water supply complex owned by United Water. Amwell Dams 2 and 3 have been rehabilitated, Lambertville Dam 2 will be rehabilitated, Lambertville Dam 1 will be removed, and Amwell Dam 1 will remain as a significant hazard dam. The 1999 flood also caused erosion along the creek banks; riprap along Alexauken Creek, gabion baskets with stone along Swan Creek, and the gabion retaining wall along the Union Fire House all required replacement.

During flooding events, Holcombe Island is inundated by waters from the Delaware River. The Delaware River then backs into Swan, Ely, and Alexauken Creeks, which then floods the basements and first floors of residential and commercial structures along Lambert Lane. In June 2006, debris impacted the Free Bridge, which inhibited movement of emergency services.

In 2001, NJDOT completed a flood control measure that included the installation of a large-diameter diversion pipe along Delaware Avenue to relieve flooding near and downstream from Lambertville Elementary School. Ely field is now utilized as a detention basin during high flow events. In addition, the junction at the eastern end of Delaware Avenue transitions into 2 tunnels which pass under the D&R Canal where the flow is then discharged to Island Creek and the Delaware River. This system requires frequent debris removal at the diversion structure and protects Buttonwood and Elm Streets and the Lambertville Public School.

Riverine flooding occurs along the Delaware River west of the Delaware and Raritan Canal. The Canal is elevated over the normal level of the river, and adjacent to the canal is a railroad track. The canal and railroad acts as a levee through the City, so from the treatment plant to Alexauken Creek there isn't overtopping from the Delaware River until waters rise higher than the 100-year flood. There exist two areas where these earthworks pass over creeks. Backup in water from the Delaware River prevents the creek waters from flowing out of the City resulting in backwater flooding along the Swan Creek (+3 mi² drainage area) and Alexauken Creek (15 mi² drainage area). A 1999 flood event, from Hurricane Floyd, was a Swan Creek only event; the Delaware River did not cause a problem. Nearby, Ely Creek (0.7 mi² drainage area) also floods. It flows between Alexauken and Swan Creeks and goes behind businesses and homes.

Flash flooding has occurred in the vicinity of the Elementary School along North Main Street. Additionally, flash flooding has been associated with hillside runoff. In both instances the hazards, vulnerability and potential mitigation measures have been studied by the City and selected mitigation measures have been funded or are scheduled in the next year or two. In the past, the area of the School has received additional drainage structures that have mitigated the problem to a great extent, but has not eliminated it entirely. Flooding in this area has an impact to the school and the adjacent roadway that impairs commerce and limits accessibility of the fire company equipment during times of flooding.

Unique Flood Risk to Municipality: None

Local Flood Mitigation Planning Committee:

David DelVecchio	Mayor
David Burd	OEM Coordinator
Alan Tamm	Absaroka Corporation (private contractor)
Paul Cronce	PWD Director/OEM Deputy Coordinator
John Miller	Planning Board Member
Allen Rowles	Construction Official
Matt Hartigan	Fire Chief
James Meehan	Sewerage Authority
Michael Burns	Historic Preservation Commission Chair
Caren Franzini	Flooded Property Owner
Bradley M. Campbell	Resident/Past NJDEP Commissioner
William Powell	Hunterdon County OEM Coordinator
Gregory Westfall	USDA NRCS Water Resource Planner
Bambi Kuhl	Social Services Director
Donna Drewes	Community Planner-Municipal Land Use Center at the College of New Jersey
Chad Brown	FEMA
William Millette	Hunterdon County Planning Board
Ken Bogen	Hunterdon County Planning Board

Ordinances/Plans Reviewed:

Master Plan, Annual Capital Improvement Plan, Flood Damage Prevention Ordinance, flood insurance studies, Emergency Operations Plan, Zoning Ordinance, Building Code, Stormwater Management Ordinance, existing land use maps, elevation certificates

Outreach:

Boy Scouts, Girl Scouts, Chamber of Commerce, Fire Department, Rescue Squads, various civic organizations, business owners, clergy and residents from different sections of the community, Princeton University, N.J. State Department of Environmental Protection, County Emergency Managers from more than a dozen different counties statewide, municipal, county and state-level police and fire department personnel, N.J. Department of Geologic Services, students at the College of New Jersey, The Municipal Land Use Center (a non-profit organization), Hunterdon County emergency management officials

First Public Meeting: 07/24/2006

Advertisement for Meeting:

The Beacon, Hunterdon County Democrat before meetings, public service announcements through local radio stations

Questionnaire Distribution:**Public Response:****Flood Mitigation Goals:**

1. Protect and promote public health and safety
2. Safeguard public essential facilities and infrastructure
3. Protect public and private property

4. Promote Lambertville’s economic vitality
5. Preserve the natural environment and promote human health

Lambertville Mitigation Action Plan:

1. ACTION: Install a backflow prevention device storm sewer behind CVS Pharmacy that surcharges adjacent to the Canal Studios building

Description/Background: When the Delaware River is above flood stage, Alexauken Creek back flows through a storm sewer system. The storm sewer system surcharges at an inlet adjacent to the Canal Studios building that is located on North Union Street, just south of an open lot and intersection with Cherry Street. This surcharge can be mitigated by the installation of a backflow prevention device. The City Council has authorized an engineering feasibility study to be performed to confirm that a backflow valve can be installed on an existing headwall at the discharge of the storm sewer system. The City has also authorized a consultant to prepare a HMGP application as per the instruction of the State Hazard Mitigation Officer.

Hazard: Flooding

Existing or new assets: Existing

Existing mechanism through which action will be implemented: TBD

Responsible Organization: City Council

Target Completion Date: Feasibility study: March 2007; HMGP application: June 2007; Installation pending approval

Estimated Cost: Estimated \$75,000

Potential Funding Sources: Hazard Mitigation Grant Program, City

Priority: High

2. ACTION: Install backflow prevention device within Niece Lumberyard to mitigate backflow of Ely Creek

Description/Background: The storm sewer system that feeds Ely Creek surcharges to North Union Street when the Delaware River is above flood stage. This floods the residential and commercial area bounded by the canal, Arnett Avenue and Cherry Street. The area has a combination of residential and commercial properties. It is believed that the surcharge can be mitigated by the installation of a backflow prevention device within the Niece Lumberyard and a portable pump. The City of Lambertville City Council has authorized an engineering feasibility study to be performed to confirm that a flood gate can be installed on an existing headwall within the Niece Lumberyard. The City has also authorized a consultant to prepare a HMGP application as per the instruction of the State Hazard Mitigation Officer.

Hazard: Flooding

Existing or new assets: Existing

Existing mechanism through which action will be implemented: TBD

Responsible Organization: City Council

Target Completion Date: Feasibility study: March 2007; HMGP application: June 2007; Installation pending approval

Estimated Cost: \$120,000

Potential Funding Sources: Hazard Mitigation Grant Program, City

Priority: High

3. ACTION: Install flood gate and lift station at Swan Creek

Description/Background: Swan Creek surcharges onto North Union Street and vicinity when the Delaware River is above flood stage causing flooding of the residential and commercial area. The area impacted is bounded by the canal to the west, Ferry Street to the north, South Main Street to the east and Mount Hope Street to the south. The area is mostly residential with some commercial zone including a drycleaner. Critical infrastructure to the west of South Union Street includes a wastewater pumping station and the Justice Center where the City has board meetings and municipal court. It is believed that the surcharge can be mitigated by the installation of a flood gate and lift station. The City commissioned a study of the back-flooding by the United States Department of Agriculture - Natural Resources Conservation Service (NRCS). The objective of the study was to provide technical assistance for determining elevations of existing flood-prone structures as well as to preliminarily review hydrology and hydraulics alternatives of flood mitigation. Tentatively, the NRCS has confirmed that a flood gate and lift station will work to prevent the back-flooding of the Delaware River and de-water the local runoff from the relatively small (3.43 square miles) Swan Creek watershed. Coordination with the New Jersey Water Supply Authority is ongoing since the overflow from the canal must be diverted to reduce the size of the pump station. The City is meeting with the Authority and NRCS to see if the wasting of the canal can be relocated or modified. The City has also authorized a consultant to prepare a PDM application. Detailed licensing and design has begun.

Hazard: Flooding

Existing or new assets: Existing

Existing mechanism through which action will be implemented: TBD

Responsible Organization: City Council

Target Completion Date: Study: March 2007; other dates pending NJWSA and PDM program

Estimated Cost: \$8,000,000

Potential Funding Sources: Pre-Disaster Mitigation Grant Program, City

Priority: High

4. ACTION: Study of sanitary sewerage backflow during flooding events

Description/Background: The City believes that a study of the potential backflow of the sanitary sewer during a flood would be wise.

Hazard: Flooding

Existing or new assets: Existing

Existing mechanism through which action will be implemented: TBD

Responsible Organization: Lambertville Sewer Authority

Target Completion Date: TBD

Estimated Cost: \$500,000

Potential Funding Sources: Pre-Disaster Mitigation Grant Program, Lambertville Sewer Authority

Priority: High

5. ACTION: Assist residents and business owners with elevation applications

Description/Background: The City of Lambertville City Council is aware that a structural

solution may not exist specifically along Lambert Lane. The City will help residents and businesses with applications to elevate buildings if deemed feasible.

Hazard: Flooding

Existing or new assets: Existing

Existing mechanism through which action will be implemented: TBD

Responsible Organization: City Council

Target Completion Date: TBD

Estimated Cost: \$250,000

Potential Funding Sources: Pre-Disaster Mitigation Grant Program, Repetitive Flood Claim Losses

Priority: High

6. ACTION: Analyze properties north of Cherry Street for structural elevation
Description/Background:

Hazard: Flooding

Existing or new assets: Existing

Existing mechanism through which action will be implemented: TBD

Responsible Organization: City Council

Target Completion Date: TBD

Estimated Cost: TBD

Potential Funding Sources: TBD

Priority: Medium

Lebanon Township, Hunterdon County:

Location:

Lebanon Township is located in mountainous northern Hunterdon County. Lebanon's 31.72 square miles is home to 5,816 people.

Lebanon Township is bordered by Morris Township to the northeast, Tewksbury Township and the Borough of Califon to the southeast, Clinton Township and the Borough of High Bridge to the south, Union and Bethlehem Townships to the southwest, the Boroughs of Glen Gardner and Hampton to the west, and the Townships of Mansfield and Washington to the northwest.



Geology:

The township is located in the New England Uplands province (Highlands of New Jersey, locally known). The area is moderately rugged and characterized by approximately parallel, somewhat irregular ridges intervening valleys all trending northeast. The township is underlain by carbonates, shale and some glacial till. The soils in this area are deep and mostly well drained, moderate sloping and rocky. The ridges in the township rise 500 to 1,000 feet above the valley floor.

Hydrology:

Only the northern portion of the township lies in the Delaware River Basin, as it is drained to the *Musconetcong River* which comprises its western border. The Musconetcong River originates at Lake Hopatcong and flows northwest. After flowing through Lake Musconetcong, the river flows southwest forming the border of Hunterdon and Warren counties and joins the Delaware River in Reigelsville, New Jersey. This river flows through the northern and eastern portions of the township.

The rest of the waterways in Lebanon Township drain to the Raritan River Watershed.

The *Rocky Run* and *Willoughby Creek* both have their confluence with the Spruce Run. The *Spruce Run* begins in the north central part of the township and flows southwest to its confluence with the Spruce Run Reservoir.

The *South Branch* of the Raritan River and one of its tributaries, the *Little Brook*, flow through the southeastern portion of the Township.

Recent Flood History:

Lebanon Township was affected by the September 2004 and September 1999 flood events. Minor road damage along Hollow Road and River Road was incurred during the 2004 storm. In 1999, less than 10 homes sustained minor basement flooding. No essential facilities were affected.

Unique Flood Risk to Municipality: None

Local Flood Mitigation Planning Committee:

Warren Newman	Floodplain Administrator
Steve Reisse	Engineer
Warren Gabriel	OEM Coordinator
Ed Post	Mayor

Ordinances/Plans Reviewed:**Outreach:**

First Public Meeting: May 16, 2007

Advertisement for Meeting: *Hunterdon County Democrat*

Questionnaire Distribution: Mail

Public Response:

1. Wanted to find out if the plan affected their flood insurance and how
2. Advised that storms caused minimal damage to their properties

Flood Mitigation Goals:

1. To be prepared for the future should the need arise

Lebanon Mitigation Action Plan:**1. ACTION: Public education**

Description/Background: The township wants to enhance public awareness through information portals, including the township newsletter and website. It also would like to

investigate potential public outreach opportunities with a cooperative effort between Lebanon Township and the Musconetcong Watershed Association.

Hazard: Flooding

Existing or new assets: Existing

Existing mechanism through which action will be implemented: TBD

Responsible Organization: Township of Lebanon

Target Completion Date: January 2008

Estimated Cost: Minimal Direct Cost

Potential Funding Sources: Township of Lebanon

Priority: Medium

Milford Borough, Hunterdon County:

Location:

The Borough of Milford is located on the western border of central New Jersey in northwestern Hunterdon County. It is bordered by Bridgeton Township (PA) to the west, Alexandria Township to the south, and Holland Township to the north and east.



Geology:

The borough lies in the Piedmont Plateau, which is part of the Appalachian Province. This area is characterized by nearly level lowlands, occasional ridges and low hills, and is underlain by sedimentary rock. Elevations range from 95 feet at the Delaware River to 440 feet in the northwestern part of the borough. Elevations along the Delaware are higher in Milford than across the river in Pennsylvania.

Hydrology:

The *Delaware River* flows along the western border of the Borough of Milford.

The *Harihokake Creek* has its headwaters in Alexandria and flows generally southeast into the Borough of Milford, where it empties into the Delaware River.

The *Quequacommisacong Creek* begins in Eastern Holland Township and flows southward into the Borough and empties into the Harihokake Creek.

Recent Flood History:

Milford Borough was affected by the June 2006 and April 2005 flooding events. During the events, the Delaware River, Quequacommisacong *Creek*, and Harihokake Creek flooded Water Street, York Street, Carpenter Street, Spring Garden Street, and Railroad Avenue. Residential, commercial, and government properties became inundated with water. The Milford Sewerage Treatment Plant's lift station and chlorination chamber was damaged.

Since the floods, one property has been elevated by the homeowner. Milford Borough wants

to continue maintenance of local streams and the banks of the Delaware River to prevent debris from blocking the waterways.

Unique Flood Risk to Municipality: The sewer plant is located in the flood area in the borough, will review again after public meeting and surveys are received.

Local Flood Mitigation Planning Committee:

James Gallos	Mayor
Henri Schepens	OEM Coordinator
John Phillips	Council
Larry Lutz	EMS
Douglas Sloyer	Fire Department
Greg Romeo	School Board
Lori Laughton	OEM
Mike Giannone	Fire Official
Rick Aller	OEM
Greg MacTye	GSUWR
Dr. Debra Curry	OEM

Ordinances/Plans Reviewed:

Outreach:

First Public Meeting: 10/1/07

Advertisement for Meeting: Delaware Valley News 9/20/07 and Milford Web site

Questionnaire Distribution: Mailing

Public Response:

Flood Mitigation Goals:

1. To prevent future damage and flood proof the sewage treatment plant's lift station and chlorination chamber
2. To continue maintenance of local streams and the banks of the Delaware River to prevent debris from blocking the waterways

Milford Mitigation Action Plan:

1. ACTION: Wet well

Description/Background:

Hazard: Flooding

Existing or new assets: Existing

Existing mechanism through which action will be implemented: None

Responsible Organization: Borough of Milford

Target Completion Date: 2009

Estimated Cost: Currently researching costs

Potential Funding Sources: Grants

Priority: Medium

Raritan Township, Hunterdon County:

Location:

Raritan Township is located in central Hunterdon County and is home to 19,809 people. It is bordered by the Township of Clinton to the north, the Townships of Readington and Hillsborough to the east, the Township of East Amwell to the south, and the Townships of Franklin and Delaware to the west. The township encompasses 37.91 square miles. Only the northwestern portion of this township, approximately 4.82 miles, is drained by the Delaware River.



Geology:

The township lies in the Piedmont Physiographic Province. The underlying rock is primarily Brunswick shale. The elevations range from 100 feet at its eastern border to 625 feet in the northern part of the township.

Hydrology:

Over 85% of Raritan drains to the Raritan River Watershed, but a small northwestern portion of the township drains to the Delaware River. The upper reaches of the *Wickecheoke River* and *Plum Brook* flow through the Township. These are both tributaries to the Delaware.

The remaining portion of Raritan Township is located within the Raritan River Basin and includes the *Neshanic River* and its 3 tributaries, as well as *Walnut Brook* that drain to Neshanic.

The *South Branch of the Raritan River* forms the western boundary of the township. Tributaries to the South Branch in Raritan Township, from north to south, include the *Assiscong River*, the *Minneaconing Creek*, and the *Bushkill Brook*.

Recent Flood History:

Raritan Township was affected by the June 2006, April 2005, September 2004, and September 1999 flood events. During these events, no developed land was affected, but Wickecheoke Creek, Plum Brook, South Branch of the Raritan River and its tributaries flooded. Street flooding denied vehicular access in 5 locations along the Wickecheoke Creek, 1 on Plum Brook, and 11 locations along the Neshanic River. More specifically, Kuhl Road, Hampton Corner Road, Plum Brook Road, Sam Levine Road, Old Croton Road, Oak Grove Road, Dayton Road, and areas near 202 flooded. Road, culvert, and bridge repair and debris clean-up were the only impacts on the city infrastructure.

Unique Flood Risk to Municipality: None

Local Flood Mitigation Planning Committee:

Thomas Camporeale	OEM Coordinator
Don Gootee	OEM
Allan Pietrefesa	Twp. Administrator
Fred Coppola	Engineer
Dirk Struening	Director of Public Works

Ordinances/Plans Reviewed:

Stormwater Management Ordinance and plan, existing FEMA studies, floodplain maps

Outreach: None

First Public Meeting: 8/23/2007

Advertisement for Meeting: 08/15/2007 Hunterdon County Democrat

Questionnaire Distribution: Township Web site

Public Response: None

Flood Mitigation Goals:

1. Preservation of Open Space that includes areas in the floodplain
2. Attempt to limit impervious cover
3. Eliminate flooding for emergency access purposes
4. Take as many steps as environmentally possible to reduce roadway flooding by proper maintenance of infrastructure

Raritan Mitigation Action Plan:**1. ACTION: Kuhl Road elevation**

Description/Background: The mitigation action would be road elevation to alleviate flooding. Flooding prevents vehicular traffic which includes emergency vehicles.

Hazard: Flooding

Existing or new assets: Existing

Existing mechanism through which action will be implemented: Capital improvement

Responsible Organization: Township of Raritan, County

Target Completion Date: 2009

Estimated Cost: \$1,500,000

Potential Funding Sources: Flood mitigation assistance program

Priority: High

2. ACTION: Copper Hill Road elevation and bridge replacement

Description/Background: The mitigation action would be roadway elevation and bridge replacement. Flooding prevents vehicular traffic which includes emergency vehicles.

Hazard: Flooding

Existing or new assets: Existing

Existing mechanism through which action will be implemented: Capital improvement

Responsible Organization: Raritan Township, County

Target Completion Date: 2010

Estimated Cost: \$280,000

Potential Funding Sources: Flood mitigation assistance program

Priority: High

3. ACTION: Hampton Corner Road elevation and bridge replacement

Description/Background: This project would require roadway elevation and bridge replacement. Flooding prevents vehicular traffic which includes emergency vehicles.

Hazard: Flooding

Existing or new assets: Existing

Existing mechanism through which action will be implemented: Capital improvement

Responsible Organization: Raritan Township, County

Target Completion Date: 2009
Estimated Cost: \$330,000
Potential Funding Sources: Flood mitigation assistance program
Priority: High

Stockton Borough, Hunterdon County:

Location:

The Borough of Stockton is a small community of 560 people within a 0.60 square mile area. The borough is located in southwestern Hunterdon County and is bordered by the D&R Canal and Delaware River to the south and southwest, the Wickecheoke Creek to the northwest, and Delaware Township everywhere else. It is bordered by Solebury Township (PA) to the west.



Geology:

The borough lies in the Piedmont Plateau, which is part of the Appalachian Province. This area is characterized by nearly level lowlands, occasional ridges and low hills, and is underlain by shale. The relatively flat topography of the river terrace is found in the southern portion of the borough and adjacent to the Delaware River.

Hydrology:

The *Delaware River* flows along the southern border of the Borough of Stockton.

The *Brookville Creek* is located in the southwestern part of the township and flows southwest to its confluence with the Delaware and Raritan Canal. The last 2,500 feet of the stream forms the southeastern corporate limits with the Borough of Stockton and the Township of Delaware.

The *Wickecheoke Creek* has its headwaters in the Township of Raritan and flows generally southwest.

The *Brookville Creek* is located in the southwestern part of the township and connects with the D&R Canal.

Recent Flood History:

Stockton was impacted by the June 2006 and the April 2005 flooding events. June 2006, the Delaware River and its local tributaries encroached into more than 100 residents' basements and over 50 residents' first floors. The average assessed value of the homes was \$300,000 and the homes were 50 to 100 years old. The flood cost the borough \$65,000 in public damage and residents and business costs were estimated at \$2,000,000, much of which was reimbursed by FEMA and insurance. During the June 2006 flood the canal wall breached in town at the south end of Mill Street.

During the April 2005 flood the canal wall north of town (just south of the Prallsville Mill) breached. The canal wall also breached south of Mill Street. The April 2005 event caused more damage than the 2006 event. In 2005, 25% to 50% of the borough was affected. Over 150 residential and commercial structures sustained basement damage and over 100 residential and commercial structures sustained first floor damage. The flood cost the borough about \$85,000. \$45,000 was reimbursed by FEMA and the rest is being paid for by a tax increase. It is estimated that residents and businesses incurred a \$7,000,000 loss collectively, which was mostly reimbursed by insurance.

The Stockton Fire Department located on Mill Street has had first floor damage as a result of the floods of 2005 and 2006.

The sewage pump station was inundated with flood waters in 2005 and 2006 and the electrical and mechanical systems had to be replaced. Sewage is normally pumped to Lambertville for treatment.

The September 2004 flood only affected one residence in Stockton.

Flood Mitigation:

There are 2 homes that have been elevated by residents at a cost of more than \$100,000/each.

Unique Flood Risk to Municipality: The D&R Canal is a feeder branch to the main canal, which NJWSA uses to supply water to other parts of New Jersey. NJDEP, Parks & Forestry owns the canal. The NJ Water Supply Authority is responsible for maintenance of the canal, including breaches. The levee can adequately hold in the canal water, but the outer wall tends to fail against flooding pressure from the Delaware River. This occurred during 1955, as well as, the 2005 and 2006 storms. The canal has been repaired, since the recent storm events, to the pre-existing wall elevations. Each repair cost NJWSA about \$500K, of which the 2006 repairs were partially reimbursed by FEMA. Everything within 300' of the 170 year old D&R Canal is affected by its historic designation (essentially, from Route 29 to the Delaware River). The municipality would like to shore up the walls of the D&R Canal, so that the potential for flooding would be less.

Stockton OEM notifies all residents in danger of flooding by going door-to-door. The Stockton Fire Department is located on Mill Street and has had first floor damage as a result of the floods of 2005 and 2006.

Local Flood Mitigation Planning Committee:

Michael Hagerty	Council President
Andrew Giannattasio	Councilman
Greg Cook	OEM Coordinator
Robert Miller	Floodplain Administrator
Robert Ent	Sewer and Water Supervisor
Tom Manning	Planning Board Chair
Bill Lowry	Environmental Commission Chair
Denis O'Neal	Borough Engineer

Ordinances/Plans Reviewed:

Lambertville’s plan, FEMA information, Hopewell Township’s plan

Outreach: NJWSA, Delaware River Mill Society

First Public Meeting: 11/20/2007

Advertisement for Meeting: 11/08/07 editions of the Lambertville Beacon and the Hunterdon County Democrat

Questionnaire Distribution: Hand delivered to residents in the floodplain

Public Response:

1. Of the 30 responses, all but 2 had suffered some kind of flood damage, most of it in the floods of 2005 and 2006. Nine of those having flood damage had damage as far back as the flood of 1955. Almost everyone had flood damage to their basements and about 50% of them had first floor damage, of those three received substantial damage (foundation walls where blown in). The cost of the damage varied from \$1,000.00 to \$165,000.00.
2. All but 4 of the respondent's have flood insurance that covered some but not all of the cost of the repairs.
3. The question of whether or not they would be characterized by FEMA as repetitive or severe repetitive loss properties seemed to not be understood as 6 said yes, 12 said no and 12 said they don't know.
4. Almost all would like to elevate their mechanical equipment, but only 3 said they were interested in elevation of their houses. Only 2 said they would be interested in acquisition.
5. They seemed unanimous in the desire to see the level of the reservoirs better controlled by some tri-state agency and the river wall of the canal either raised or maintained because it acts as a levy in protecting the borough.

Flood Mitigation Goals:

1. Inform residents of the flood prevention and mitigation measures and property acquisition options available to them.
2. Prepare systems and procedures for the Borough’s response to future flooding.
3. Work with NJWSA and neighboring communities to insure that existing flood prevention systems are working.
4. Reach out to state and federal agencies for funding options.

Stockton Mitigation Action Plan:**1. ACTION: Public awareness program**

Description/Background: Update the flood mitigation plan as information presents itself. Update existing flood plain ordinances so that they continue to manage the development in the flood plain. Distribute flood mitigation material to residents as it becomes available. Update our handouts and procedures so that we are better prepared when the next flood comes. Create and maintain a database showing the history of effected properties and any improvements to those properties. Seek to identify funding and alternative revenue sources to address the identified plan goals.

Hazard: Flooding

Existing or new assets: Existing/New

Existing mechanism through which action will be implemented: NA

Responsible Organization: OEM
Target Completion Date: 1 year
Estimated Cost: \$500
Potential Funding Sources: County, State
Priority: Medium

2. ACTION: Relocate Fire Department

Description/Background: The fire department is located on Mill Street and has had first floor damage as a result of the floods of 2005 and 2006. The Stockton Fire Department is a private, non-profit organization that owns only the land that the fire department is presently on. Furthermore, the borough has no open land that it owns that is not in the flood plain. We have joint ownership with the state of a large tract of land that, per our agreement with the state, can only be used for passive recreation and does not allow for any building.

Hazard: Flooding

Existing or new assets: Existing

Existing mechanism through which action will be implemented: Master Plan

Responsible Organization: Planning Board

Target Completion Date: 2 years

Estimated Cost: \$750,000

Potential Funding Sources: FEMA, Capital Improvement Fund

Priority: Medium

3. ACTION: Flood proof Borough Hall

Description/Background: Borough Hall is located on South Main Street and suffered only basement flooding from the floods of 2005 and 2006. It did have about 1 foot of water on the first floor during the flood of 1955. As of now, we do not have a historic district in the borough, but we have had discussion at the Planning Board level on the pros and cons of creating them. If that was to happen, then Borough Hall would be in one of those districts. We are creating a plan to move our mechanical equipment and archival storage to the second floor which is above the flood hazard zone.

Hazard: Flooding

Existing or new assets: Existing

Existing mechanism through which action will be implemented: Capital Improvement Plan

Responsible Organization: Floodplain Administrator

Target Completion Date: 2 years

Estimated Cost: \$25,000

Potential Funding Sources: FEMA, Capital improvement Fund

Priority: Low

4. ACTION: Residential property acquisition

Description/Background: Based on our survey and face to face discussions, we have about 5 residents that would be interested in property acquisition if the monies work out. All of these properties are located on Mill Street and would be considered severe repetitive loss properties.

Hazard: Flooding

Existing or new assets: Existing

Existing mechanism through which action will be implemented: Floodplain Management Plan

Responsible Organization: Floodplain Administrator

Target Completion Date: 1 year

Estimated Cost: \$1,000,000

Potential Funding Sources: FEMA, Greenacres

Priority: High

5. ACTION: Flood proof sewer pump station

Description/Background: During the floods of 2005 and 2006, the sewer pump station filled with flood water. We have a plan in place that we hope to find funding for in 2008 to install a sluice gate.

Hazard: Flooding

Existing or new assets: Existing

Existing mechanism through which action will be implemented: Capital Improvement Plan

Responsible Organization: Sewer Authority

Target Completion Date: 6 months

Estimated Cost: \$25,000

Potential Funding Sources: Capital Improvement Fund

Priority: High

6. ACTION: Levee (river wall) improvement plan

Description/Background: The river wall that is part of the DRCC canal is higher than most of the land in the flood plain. The borough flooded during the 2005 and 2006 floods because the wall breached. Until it breached, the wall acted as a levy in protecting the borough from the river's flooding.

Hazard: Flooding

Existing or new assets: Existing

Existing mechanism through which action will be implemented: NA

Responsible Organization: Governing body

Target Completion Date: 1 year

Estimated Cost: \$5,000,000

Potential Funding Sources: NJWSA, Army Corps of Engineers

Priority: High

7. ACTION: Backflow prevention on storm drain outlets

Description/Background: We have 2 outlets into the canal that effect flooding in the borough. When the canal fills up, the storm drains backup and flood North and South Railroad Avenues.

Hazard: Flooding

Existing or new assets: Existing

Existing mechanism through which action will be implemented: Storm Water Management Plan

Responsible Organization: Storm Water Management Coordinator

Target Completion Date: 1 year
Estimated Cost: \$50,000
Potential Funding Sources: FEMA, Capital Improvement Fund
Priority: Medium

West Amwell Township, Hunterdon County:

Location:

West Amwell Township is a rural community of 2,383 people within 21.9 square miles. The township is located in southwestern Hunterdon County and serves as the border between Hunterdon and Mercer Counties. It is bordered by Solebury Township (PA) and New Hope (PA) to the west, Delaware Township and Lambertville to the north, East Amwell Township to the north and east, and Hopewell Township to the south and east.



Geology:

The township lies in the Piedmont Plateau, which is part of the Appalachian Province. This area is characterized by nearly level lowlands, occasional ridges and low hills, and is underlain by sedimentary rock. The relatively flat topography of the river terrace is found along the Delaware River. Elevations range from 28 feet at the Delaware River to 475 feet in the northeast part of the township.

Hydrology:

The *Delaware River* flows along the western border of West Amwell Township.

The *Swan Creek* has its headwaters in the central part of the Township and flows through the City of Lambertville to its confluence with the Delaware.

The *Alexauken Creek* has its headwaters in the northeastern part of the township of West Amwell and flows generally northwest to a point just south of the center of the township's northern boundary. From this point, it flows southwest to its confluence with the Delaware River. The creek also forms part of the border between West Amwell Township and Lambertville. This creek drains the northwestern portion of West Amwell Township.

The *Moores Creek* flows through the southern part of the Township and, after passing through Hopewell Township in Mercer County, empties into the Delaware River.

Recent Flood History:

The majority of the township is unaffected by flooding due to its elevation, although there are a few repetitive loss properties in West Amwell near Swan Creek.

Unique Flood Risk to Municipality:

West Amwell Township has little risk of flood impacts, but 3 significant streams flow into the

Delaware River, which could add to problems downstream. West Amwell is interested in reducing the amount of runoff entering these streams and exacerbating problems in communities along the Delaware.

Local Flood Mitigation Planning Committee:

Ron Shapella	Mayor
Harry Heller	Township OEM Director
Lora Olsen	Township Clerk

Ordinances/Plans Reviewed:

Stream Corridor Ordinance - buffer inclusive of all 100-year floodplains, 150-foot buffer for major development, FEMA 100 and 500 year floodplain maps

Outreach: Stonybrook Millstone Watershed Association

First Public Meeting: 10/17/2007

Advertisement for Meeting:

Questionnaire Distribution: Local volunteers

Public Response: None

Flood Mitigation Goals:

1. Preserve open space and farmland

West Amwell Mitigation Action Plan:

1. ACTION: Preserve open space and farmland

Description/Background: There are significant developable areas along Alexauken Creek (C1), Moores Creek (TM) and Swan Creek. Preserving these areas from development would reduce potential flood damage that might occur to these areas in the future.

Hazard: Flooding

Existing or new assets: New and Existing

Existing mechanism through which action will be implemented:

Responsible Organization: To be determined

Target Completion Date: To be determined

Estimated Cost: To be determined

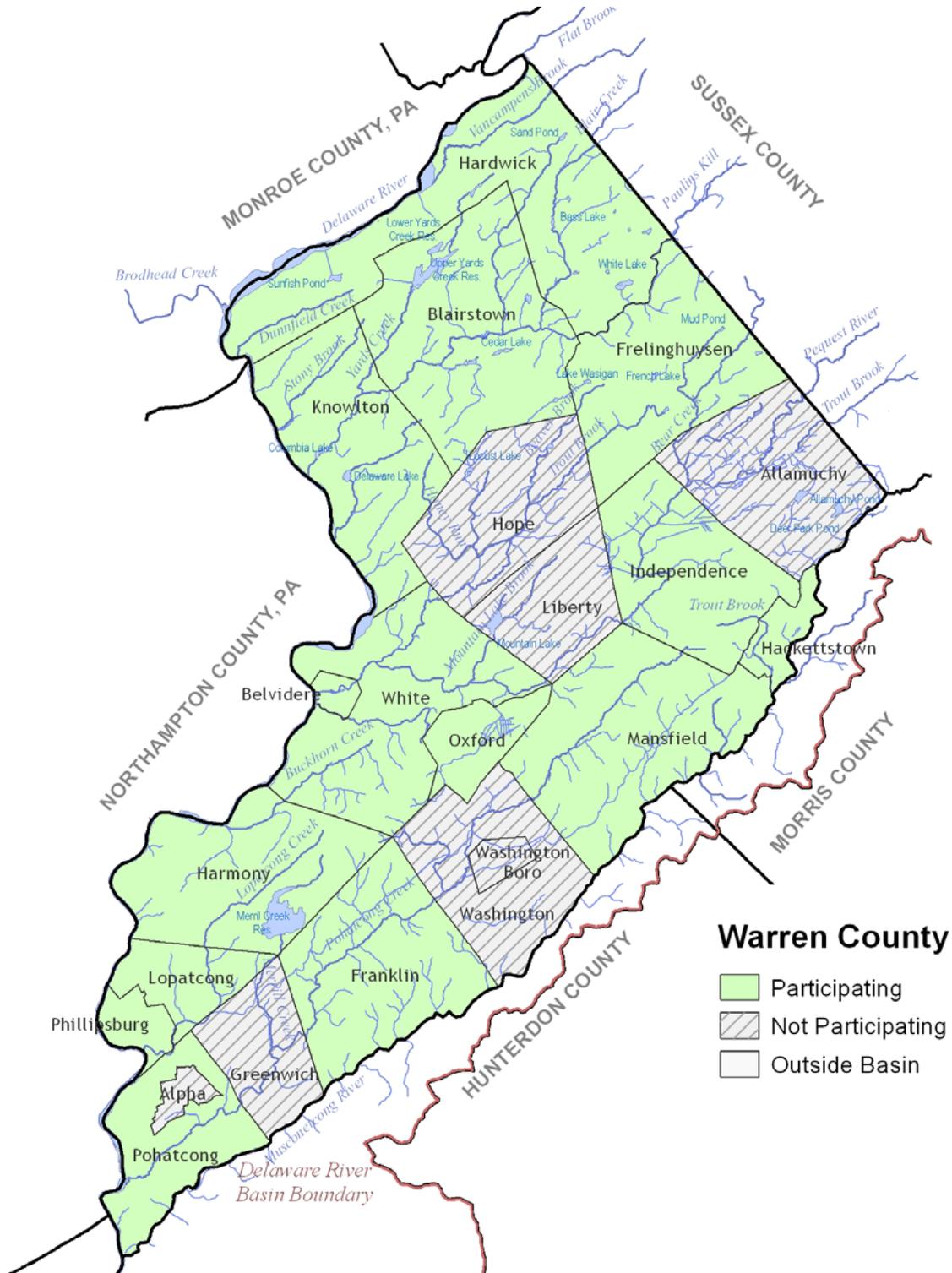
Potential Funding Sources: To be determined

Priority: Medium

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Warren County:

Participating municipalities in Warren County include Belvidere, Blairstown, Franklin, Frelinghuysen, Hackettstown, Hardwick, Harmony, Independence, Knowlton, Lopatcong, Mansfield, Oxford, Phillipsburg, Pohatcong and White.



Warren County was affected by the flood events in June 2006, April 2005, September 2004, and September 1999. Numerous county roads, bridges, and culverts sustain major damage during flooding events and limits emergency service access. Three county facilities are impacted by flooding: the Prosecutor's Office at Prospect and Water Street in Belvidere, which is impacted by the Pequest River; the Warren County Nutrition Program building in Blirstown Township, which is impacted by the Paulinskill River, and the ECHO residence in Stewartsville, which is impacted by the Pohatcong Creek. These buildings become uninhabitable during a flood event until the waters recede and the building cleaned. After flooding events, the county responds to a tremendous influx of solid waste that is disposed of at the county landfill. In addition, stream bank erosion, debris left in the river, and water pollution caused by household heating oil tanks are significant environmental impacts.

Warren County provides Reverse 911 service for its municipalities and has educated the public how to proceed and where to go if there is an anticipated flood. Before a predicted flood event, the county makes contact with NJSP/NJOEM and begins to **pre-stage assets**. The county also updates local coordinators with timely information and anticipated flooding levels. During a flood event, the county responds to and assists the municipalities with evacuations and opening shelters. The county contacts the Red Cross and the Salvation Army and continues to communicate with the state through phone and E-Team, an emergency response and incident management software. The county also assists the local coordinators with obtaining any equipment and assets to ensure safety and survival. After a flooding event, the county helps municipalities transition back into normal operation by closing shelters, assisting with the preliminary damage assessments, and if a disaster is declared, assist with the official walk through.

Warren County has open space acquisition/preservation and stormwater regulations in place to help mitigate flooding, but these policies do not entirely prevent the floodwaters. Warren County works closely with NJOEM during flood events, and reaches out to FEMA for financial assistance, NJSP/OEM for manpower assistance, and the ACE to conduct a study of the Delaware River. The county has previously received money from FEMA's Public Assistance Grant Program to rebuild county infrastructure after flooding events. **Uniquely, the Delaware River pushes the Pequest backwards so that even though the flood stage is 22 feet in Belvidere, "we" begin to flood at 16 feet.**

Warren County is interested in pursuing several mitigation actions. There are several high hazard dams in Warren County that need to be repaired including Bass Lake Dam in Hardwick Township and Blair Lake Dam in Blirstown Township. The county would also like to see the lower Pequest Dam north of the Delaware River decommissioned. Through the New Jersey Blue Acres program, the county hopes to assist municipalities in acquiring residences within the floodplain.

County Mitigation Statement:

Warren County pledges to support the mitigation goals and actions of their municipalities to the best of their ability.

County Mitigation Actions:

1. ACTION: Desnag the Pequest, Paulinskill, and Delaware River

Background:

Hazard: Flooding

Existing or new assets:

Existing mechanism through which action will be implemented:

Responsible Organization: NJDEP

Target Completion Date: 2012

Estimated Cost: Unknown

Potential Funding Sources: Grant

Priority: Medium

2. ACTION: Decommission the Lower Dam of the Pequest River

Description/Background:

Hazard: Flooding

Existing or new assets:

Existing mechanism through which action will be implemented:

Responsible Organization: NJDEP

Target Completion Date: 2015

Estimated Cost: Unknown

Potential Funding Sources: Unknown

Priority: High

3. ACTION: Dredge lower portion of the Pequest River

Description/Background:

Hazard: Flooding

Existing or new assets:

Existing mechanism through which action will be implemented:

Responsible Organization: NJDEP, ACE

Target Completion Date: 2015

Estimated Cost: Unknown

Potential Funding Sources: Unknown

Priority: Medium

Mitigation Action Plan of Participating Jurisdictions for Warren County

Jurisdiction	Page Number	Status
Warren County	193	3 actions submitted
Belvidere Township	200	6 actions submitted
Blairstown Township	204	6 actions submitted
Franklin Township	208	2 actions submitted
Frelinghuysen Township	209	4 actions submitted
Town of Hackettstown	212	2 actions submitted
Hardwick Township	214	2 actions submitted
Harmony Township	215	1 action submitted
Independence Township	218	2 actions submitted
Knowlton Township	220	2 actions submitted
Lopatcong Township	222	1 action submitted
Mansfield Township	225	1 action submitted
Oxford Township	227	2 actions submitted
Town of Phillipsburg	230	5 actions submitted
Pohatcong Township	234	8 actions submitted
White Township	238	3 actions submitted

Warren County: Municipal Mitigation Actions by Action Category

1. Prevention (Policy/Ordinances/Studies/Enforcement)				
Municipality	Mitigation Action	Responsible Party	Estimated Cost	Priority
Belvidere Township	Decommission lower dam	TBD	To be determined	Medium
Blairstown Township	Change ordinance to request BFE of at least one foot above	Blairstown Township	\$100	High
Frelinghuysen Township	Maintenance of stormwater facilities (non-functioning retention pond)	To be determined	To be determined	TBD
Warren County	Decommission the Lower Dam of the Pequest River	NJDEP/USACE	Unknown	High
Pohatcong Township	Adopt new flood damage prevention ordinance	Township Council	\$5,000.00	High
Pohatcong Township	Review development ordinances including density of development and stormwater management requirements	Land Use Board and Township Council	\$5,000.00	Medium
2. Property Protection (Acquisition, Elevation or Flood proofing)				
Municipality	Mitigation Action	Responsible Party	Estimated Cost	Priority
Belvidere Township	Elevation	TBD	To be determined	High
Blairstown Township	Elevate utilities in homes in flood prone areas	Homeowners	5,000 to 10,000 per home	High
Frelinghuysen Township	Analyze the properties in a portion of town for structural elevation	TBD	To be determined	TBD
Frelinghuysen Township	Elevation of flood-prone structures	TBD	To be determined	TBD
Harmony Township	Acquire 10 properties on Goat Farm Road	Township Committee	\$2,500,000	High
Knowlton Township	Mitigation of Severe Repetitive Loss Properties	Knowlton Township	To be determined	High
Knowlton Township	Elevate utilities and secure oil tanks	Property owners	To be determined	High
Independence Township	Assess elevations of critical facilities identified as being within the 100 year floodplain of the Pequest River	Township Committee	\$10,000	Medium
Oxford Township	Assess elevations of critical equipment in the wastewater treatment plant and plan corrective action	PRMUA	\$10,000 (assessment)	Medium
Pohatcong Township	Elevation of flood-prone residences	Property owners	\$50,000 - \$100,000 per structure	High
3. Public Information and Awareness				
Municipality	Mitigation Action	Responsible Party	Estimated Cost	Priority
Hardwick Township	Education through seminars and discussions	TBD	To be determined	Medium

4. Emergency Services				
Municipality	Mitigation Action	Responsible Party	Estimated Cost	Priority
Allamuchy Township	Create an emergency plan in case of dam failure or an uncontrolled release of stored water	TBD	To be determined	High
Hardwick Township	Continue Early Warning by use of Emergency Operation Plan	OEM	To be determined	High
White Township	Early Warning	Township	\$15,000	High
5. Natural Resource Protection (Floodplain protection, Stream Corridor Restoration, Open space)				
Municipality	Mitigation Action	Responsible Party	Estimated Cost	Priority
Belvidere Township	Reroute creek banks to channel water away from residential areas	TBD	To be determined	TBD
Belvidere Township	River and creek bank replacement	TBD	To be determined	TBD
Belvidere Township	Dredging	TBD	To be determined	TBD
Blairstown Township	Removing debris along Paulinskill River	DPW and DEP	\$100,000.00	High
Franklin Township	Remove debris from the Musconetcong and other waterways	NJDEP	\$100,000	Medium
Hackettstown	Remove downed trees and debris from Musconetcong and small streams.	Hackettstown OEM	To be determined	Low/ Medium
Independence Township	Remove debris from sections of the Pequest	NJDEP	\$100,000	High
Mansfield Township	Remove or thin out debris on Musconetcong River	TBD	To be determined	TBD
Pohatcong Township	Landscape Block 97, Lots 53 & 54 which are in the riparian zone of the Delaware River	Rutgers Forest Restoration Program	\$20,000	Low
Warren County	Dredge lower portion of the Pequest River	NJDEP/USACE	Unknown	Medium
Warren County	Desnag the Pequest, Paulinskill, and Delaware River	NJDEP	Unknown	Medium
White Township	Remove debris from tributaries	DEP, DPW	\$100,000	High
White Township	Keep entrance from tributaries to the Delaware River clear to prevent backup	DEP, federal	\$100,000	High

6. Structural Projects				
Municipality	Mitigation Action	Responsible Party	Estimated Cost	Priority
Belvidere Township	One-way valve	To be determined	To be determined	TBD
Belvidere Township	Reroute creek banks	To be determined	To be determined	TBD
Blairstown Township	Install backflow suppressors	DPW	\$20,000	Medium
Blairstown Township	Levy along Paulinskill River at Paulinskill Fields	Contractor and DEP	\$30,000	Medium
Blairstown Township	Channeling or walls built along Blair Creek	Contractor and DEP	TBD	Medium
Franklin Township	Attenuate Stormwater with a section of the Morris Canal	Township Committee	\$270,000	High
Frelinghuysen Township	Construction of barriers to protect flood-prone	To be determined	To be determined	TBD
Hackettstown	Install storm drain basins and larger storm pipes in area of East Prospect Street	Hackettstown Department of Public Works	\$51,000	Medium
Lopatcong Township	Sewer Line Modification	Lopatcong/Phillipsburg	\$625,000	High
Oxford Township	Use Furnace Lake and dam as a detention basin to attenuate stormwater	NJDEP	\$30,000	High
Phillipsburg Town	Modifications to Lift Station on Riverside Way	Town of Phillipsburg	\$500,000	High
Phillipsburg Town	Modifications to WWTP on S. Main Street	Town of Phillipsburg	\$500,000	High
Phillipsburg Town	Modifications to Street and Retaining Wall on Riverside Way	Town of Phillipsburg	\$400,000	High
Phillipsburg Town	Provide for an Engineering Feasibility Study of the Lopatcong Creek to determine Mitigation Actions to Prevent Backflow of Creek when the Delaware River is at Flood Stage	Town of Phillipsburg	\$200,000	High
Phillipsburg Town	Install Backflow Prevention on Stormwater Discharges to the Delaware River and Lopatcong Creek	Town of Phillipsburg	\$500,000 - \$1,000,000	High
Pohatcong Township	Install a pipe with backflow prevention device under railroad from River Road to the Delaware River	Township Council	\$150,000	Medium
Pohatcong Township	Install backflow prevention device on several existing pipes/culverts that discharge to the Delaware River	Township Council	\$300,000	Medium
Pohatcong Township	Construct a stormwater detention basin along to Mountain Road to control runoff from the mountain	Dept. of Agriculture, Soil Conservation Service	\$250,000 - \$350,000	Medium
Pohatcong Township	Study the impact of the removal of the Musconetcong River dams on flooding	Musconetcong Watershed Assoc., USACE	\$300,000	Medium

Belvidere Township, Warren County:

Location:

Belvidere Township is located along the Delaware River in west-central Warren County. Belvidere is home to 2,771 people living within 1.35 square miles. It is bordered by White Township to the north, south and east and the Delaware River to its west.



Geology:

The soils consist of glacial sands, gravels, and till deposits of the Wisconsin age. Granular limestone and dolomite are located in exposed areas of the flood plain.

Hydrology:

The *Delaware River* flows south along the western border of the township.

The *Pequest River* divides the township and comes in confluence with the Delaware River within Belvidere's borders.

The *Pophandusing Creek* is located in the southern portion of town and because of its smaller drainage area, is more reactive to shorter duration, high intensity events.

Recent Flood History:

When the Delaware River rises to 16 feet, its waters back into the Pequest River. The Pequest's waters then go up through Belvidere's storm drains and flood the township. During heavy rain and flooding events, the Pequest River later overtops its banks and causes additional flooding. The Pequest floods parts of Wall Street, Water Street, Front Street and DePue Street. On the southern side of the Pequest, water from the Delaware River also comes up a municipal boat ramp and further contributes to the flooding.

There are two existing run of river type dams within Belvidere on the Pequest River; the E.R. Collins and Son - Railroad Dam (NJDEP File No. 24-28), is located just downstream of the railroad (Conrail) bridge near the intersection with Water Street and the other, known as E.R. Collins & Son Dam – Market Street Dam (NJDEP File No. 24-29), is located just upstream of the Greenwich Street bridge. The E.R. Collins & Son Dam – Railroad Dam was recently purchased by the State of New Jersey with Green Acres funding and is currently operated by the NJDEP, Division of Fish & Wildlife. Local residents report siltation within the Pequest, notably behind and downstream of the lower Railroad Dam. Local residents also report a rise in the Delaware River bed at the confluence of the Pequest and Delaware River; where, since the first of the three floods, an island is forming on the south side of the Water Street bridge.

In the southern portion of Belvidere, the Pophandusing Brook backs up when the Delaware River floods. Just upstream from the confluence of the river and the brook, the Pophandusing flows in an "S" shaped meander that is constrained by a culvert thru a railroad embankment and by the end of DePue Street. The Pophandusing's banks are heavily eroded and the brook shows signs of impending realignment. Residents have placed boulders along the brook to prevent its

realignment from interfering with DePue Street. Portions of one driveway have already been lost due to bank erosion.

Belvidere was affected by the June 2006, April 2005, September 2004, and January 1996 flooding events. According to the township, there are six severe repetitive loss properties located at Water and Wall Streets, thirty-five repetitive loss properties near DePue Street, and eighteen repetitive loss properties located on Water Street between Wall and Market. Property values of the homes are approximately \$250K-\$350K. There are approximately 3 to 4 homeowners interested in being acquired or elevated, but there is no funding available.

During the past 3 flooding events, the Belvidere pump station was adversely affected. Residents were displaced, potable water was contaminated, and heating oil from residents' tanks was washed downstream. In addition, stream banks eroded and sand and silt was deposited in storm drains. In each flood, around 33 homes sustained basement damage and 22 sustained first floor damage.

Belvidere uses a community telephone notification system and goes door-to-door to encourage evacuations. Many people with only basement flooding refuse to evacuate and simply move their appliances to upper floors. The municipality has encouraged residents to elevate their utilities, evacuate when instructed, and seal basements from groundwater.

The municipality wants to explore dredging options in the Pequest River and is interested in redirecting flood waters to undeveloped areas. It is also interested in information about the effects of dam removal and channelization of the Pequest River. To mitigate stormwater drain backflow, Belvidere would like to install one-way flap gates.

Unique Flood Risk to Municipality:

The Delaware River runs along the western end of the entire town. The Pophandusing Creek runs along the southern end of the entire town. The Pequest River runs through the entire town including the business district. Flooding occurs on both the Pequest and the Pophandusing where it meets the Delaware River. Flooding along the Pequest causes a disruption to the business district.

Local Flood Mitigation Planning Committee:

Susan Reeder	EMC
Kelly Offerman	Resident
Paul Sterbenz	Engineer
Maryann Meyer Garcia	Governing Body
Charles Hoff	Zoning Officer
Charles O'Conner	Construction Official
Howard Thompson	Planning Board/Gov.
John Snyder	DPW

Ordinances/Plans Reviewed: Belvidere Municipal Code, Belvidere Tax Map, input from Army Corps of Engineers

Outreach: Army Corps of Engineers

First Public Meeting Date: 9/4/2007**Date and Method of Advertisement for FMP:** Week of 8/27/2007 Riverbend Advertiser**Questionnaire Distribution Method:** US Mail, 25 responses received**Public Response:**

1. Concerns about water being released from the dams and reservoirs upstream
2. Suggest to work with NY and PA to control development
3. Clean and dredge Delaware and Pequest Rivers so that water can flow within their banks
4. Implement better stormwater management
5. Repair bank erosion along the banks of the Delaware River

Flood Mitigation Goals:

1. Install one-way flap valves in storm sewers along Water Street and Pequest and 4th St along the Pophanduysen Creek.
2. Elevation of Properties
3. Elevation of utilities for affected residences
4. Clean and Dredge areas of the Delaware, Pequest and Pophanduysen Creek
5. Replace riverbanks along the Delaware, Pequest and Pophanduysen that have been lost due to flooding.

Belvidere Mitigation Actions:**1. ACTION: Decommission lower dam**

Description/Background: Municipal representatives want to know whether removal of the downstream dam on the Pequest would help with the backwater problem they seem to experience from the Delaware River by helping the Pequest carry floodwater more efficiently, thereby reducing property damage

A Pre-Authorization Planning Report and Plan of Work, titled “Lower Pequest River Watershed, Warren County, New Jersey”, was completed by the United States Department of Agriculture, Soil Conservation Service (now known as the Natural Resource Conservation Service (NRCS)) in April 1985. This report was prepared in part to evaluate various methods to reduce flooding along the Lower Pequest River, specifically in the Town of Belvidere. Two of the alternatives pertain to the removal of one or more of the existing dams mentioned above and were both determined to be economically justified at that time.)

Hazard: TBD**Existing or new assets:** Existing/New**Existing mechanism through which action will be implemented:** TBD**Responsible Organization:** TBD**Target Completion Date:** TBD**Estimated Cost:** TBD**Potential Funding Sources:** TBD**Priority:** TBD**2. ACTION: Elevation of properties**

Description/Background: Local officials would prefer not to have buyouts of flooded properties due to a loss of tax ratables.

Hazard: Prevent first floor damage

Existing or new assets: Existing
Existing mechanism through which action will be implemented: TBD
Responsible Organization: TBD
Target Completion Date: TBD
Estimated Cost: TBD
Potential Funding Sources: TBD
Priority: TBD

3. ACTION: Reroute creek banks to channel water away from residential areas

Description/Background:
Hazard: TBD
Existing or new assets: TBD
Existing mechanism through which action will be implemented: TBD
Responsible Organization: TBD
Target Completion Date: TBD
Estimated Cost: TBD
Potential Funding Sources: TBD
Priority: TBD

4. ACTION: Rebuild river banks

Description/Background: Replace riverbanks along the Delaware, Pequest and Pophanduysen that have been lost due to flooding.
Hazard: TBD
Existing or new assets: TBD
Existing mechanism through which action will be implemented: TBD
Responsible Organization: TBD
Target Completion Date: TBD
Estimated Cost: TBD
Potential Funding Sources: TBD
Priority: TBD

5. ACTION: Dredging

Description/Background: Clean and dredge areas of the Delaware, Pequest and Pophanduysing Creek
Hazard: TBD
Existing or new assets: TBD
Existing mechanism through which action will be implemented: TBD
Responsible Organization: TBD
Target Completion Date: TBD
Estimated Cost: TBD
Potential Funding Sources: TBD
Priority: TBD

6. ACTION: Install One-way valves

Description/Background: Install one-way flap valves in storm sewers along Water Street and Pequest and 4th St along the Pophanduysen Creek.

Hazard: Prevent stormwater back-up

Existing or new assets: TBD

Existing mechanism through which action will be implemented: TBD

Responsible Organization: TBD

Target Completion Date: TBD

Estimated Cost: TBD

Potential Funding Sources: TBD

Priority: TBD

Blairstown Township, Warren County:

Location:

Blairstown Township is located in the northern portion of Warren County and contains part of the Delaware Water Gap National Recreation Area. The township is home to 5,747 people within 31.77 square miles. It is bordered by Hardwick Township to the north, Frelinghuysen Township to the east, Hope Township to the southeast and Knowlton Township to the southwest.



Geology:

The topography of the area is hilly terrain, with the steepest slopes along the Kittatinny Mountains and the mildest terrain in the area surrounding the Paulins Kill. Elevations range from 320 feet near Paulins Kill to over 1,500 feet in the Kittatinny Mountains. There is a shaly soil over limestone bedrock which produces high runoff and low groundwater volatility.

Hydrology:

The *Paulinskill* is a tributary to the Delaware River located in the central part of the township. It enters Blairstown, where it is joined by *Blair Creek*, as well as *Jacksonburg Creek*, *Dilts Creek* and *Walnut Creek*. *Yard's Creek*, which rises at the Yard's Creek reservoir in Blairstown, enters the Paulins Kill near the hamlet of Hainesburg.

Recent Flood History:

The main source of flooding is the Paulinskill River which runs through the township.

As of 1991, there were 6 dams in the township, including 3 along the Paulinskill. These dams lessen flood severity downstream. Unfortunately, dam failure has historically plagued Blairstown. In 1892, the Slabtown Creek dam failed and structures on Main Street incurred flood damage. In 2004, Hurricane Ivan caused dam failure at Blair Creek and at the Hardwick Township YMCA camp dam.

The township was affected by the April 2005, September 2004, and January 1996 flooding events. Blairstown was also hit hard by the 1955 flood when the Paulinskill and Blair Creek overtopped their banks and flood waters inundated Main Street.

Of the recent flooding events, the September 2004 floods caused the most damage as flooding was exacerbated by dam failure. Fifty three houses sustained basement damage and 15 houses sustained first floor damage. Essential facilities, including schools and historic structures, were identified in Blairstown. Septic systems are also affected.

The community is in need of funding to help refurbish dams. In addition, it has been suggested that Blairstown expand the storm sewer system, install flood gates on pipes that outlet into the Paulinskill, construct dikes and floodwalls along the Paulinskill, insert a small floodwater retarding structure on Trout Brook, and widen and deepen Blair Creek in hopes to alleviate flooding. Land rights and lack of funding present problems for the municipality.

Unique Flood Risk to Municipality:

Dam failures in Blairstown and adjoining towns, Yards Creek breach or dam failure to one of their three reservoirs

Local Flood Mitigation Planning Committee:

Jeff Jablon	OEM Coordinator
Dawn Gallant	Adm. Ass. OEM
David Deihl	Floodplain Admin.
Robert DePuy	Deputy OEM Coord./Director Public Works
Dick Mach	Committee Member/Planning Board Member
Roger Gutzwiller	Environmental Committee Chairman

Ordinances/Plans Reviewed: NRCS Field Trip Report – July 2006, Watershed 1971 Work Improvement Report, Environmental Resource Inventory 2006

Outreach: Residents in floodplain areas

First Public Meeting Date: 2/20/2007

Date and Method of Advertisement for FMP: 1/29/2007 Express Times, 1/31/2007 The Press, 2/15/2007 posted at the Blairstown Municipal Building last week in January until the meeting, announced at Blairstown Township Committee meeting

Questionnaire Distribution Method: Mailed to residents in the floodplain, hand delivered by resident volunteers to the village area

Public Response:

1. Pennsylvania should be as proactive as the NJ towns are
2. Something needs to be done about the flooding problem in the downtown area
3. Get rid of the silt buildup in Blair Creek and the Paulinskill
4. Expedite permit process for mitigation actions
5. Improve and maintain storm drains, elevate roads, raise banks along the river, dredge Blair Creek and Paulinskill, clean debris from rivers, control building, keep dams in better shape, build retaining walls, plant trees and shrubs along banks, lower floor of river
6. 2 Pennsylvania residents were impressed with the local flood mitigation approach and were going to see if their towns in Pennsylvania would consider putting together an FMP

Flood Mitigation Goals:

1. Reduce flood waters in village area by installing backflow suppressors
2. Remove debris in Paulinskill River
3. Channel or build walls along Blair Creek
4. Reduce current along ball fields in flood area by installing a berm along one side of the Paulinskill River to channel current downstream further
5. Reduce likelihood of flooding of new or renovated construction by changing ordinance to request a BFE of at least one foot above

Blairstown Mitigation Actions:**1. ACTION: Change ordinance to request BFE of at least one foot above**

Description/Background: Base flood elevation – increase margin of safety with one foot additional freeboard.

Hazard: Flooding of new construction

Existing or new assets: New

Existing mechanism through which action will be implemented: Township Committee and Floodplain administrator

Responsible Organization: Blairstown Township

Target Completion Date: 2008

Estimated Cost: \$100

Potential Funding Sources: Blairstown Township

Priority: High

2. ACTION: Elevate utilities in homes in flood prone areas

Description/Background: Elevate utilities above BFE when replacing old or flood-damaged equipment (FEMA recommendation/requirement).

Hazard: Flooding

Existing or new assets: Existing

Existing mechanism through which action will be implemented: Zoning and Construction Dept./Permits

Responsible Organization: Homeowners

Target Completion Date: TBD

Estimated Cost: \$5,000 to \$10,000 per home

Potential Funding Sources: Grants

Priority: High

3. ACTION: Removing debris along Paulinskill River

Description/Background: Debris, downed trees, limbs, trash, etc. causes a restriction or backup to the flow and increases flood potential during heavy rains.

Hazard: Flooding in downtown area

Existing or new assets: TBD

Existing mechanism through which action will be implemented: Dept. of Public Works and Twp Committee

Responsible Organization: DPW and DEP

Target Completion Date: TBD

Estimated Cost: \$100,000

Potential Funding Sources: Grants

Priority: High

4. ACTION: Channeling or walls built along Blair Creek

Description/Background: This will help with elevated water in Blair Creek from the dam to the Paulinskill River

Hazard: Flooding to homes on both sides of Blair Creek

Existing or new assets: TBD

Existing mechanism through which action will be implemented: Township Engineer and Floodplain Administrator

Responsible Organization: Contractor and DEP

Target Completion Date: TBD

Estimated Cost: TBD

Potential Funding Sources: Grants

Priority: Medium

5. ACTION: Install backflow suppressors

Description/Background: This will help with elevated drainage into Blair Creek and the Paulinskill River

Hazard: Flooding in downtown area

Existing or new assets: New

Existing mechanism through which action will be implemented: Dept. of Public Works and Twp Committee

Responsible Organization: DPW

Target Completion Date: TBD

Estimated Cost: \$20,000

Potential Funding Sources: Township budget or grants

Priority: Medium

6. ACTION: Levy along Paulinskill River at Paulinskill Fields

Description/Background: Currents during heavy rains are very strong and wash clay and debris from ball fields downstream. A levy would relocate the strong current downstream farther onto vacant land.

Hazard: Flooding

Existing or new assets: New

Existing mechanism through which action will be implemented: Dept. of Public Works and Twp Committee

Responsible Organization: Contractor and DEP

Target Completion Date: TBD

Estimated Cost: \$30,000

Potential Funding Sources: Grants

Priority: Medium

Franklin Township, Warren County:

Location:

Franklin Township is located southeastern Warren County in the New Jersey highlands. The township houses 2,768 people within 23.99 square miles of land. Franklin was named after Benjamin Franklin and contains three historic villages. It is bordered by Washington Township on the northeast, Oxford Township to the north, Harmony Township to the northwest, Lopatcong Township to the west, Greenwich Township to the southwest, and the Borough of Bloomsbury and Bethlehem Township to the south and southeast.



Geology:

The township lies in the Highlands of New Jersey. The topographic relief of the township is moderate and characterized by parallel, irregular ridges and intervening valleys trending northeast. The ridges, which rise about 500 – 1000 feet above the valleys are composed of gneiss and other hard crystalline rocks. The valleys are mainly composed of carbonate rocks and shale.

Hydrology:

The *Musconetcong River* is the major waterway in Franklin Township. It originates at Lake Hopatcong; it then loops to the northwest after flowing through Lake Musconetcong. The river then flows southwest forming the border of Warren County until it gets to the Delaware River.

The *Pohatcong River* is a tributary to the Delaware River and flows from northeast to southwest. It flows through the central part of the township and drains the largest portion of the township.

Recent Flood History:

Major waterways in the township include the Musconetcong River to the southeast and the Pohatcong Creek. Flooding mainly occurs along the Pohatcong Creek. Franklin Township was affected by the April 2005, September 2004, and the September 1999 floods. During these events, 15 mobile homes in the Angel Valley Trailer park were flooded. Stewartsville Road and Mill Brook Road also sustained damages from the April 2005 flood.

Unique Flood Risk to Municipality: None

Local Flood Mitigation Planning Committee:

Sonny Read	Emergency Management Coordinator
Denise Cicerelle	Municipal Clerk
Joseph Nalio	Municipal Engineer Representative

Ordinances/Plans Reviewed: Stormwater Management Plan

Outreach: The Planning Committee will reach out as necessary once the extent of the flood risk is assessed and mitigation goals and implementation plans are being formulated.

First Public Meeting Date: 11/5/2007

Date and Method of Advertisement for FMP: 10/24/2007 Star Gazette

Questionnaire Distribution Method: US mail

Public Response: No responses from questionnaire.

Flood Mitigation Goals:

1. Reduce flood damages along all identified waterways within the township where the FIRM maps indicate a 100-year floodplain
2. Maintain emergency access to all township residents within the 100-year floodplain

Franklin Mitigation Actions

1. ACTION: Attenuate Stormwater with a section of the Morris Canal

Description/Background: Use a section of the Morris Canal to attenuate stormwater flowing from Montana Mountain to Third Street

Hazard: Flood

Existing or new assets: Existing/New

Existing mechanism through which action will be implemented: Township Committee

Responsible Organization: Township Committee

Target Completion Date: June 2008

Estimated Cost: \$270,000

Potential Funding Sources: Grants

Priority: High

2. ACTION: Remove debris from the Musconetcong and other waterways

Description/Background: This will improve flow in the waterway and help alleviate flooding.

Hazard: Flood

Existing or new assets: Existing/New

Existing mechanism through which action will be implemented: Township Committee

Responsible Organization: NJDEP

Target Completion Date: December 2008

Estimated Cost: \$100,000

Potential Funding Sources: Grants

Priority: Medium

Frelinghuysen Township, Warren County:

Location:

Frelinghuysen Township is located in the northeastern portion of Warren County. The township is home to 2,083 people in 23.55 square miles.

Geology:

Most of the township is characterized by well drained soil overlying limestone or gneissic bedrock. The valleys are mainly composed of



carbonate rocks and shale.

Hydrology:

The *Paulinskill River* forms the northern border of this township.

Beaver Brook, a tributary to the Pequest, originates in the southwestern portion of Frelinghuysen. It does not reach its confluence with the Pequest until it enters the confines of White Township. *Trout Brook*, a tributary to the Beaver Brook, also has its headwaters in Frelinghuysen and has its confluence with the Beaver Brook in Hope Township.

Bear Creek, a tributary to the Pequest, originates in the eastern portion Frelinghuysen. It joins with the Pequest in Allamuchy Township. The *Bear Brook* is a tributary to Bear Creek and flows south to the east of Bear Creek.

Recent Flood History:

Frelinghuysen was affected by the September 2004 flood and a March 1997 winter storm. In September 2004, over 100 wooden structures sustained basement damage mainly due to cascading mountainside streams. In addition, springs overflowed and sinkhole basins flooded. All of the streams in the township were affected and homes that had never seen water damage incurred flooding.

In March of 1997, the Paulinskill River and the sinkhole basins flooded due to heavy rains on top of ice and snow. The most severe flooding occurred on South Street. Detention basins overflowed and streams became large lakes. Over 100 homes sustained basement damage and over 20 homes sustained first floor damage. Twelve families were evacuated. Since then, flooding in this area has continued and the township lowered property taxes for the affected families. Much effort has gone into engineering flood remediation for this South Street sinkhole basin including the construction of a detention pond/dam. Many people in the South Street sinkhole basin are interested in acquisition or elevation.

Unique Flood Risk to Municipality:

South Town Road is a known flood area that is unique because the floods come from underground springs during high water table years.

Local Flood Mitigation Planning Committee:

Nancy Predale	EMC
Allan DeCarlos	Planning Board Member
Debra Natyzak-Osadca	Township Committee
Billy Crone	Road Supervisor

Ordinances/Plans Reviewed:

Outreach:

First Public Meeting Date: 6/2/2007

Date and Method of Advertisement for FMP: May, 2007 Founders Day Event

Questionnaire Distribution Method: Mailed and handed out at events

Public Response:

1. There is little flood damage. Only 3 of the 4 people present incurred damages, which totaled under \$7,000 in the last 5 years.
2. The problem area lies within a development that wasn't properly engineered or is defective.

Flood Mitigation Goals:

1. Alleviate flooding near South Town Road.

Frelinghuysen Mitigation Actions

1. ACTION: Construction of barriers to protect flood-prone

Description/Background:

Hazard: TBD

Existing or new assets: TBD

Existing mechanism through which action will be implemented: TBD

Responsible Organization: TBD

Target Completion Date: TBD

Estimated Cost: TBD

Potential Funding Sources: TBD

Priority: TBD

2. ACTION: Analyze the properties in a portion of town for structural elevation

Description/Background:

Hazard: TBD

Existing or new assets: TBD

Existing mechanism through which action will be implemented: TBD

Responsible Organization: TBD

Target Completion Date: TBD

Estimated Cost: TBD

Potential Funding Sources: TBD

Priority: TBD

3. ACTION: Elevation of flood-prone structures

Description/Background:

Hazard: TBD

Existing or new assets: TBD

Existing mechanism through which action will be implemented: TBD

Responsible Organization: TBD

Target Completion Date: TBD

Estimated Cost: TBD

Potential Funding Sources: TBD

Priority: TBD

4. ACTION: Maintenance of stormwater facilities (non functioning retention pond)

Description/Background:

Hazard: TBD**Existing or new assets:** TBD**Existing mechanism through which action will be implemented:** TBD**Responsible Organization:** TBD**Target Completion Date:** TBD**Estimated Cost:** TBD**Potential Funding Sources:** TBD**Priority:** TBD

Hackettstown Township, Warren County:

Location:

The Town of Hackettstown is located in eastern Warren County in Northwestern New Jersey. It is home to 10,403 people in an area of 3.70 square miles. The township is bordered by Allamuchy Township to the north, Mount Olive Township to the northeast, the Township of Washington to the southeast, the Township of Mansfield to the southwest, and the Township of Independence to the northwest.



Geology:

The borough lies in the Highlands of New Jersey. The topographic relief of the borough is moderate and characterized by parallel, irregular ridges and intervening valleys trending northeast. The ridges, which rise about 500 – 1000 feet above the valleys are composed of gneiss and other hard crystalline rocks. The valleys are mainly composed of carbonate rocks and shale.

Hydrology:

The *Musconetcong River* is the main waterway in the borough. It originates at Lake Hopatcong, it then loops to the northwest after flowing through Lake Musconetcong. The river then flows southwest forming the border of Warren County until it gets to the Delaware River.

The *Hackettstown Brook* and *Hackery Brook* are tributaries to the Musconetcong River.

Recent Flood History:

Hackettstown was affected by the June 2006, April 2005, September 2004, September 1999, July 2000, August 2003, and November 2003 flooding events. Areas along the Musconetcong River, Water Street, Mountain Avenue, East Avenue and Rustic Knolls are repeatedly flooded. Hackettstown identifies 18 essential facilities, and during the September 2004 and September 1999 events, the House of Good Shepard Nursing Home was affected by flood waters. In July of 2000, localized heavy flooding and dam failures in Sussex County contributed to the flooding of 30 residential basements.

Unique Flood Risk to Municipality:

There are two partial dams on the Musconetcong River that tend to back up the flow of the

river. Both dams are under review by the Musconetcong River Authority for possible removal.

Local Flood Mitigation Planning Committee:

Charles Volkert	Emergency Management
Paul Sterbenz	Town Engineer
Michael Lavery	Mayor
Joseph Bristow	Council
Tom Kitchen	DPW Super.
Jerry McDonnell	Master Foods
Forrest Kinzli	Hackettstown Hospital
Bruce J Tynan	Fire Chief
Michele Vargo	Squad Chief
Lenny Kunz	Police Chief

Ordinances/Plans Reviewed:

Outreach:

First Public Meeting Date: 6/27/2007

Date and Method of Advertisement for FMP: Press release to all local newspapers, posters in town buildings, WRNJ radio

Questionnaire Distribution Method: OEM distributed, left for pick-up at town hall

Public Response:

1. Very little damage to structures, mostly water in basements

Flood Mitigation Goals:

1. Install storm drains and piping in area of East Prospect Street. This is in the area of one of our repetitive loss properties.
2. Clean downed trees and debris from streams and river.

Hackettstown Mitigation Actions

1. ACTION: Install storm drain basins and larger storm pipes in area of East Prospect Street

Description/Background: East Prospect Street is the location of a repetitive loss property.

Hazard: Flooding from heavy rain

Existing or new assets: Both

Existing mechanism through which action will be implemented:

Responsible Organization: Hackettstown Department of Public Works

Target Completion Date: 2008

Estimated Cost: \$51,000

Potential Funding Sources: Grants

Priority: Medium

2. ACTION: Remove downed trees and debris from Musconetcong and small streams.

Description/Background: This will help prevent the Musconetcong from flooding.

Hazard: Flooding, back-up water flow

Existing or new assets: Existing

Existing mechanism through which action will be implemented:

Responsible Organization: Office of Emergency Management

Target Completion Date: Spring 2008

Estimated Cost:

Potential Funding Sources: Grant

Priority: Low/medium

Hardwick Township, Warren County:

Location:

Hardwick Township is located in the northernmost part of Warren County. Hardwick is now home to 1,464 people in 37.92 acres. Hardwick is the least-populated and most remote township in Warren County as large portions of the township are contained within the Delaware Water Gap National Recreation Area. The now-defunct township of Pahaquarry was absorbed into Hardwick in 1997.



Geology:

Most of the township is characterized by well drained soil overlying limestone or gneissic bedrock. The valleys are mainly composed of carbonate rocks and shale.

Hydrology:

The *Delaware River* forms the northwestern border of the township. *VanCampens Brook* and *Dunnfield Creek* are tributaries to the Delaware that join the Delaware within the borders of the township and the Delaware Water Gap National Recreation Area.

The Paulinskill River forms the southeastern portion of the township. Both *Blair Creek* and *Jacksonburg Creek* are tributaries to the Paulinskill and have their confluence in Blirstown.

Recent Flood History:

The September 1999 storm affected over 75% of the municipality. Jacksonburg Creek, Blair Creek, the Paulinskill River, and the Delaware River flooded an unknown number of residential basements and affected 3 bridges, 1 dam, and over 10 miles of road. There are no repetitive loss properties in Hardwick.

Unique Flood Risk to Municipality: Hardwick Township could be jeopardized if a dam breach were to occur (most likely from the Yards Creek Pumping Station in Blirstown).

Local Flood Mitigation Planning Committee:

Rob Krok	OEM Coordinator
Kevin Duffy	Mayor
Ted Rodman	Twp. Engineer
Tom Campbell	DPW Supervisor

Ordinances/Plans Reviewed: None

Outreach: Yards Creek Pumping Station

First Public Meeting Date: 8/1/2007

Date and Method of Advertisement for FMP: 8/2007 NJ Herald

Questionnaire Distribution Method: Posted in municipal building, delivered by Emergency Management Coordinator, distributed at Township Recognition Day

Public Response: None received

Flood Mitigation Goals:

1. Alleviate flood problems that arise from severe weather/storms
2. Early warning and education for residents

Hardwick Mitigation Actions

1. ACTION: Education through seminars and discussions

Description/Background:

Hazard: TBD

Existing or new assets: TBD

Existing mechanism through which action will be implemented: TBD

Responsible Organization: TBD

Target Completion Date: TBD

Estimated Cost: TBD

Potential Funding Sources: TBD

Priority: Medium

2. ACTION: Continue Early Warning by use of Emergency Operation Plan

Description/Background:

Hazard: TBD

Existing or new assets: TBD

Existing mechanism through which action will be implemented: TBD

Responsible Organization: OEM

Target Completion Date: TBD

Estimated Cost: TBD

Potential Funding Sources: TBD

Priority: High

Harmony Township, Warren County:

Location:

Harmony Township is located along the Delaware River in the southwestern portion of Warren County. The township is 24.14 square miles and contains 2,729 people in 1,076 housing units. It is bordered by the communities of Forks and Lower Mount Bethel (PA) on the west, the community of White to the north, Washington Township and Franklin to the east, and Greenwich and Lopatcong to the south.



Geology:

The township lies in the Highlands of New Jersey. The topographic relief of the township is moderate and characterized by parallel, irregular ridges and intervening valleys trending northeast. The ridges, which rise about 500 – 1000 feet above the valleys are composed of gneiss and other hard crystalline rocks. The valleys are mainly composed of limestone and shale. Elevations range from 155 feet at the Delaware River to 1,245 feet in the eastern part of the township.

Hydrology:

The *Buckhorn Creek*, a tributary to the Delaware, is in the northern portion of the township. It begins in the southwestern portion of White township and flows southwest to its mouth on the Delaware River. This creek drains most of southwestern White Township and north-central Harmony Township.

The *Delaware River* forms the western border of the township. It flows south and is the largest body of water flowing through the township.

The *Lopatcong Creek* has its headwaters in northeastern Harmony and flows generally southwest through the townships of Lopatcong, Greenwich, Pohatong, and Phillipsburg where it empties into the Delaware River.

Merrill Creek, a tributary to the Pohatcong River is located in the eastern portion of the township. *Merrill Creek Reservoir* was built in 1988 following a severe drought by a consortium of power companies, collectively known as the Merrill Creek Owners' Group. The reservoir has a drainage area of only 3.13 square miles but is a pump-storage facility. During low water periods, the reservoir releases water to the Delaware River to supplement water used by electric generating facilities.

Recent Flood History:

Flooding in Harmony is severe. About 125 homes get flooded with 50% to 75% receiving 2-3 feet of water on the first floor. Floodwaters in the Hutchinson area have reached the eaves of 6 to 8 homes. When the Delaware River reaches 14 feet in Belvidere, the Hutchinson section of Harmony experiences flooded.

Harmony was affected by the June 2006, April 2005, September 2004, September 1999, and January 1996 flooding events. During flooding events, the Delaware River and Buckhorn Creek flood Hutchinson River Road, Harmony Station, the Brainards, Harmony Terrace, South River Terrace, and the Goat Farm areas. During the June 2006 event, 120 homes incurred basement flooding and 50 homes incurred first floor flooding. Flooding in Harmony causes significant erosion and road damage and normally requires 3 to 6 weeks of clean-up.

The township has already written a Flood Mitigation Plan to help address flooding issues. In 2006, six properties in the Hutchinson area were acquired and demolished. The land is now restricted for open space uses. Many more homes throughout the city have been elevated. In

2005, approximately ten homes were elevated. In July 2006, two ongoing property elevations had begun. Approximately 40 more people are interested in elevation or demolition, but need monetary assistance.

In addition to repetitive flooding of properties, Harmony Township is concerned about a abandoned quarry located in the Brainards section of the township. This site is in need of remediation, but the municipality does not have the means to adequately clean the site. The Delaware River has breached the quarry in two locations during the floods. The breach at the southern end of the quarry is about 70' long. There has been significant scouring of the river bank downstream of the southern breach, with loss of vegetation. This has caused a large depositional area in the river, accompanied by formation of an eddy.

Flood Mitigation:

A FEMA Repetitive Flood Claim application (100% FEMA funds to cover mitigation) was submitted in 2007 for 32 occupants. The application was also submitted to the FEMA Flood Mitigation Assistance Program (75% FEMA funds/25% non-Federal funds to cover mitigation). The grant application requested \$11.5M for the 32 homes. The average value for the houses was estimated at \$280,000-\$300,000.

In 2006 six properties in the Hutchinson area were demolished and the use restricted to open space. These were the only six properties that met the FEMA Benefit Cost Ratio requirements. A pre-disaster appraisal of fair market value was used. 75% of the funds came from FEMA, 25% came from NJDEP's Green Acres Program. The homes were valued at \$250,000 - \$330,000.

Numerous homes on Riveredge Lane in the Hutchinson area have been elevated, some more than 30'.

Unique Flood Risk to Municipality:

The flood risk and damage to the Hutchinson, Brainards, Harmony Station, Harmony Terrace, South River Terrace, and Goat Farm areas are well documented. The township has been actively engaged with the state and FEMA in securing HMGP and FMA funding for acquisition and elevations.

Local Flood Mitigation Planning Committee:

Brian Tipton	Mayor
Kelley Smith	Property Owner/Municipal Clerk
Richard Collins	Local OEM and Floodplain Admin.
William Hunt	Warren County OEM
John Fritts	Zoning Officer
Molly Petty	School Business Administrator
Joseph Nalio	Finelli Consulting Engineers, Inc.

Ordinances/Plans Reviewed: Floodplain Management Plan, Stormwater Management Plan, Floodplain Ordinance

Outreach: FEMA, NJOEM

First Public Meeting Date: 8/7/2007

Date and Method of Advertisement for FMP: 7/12/2007 Star Gazette

Questionnaire Distribution Method: 7/2007 enclosed with the 2007 tax bills, posted at the local market and gas station

Public Response:

1. Upstream reservoir levels
2. Emergency response planning (evacuation routes, school evacuation, alarm sirens, evacuation shelters, and evacuation of farm animals) as opposed to mitigation actions

Flood Mitigation Goals:

1. Develop flood hazard mitigation policies that will reduce flood losses to residents and businesses and promote the health, safety, and welfare of river communities
2. Allow residents and businesses to reduce property losses through elevation or acquisition
3. Develop a dependable early flood surge warning system
4. Promote flood insurance awareness
5. Enhance and protect the natural beauty of the Delaware River

Harmony Mitigation Actions

1. ACTION: Acquire 10 properties on Goat Farm Road

Description/Background:

Hazard: Flood

Existing or new assets: Existing

Existing mechanism through which action will be implemented: Township Committee

Responsible Organization: Township Committee

Target Completion Date: December 2007

Estimated Cost: \$2,500,000

Potential Funding Sources: FMA

Priority: High

Independence Township, Warren County:

Location:

Independence Township is located in the east-central portion of Warren County. It is home to 5,603 people and encompasses 19.89 square miles.

Geology:

Hydrology:

The *Pequest River* flows through the eastern portion of the township.

The *Pohatcong Creek* has its headwaters in southern portion of Independence Township.

Hackery Brook, a tributary to the Musconetcong, has its headwaters in the eastern portion of



the township.

Recent Flood History:

Although the Pequest River floods, buildings are not affected by the flood waters. The Great Meadows area bordered by Hope-Greta Meadows Road, Shades of Death Road, and Alphano Road are susceptible to flooding.

Unique Flood Risk to Municipality: None

Local Flood Mitigation Planning Committee:

Cheryl Holowath	Emergency Management Coordinator
Gary Janiszewski	Township Committee
Joseph Nalio	Finelli Consulting Engineers, Inc.

Ordinances/Plans Reviewed: Stormwater Management

Outreach: The Planning Committee will reach out as necessary once the extent of the flood risk is assessed and mitigation goals and implementation plans are being formulated

First Public Meeting Date: 8/14/2007

Date and Method of Advertisement for FMP: 6/14/2007 Star Gazette

Questionnaire Distribution Method: Mailed to property owners in the floodplain 6/6/2007

Public Response:

1. Suggested dredging portions of the Pequest River removing debris thereby increasing its effective cross section

Flood Mitigation Goals:

1. Reduce flood damage along the Pequest River
2. Maintain emergency access to all township residents and essential facilities located within the 100 year floodplain of the Pequest River

Independence Mitigation Actions

1. ACTION: Remove debris from sections of the Pequest

Description/Background: By removing debris, the effective cross section of the river will improve. Where specifically?

Hazard: Flood

Existing or new assets: Existing/New

Existing mechanism through which action will be implemented: Township Committee

Responsible Organization: NJDEP

Target Completion Date: December 2008

Estimated Cost: \$100,000

Potential Funding Sources: Grant

Priority: High

2. ACTION: Assess elevations of essential facilities identified as being within the 100-year floodplain of the Pequest River

Description/Background:**Hazard:** Flood**Existing or new assets:** Existing**Existing mechanism through which action will be implemented:** Township Committee**Responsible Organization:** Township Committee**Target Completion Date:** June 2008**Estimated Cost:** \$10,000**Potential Funding Sources:****Priority:** Medium**Knowlton Township, Warren County:****Location:**

Knowlton Township is located in the northwestern portion of Warren County. It contains 2,977 people within 25.31 square miles. It is bordered by Blairstown Township to the east, the Townships of White and Hope to the south, the Delaware River to the west, and Hardwick Township to the north.

**Geology:**

The topography of the area is hilly terrain, with the steepest slopes along the Kittatinny Mountains and the mildest terrain in the area surrounding the Paulins Kill. Elevations range from 280 feet near Paulins Kill to over 1,400 feet in the Kittatinny Mountains. There is a shaly soil over limestone bedrock which produces high runoff and low groundwater volatility.

Hydrology:

The *Delaware River* along the western boundary of Knowlton Township.

From north to south, the *Stony Brook*, *Paulinskill*, and *Delawanna* are tributaries to the Delaware River that flow across the township from northeast to southwest.

Recent Flood History:

The township has experienced flooding along the Delaware River, which runs the western length of the township and the Delwanna Creek.

Knowlton was affected by the June 2006, April 2005, September 2004, 1996, and 1955 flooding events. During flood events, residences, businesses, and roadways along the Delaware River are impacted. Approximately 35 homes are affected by the flooding, with 13 having water in the 1st floor 3'-5' high. The homes are appraised at approximately \$150K-\$200K.

Flooding affects Route 46, which prevents access to the elementary school and fire and rescue buildings. The road becomes impassible in 4 to 5 locations. Flooding results in displaced storm drains, road erosion, washed out shoulders, and damage to the Paulinskill Bridge over

Route 46. Flooding also causes oil spillage and individual well contamination.

The township provides storage services during flooding events and has encouraged homeowners to raise their utilities. When a major event is forecast, Knowlton OEM and fire officials visit expected flood victims and help remove and store possessions in tractor trailers.

There are several people in Knowlton who are interested in elevation. Although 12 applications have been sent for FEMA's RFC program, many homes do not meet FEMA's budget cost analysis criteria. Knowlton Township needs elevation surveys for the homes that flood. The township has compiled addresses, water levels, and costs for the repairs. The township is also interested in a community telephone notification system, but has determined that it is not monetarily feasible at the current time.

Flood Mitigation:

One house on Willow Lane is being elevated at a total cost of \$110,000. It is costing \$45K to raise it, with \$30K being reimbursed through FEMA's Increased Cost of Compliance Program. There was a \$65K cost associated with doing flood repair and building an addition, with \$56K being reimbursed through flood insurance

In 2006, one structure was acquired for \$450,000.

Unique Flood Risk to Municipality: The FEMA flood risk maps are not currently accurate and need to be updated.

Local Flood Mitigation Planning Committee:

Lisa Patton	Municipal Clerk
Frank Makowski	EMC
Brian Peck	DEMO
George James	Twp. Committee
Eleanor Clarkson	Asst. Clerk
Jo Commack	Resident
Frank VanHorn	Mayor
Ralph Price	Construction Official
Ted Rodman	Floodplain Admin.
Ramon Cowell	SPW Supervisor
Craig Muser	Resident
Bill Housel	Resident

Ordinances/Plans Reviewed: Flood Damage Prevention Ordinance

Outreach: DRBC, Warren County OEM, NJDOT

First Public Meeting Date: 5/9/2007

Date and Method of Advertisement for FMP: 4/26/2007 Star Gazette, 4/30/2007 Star Ledger

Questionnaire Distribution Method: Mailing

Public Response:

1. The majority of repetitively flooded residents are pursuing mitigation through FEMA grants.
2. Local response is good. The township could possibly stock supplies for emergency measures.
3. Maintenance of storm drains along Route 46 should be better.

Flood Mitigation Goals:

1. Mitigate of residences along Route 46 with severe repetitive losses
2. Elevation of electric boxes, oil tanks, etc. to second stories

Knowlton Mitigation Actions**1. ACTION: Mitigation of Severe Repetitive Loss Properties**

Description/Background: Homes that have lost over 50% of their value due to flood events along Route 46 will be elevated

Hazard: Flood

Existing or new assets: Existing

Existing mechanism through which action will be implemented: New Jersey Office of Emergency Management/ FEMA grants

Responsible Organization: Knowlton Township

Target Completion Date: ASAP

Estimated Cost:

Potential Funding Sources: NJOEM grants, FEMA grants

Priority: High

2. ACTION: Elevate utilities and secure oil tanks

Description/Background: During past flooding events, oil tanks have been washed away and electrical equipment damaged. Elevating utilities and securing oil tanks in the flood-prone areas along Route 46 will lower risks.

Hazard: Flooding

Existing or new assets: Existing

Existing mechanism through which action will be implemented:

Responsible Organization: Property owners

Target Completion Date: 12/31/2007

Estimated Cost:

Potential Funding Sources: TBD

Priority: High

Lopatcong Township, Warren County:**Location:**

Lopatcong Township is located along the Delaware River in the southwestern portion of Warren County. The township is home to 5,765 people within 7.14 square miles. It is bordered by the communities of Forks and Easton on the west, the Town of Philipsburg to the southwest, the Townships of Pohatcong and Greenwich to the south and southeast,



Harmony Township to the north, and Franklin Township to the east.

Geology:

The township lies in the Highlands of New Jersey. The topographic relief of the township is moderate and characterized by parallel, irregular ridges and intervening valleys trending northeast. The ridges, which rise about 500 to 750 feet above the valleys are composed of gneiss and other hard crystalline rocks. The valleys are mainly composed of limestone and shale. Elevations range from 152 feet at the Delaware River to 970 feet in the eastern part of the township.

Hydrology:

The *Delaware River* forms the western border of the township. It flows south and is the largest body of water flowing through the township.

The *Lopatcong Creek* has its headwaters in northeastern Harmony and flows generally southwest through the townships of Harmony, Lopatcong, Greenwich, Pohatong, and Phillipsburg where it empties into the Delaware River. The creek drains most of the township except for areas very close to the Delaware River.

Recent Flood History:

In addition to Delaware River flooding, the Lopatcong Creek floods during heavy rainfall events and when debris impedes the floodway.

Lopatcong Township was affected by the April 2005, September 2004, and September 1999 flooding events. When the Delaware River flooded in April of 2005, two residential basements flooded. In September 2004, the Lopatcong Creek flooded Belview Road and partially washed out Lower Stryker's Road. Three residential basements flooded and 1 house incurred first floor damage. During the September 2004 event, the Baltimore Street pump station was impacted by flood waters. Raw sewerage was pumped above ground and the facility cost \$5,200.00 to repair. In September 1999, 24 homes incurred basement flooding. In addition, the sewer wastewater collection system was also affected. Lopatcong residents are not interested in elevations or acquisitions at this time.

Unique Flood Risk to Municipality:

A majority of the central and easterly portions of the township drain to the Lopatcong Creek. Lopatcong Creek is a major tributary to the Delaware River and drains in a southerly direction through the central portion of the township. Lopatcong Creek is crossed by a number of major collector roadways including Belview Road, County Route 519, State Highway Route 57, and Strykers Road. Although roadways vital to the movement of traffic and pedestrians in the township cross Lopatcong Creek, the culverts that carry stormwater are all undersized on each of these roadways. The roadways frequently get flooded when more intense rainfall events occur, requiring closure. Strykers Road sustained significant damage due to floodwaters following Hurricane Ivan in 2004.

A portion of the township abuts the Delaware River. While the area of Lopatcong Township that abuts the river is not populated, there are a number of businesses as well as an active rail line

that could be impacted by floodwater in the future. The township would like to protect those areas from flooding.

Local Flood Mitigation Planning Committee:

Gary Woolf	Local EMC
Paul Sterbenz	Engineer/Floodplain Admin/Stormwater Mgmt Coord.
George Ritter	Planner
Wayne Degan	Zoning Official
Victor Camporine	Council Pres./Pub. Safety Dir.

Ordinances/Plans Reviewed: Floodplain Prevention Ordinance, Zoning and Land Use Ordinance, Lopatcong Master Plan, Stormwater Management Regulations

Outreach:

First Public Meeting Date: 5/2/2007

Date and Method of Advertisement for FMP: 4/12/2007 Express-Times, Lopatcong Township web site

Questionnaire Distribution Method: Township web site, mailed to residents in floodplain

Public Response: none

Flood Mitigation Goals:

1. Protect human life and health
2. Minimize expenditure of public money for costly flooding, which is generally undertaken at the expense of the general public
3. Minimize the need for rescue and relief efforts associated with flooding and generally undertaken at the expense of the general public
4. Minimize prolonged business interruptions
5. Minimize damage to public facilities and utilities
6. Reduce flood loss to promote and maintain a stable tax base
7. Ensure training for local officials and enforcement of existing ordinances, codes, and regulations
8. Educate citizens regarding flood risk, sustainable development, disaster preparedness, and hazard mitigation opportunities
9. Maintain emergency access to all the township

Lopatcong Mitigation Actions

1. ACTION: Sewer Line Modification

Description/Background: Modifications to Sewer Lines along Baltimore Street/U.S. Highway Rt. 22 by reinforcing and/or replacing the sewer lines upstream in order to lessen the impact of rainwater to eliminate system backups which currently cause overflows on Baltimore and U.S. Highway Rt. 22.

Hazard: Env. Health

Existing or new assets: Existing

Existing mechanism through which action will be implemented: Capital Improvement Plan

Responsible Organization: Lopatcong/Phillipsburg

Target Completion Date: TBD
Estimated Cost: \$625,000
Potential Funding Sources: State Infrastructure Grant Programs
Priority: High

Mansfield Township, Warren County:

Location:

Mansfield Township is located on the eastern border of Warren County and is centrally located north to south. The township is home to 6,653 people in 29.94 square miles. It is bordered by the Townships of Independence and Liberty to the north, White Township to the west, Washington Township to the southwest, the Townships of Washington and Lebanon to the east, and the Town of Hackettstown to the northeast.



Geology:

The township lies in the Highlands of New Jersey. The topographic relief of the township is moderate and characterized by parallel, irregular ridges and intervening valleys trending northeast. The ridges, which rise about 500 – 1000 feet above the valleys are composed of gneiss and other hard crystalline rocks. The valleys are mainly composed of carbonate rocks and shale.

Hydrology:

The *Pohatcong River* is a tributary to the Delaware River and flows from northeast to southwest. It flows through the central part of the township and drains the largest portion of the township.

The *Musconetcong River* forms the southern border of Mansfield Township. The river then flows southwest forming the border of Warren County until it gets to the Delaware River. *Hances Brook* is a tributary to the Musconetcong.

Recent Flood History:

Mansfield was affected by the April 2005 and September 2004 flooding events and the January 1999 after-blizzard floods. In April 2005, the Musconetcong flooded State Highway 57, Kings Highway, Stephensburg Road, and Butler Park Road. The floods did not affect any buildings.

In September 2004, the Pohatcong River, coupled with stormwater run-off in poor drainage areas, partially washed out town roads and caused road closures. Road wash-outs included Carrie Road, Beatty Road, Hieser Road, Airport Road, Janes Chapel Road, Townsbury Road, Michael Road, and Mitchel Road.

In January 2006, three residences sustained basement damage near the Musconetcong River.

FEMA reports 2 repetitive loss properties in Mansfield Township. The most concerning flooding areas are along the Musconetcong on State Highway 57, which includes both residential and commercial structures.

Unique Flood Risk to Municipality:

There are low-lying residential areas including Butler Park on Route 57 along the Musconetcong River. This is a serious flooding risk. Areas along the Hopatcong Creek have incurred minor flooding due to stormwater runoff.

Local Flood Mitigation Planning Committee:

Robert Griffith	EMC
Scott Hammel	DEMC
George Baldwin	Mayor
Doug Mace	Township Engineer
C. McGuinness	Zoning Board
P. Wydner	Flooded Property Owner
B. Slyker	DPW Super.

Ordinances/Plans Reviewed:

Outreach: Musconetcong Watershed Association, NJDEP, New Jersey Land Use Regulation, NJ Dam Safety

First Public Meeting Date: 5/9/2007

Date and Method of Advertisement for FMP: Mid-April, Easton, The Express Times, The Warren Reporter, delivered meeting fliers during the April 2007 flood

Questionnaire Distribution Method: Local Boy Scout Troop and OEM Coordinator distributed, also distributed during April flood

Public Response:

1. There was concern about the slowing of the Musconetcong River waters due to large trees and branches that have collected at the bend in the river near the Butler Park area. The collected debris backs up water into the Butler Park residential area. A township fire house is also located in this area. Although the firehouse itself does not flood, access to the station is sometimes compromised. This situation has gotten worse over the past few years. There could be serious flooding in that area in the future.
2. One man commented that the Musconetcong River reaches the rear of his home, and on some occasions has damaged his floor. He is not interested in pursuing any actions to correct this. He also mentioned a small drainage ditch in the same area. When heavy rains fall, the ditch floods his yard in the area of his swimming pool. The township has looked at it, but with the level of his yard in relationship to the river, it appears that the township could not solve the flooding problem.

Flood Mitigation Goals:

1. Remove debris from the Musconetcong
2. Mitigate flooding in the Butler Park area

Mansfield Mitigation Actions

1. ACTION: Remove or thin out debris on Musconetcong River

Description/Background: The Deputy Emergency Management Coordinator (DEMC) has been in contact with the Musconetcong Watershed Association and NJDEP Land Use Permit Office. As per the land use office, the township will be able to move forward after November 5, 2007 when the land use office will have new updated permits for stream debris removal. NJDEP suggested collaborating with the Musconetcong Watershed Association. The Mansfield DEMC has been attempting to obtain vital information regarding the Mansfield Township section of the river. The township is proactively pushing forward to finalize an actual physical plan to eliminate the debris in the river that causes back up of the water flow. The plan must be very specific since the river is a highly protected trout fed river with a vast amount of wildlife.

The following questions will be asked to the Musconetcong Watershed Association regarding the river:

1. Where can the township get a list of companies for estimates regarding this type of debris removal?
2. What does the Musconetcong Watershed Association have planned for this section of the river? (This includes the Penwell Dam)
3. Who has the ultimate authority over the Mansfield Township section of the river?

A committee headed by the DEMC will meet again when more information is obtained from the Musconetcong Watershed Association. At that time, funding for this project will be discussed.

Hazard: Flooding in the Butler Park Area

Existing or new assets: TBD

Existing mechanism through which action will be implemented: TBD

Responsible Organization: TBD

Target Completion Date: TBD

Estimated Cost: TBD

Potential Funding Sources: TBD

Priority: TBD

Oxford Township, Warren County:

Location:

Oxford Township is located in central Warren County. As of 2000, the township population was 2,307. Oxford is bordered by White Township to the north and west, Liberty to the north, Mansfield to the east and Washington Township to the south.



Geology:

The topographic relief of the township is moderate and characterized by parallel, irregular ridges and intervening valleys trending northeast. Most of the township is characterized by well drained soil overlying limestone or gneissic bedrock.

Hydrology:

Furnace Brook is a tributary to the Pequest.

Headwaters of the *Pophandusing Brook* form in the western portion of the township.

Recent Flood History:

The township was affected by flooding of Furnace Brook during the April 2005 and September 2004 events. In both events, 10 commercial and 50 residential structures incurred basement flooding and 10 commercial and 10 residential structures incurred first floor flooding. Areas near Kent Street, Cinder Street, Belvidere Avenue, Main Street, and Washington Street were affected. Historic buildings were flooded, embankments were eroded, and the city incurred minor road washouts. The condition of the Furnace Brook Stream dam upstream of downtown is of particular concern to the municipality.

Unique Flood Risk to Municipality: The Furnace Lake and associated dam provide a detention basin for stormwater attenuation and could potentially be used to manage flood conditions.

Local Flood Mitigation Planning Committee:

Rick Clabrese	EMC
Alex Lazorisak	Mayor
Louis Accetturo	DPW Supervisor
Joseph Nalio	Finelli Consulting Engineers, Inc.

Ordinances/Plans Reviewed: Stormwater Management Ordinance

Outreach: The Planning Committee will reach out as necessary once the extent of the flood risk is assessed and mitigation goals and implementation plans are formulated.

First Public Meeting Date: 7/18/2007

Date and Method of Advertisement for FMP: 7/13/2007, Easton Times

Questionnaire Distribution Method: US Mail 6/8/2007

Public Response:

1. Dredging Furnace Brook culvert at Route 31
2. Possibility of lowering the water level in Furnace Lake prior to storm events

Flood Mitigation Goals:

1. Reduce flood damage along the Furnace Brook
2. Maintain emergency access to all township residents and essential facilities located within the 100-year floodplain on Furnace Brook

Oxford Mitigation Actions

1. **ACTION:** Use Furnace Lake and dam as a detention basin to attenuate stormwater

Description/Background:

Hazard: Flood

Existing or new assets: Existing

Existing mechanism through which action will be implemented: Township Committee

Responsible Organization: NJDEP
Target Completion Date: December 2008
Estimated Cost: \$30,000
Potential Funding Sources: Grant
Priority: High

2. ACTION: Assess elevations of critical equipment in the wastewater treatment plant and plan corrective action

Description/Background:

Hazard: Flood

Existing or new assets: Existing

Existing mechanism through which action will be implemented: Township Committee, Pequest River Municipal Utility Authority (PRMUA)

Responsible Organization: PRMUA

Target Completion Date: December 2008

Estimated Cost: \$10,000 (assessment)

Potential Funding Sources: Grant

Priority: Medium

Town of Phillipsburg, Warren County:

Location:

The Town of Phillipsburg is located on the Delaware River in southwestern Warren County. The town is home to 15,166 people within 3.34 square miles. It is bordered by the City of Easton to the west, Lopatcong Township to the north and east, and Pohatcong Township to the south.



Geology:

The township lies in the Highlands of New Jersey. The area is characterized by gently rolling to steep uplands underlain by gneiss, quartzite and limestone. Elevations range from 133 feet at the Delaware River to 405 feet in the north-central part of town.

Hydrology:

The *Delaware River* forms the western border of the town. It flows south and is the largest body of water flowing through the township.

The *Lopatcong Creek* has its headwaters in northeastern Harmony and flows generally southwest through the townships of Lopatcong, Greenwich, Pohatcong to Phillipsburg where it empties into the Delaware River. The creek drains most of the town except for areas very close to the Delaware River.

Recent Flood History:

The town was flooded by storms in June 2006, April 2005, September 2004, September 1999, 1996, 1955, and 1903. Flooding is most common along the Lopatcong Creek and in the Union Square area. Although the Lopatcong can flood from localized rainfall, the Delaware River can also back into the Lopatcong and cause flooding. When the Delaware River reaches 30 feet, its waters flood the storm sewers. There are 10 outfalls into the Delaware River and four into the Lopatcong Creek. There is a primary problem was with outfalls #1 to #6 into the River. The four outfalls into the creek were a problem in the 2004 storm.

During the storm events of 2004, 2005 and 2006, approximately 22 residential and 3 commercial structures incur basement damage and 2 industrial, 22 residential, and 3 commercial structures incur first floor damage. Many of the buildings are rental properties whose residents do not carry flood contents insurance. Homes range in value from \$200K - \$310K.

More properties were affected in 2004 because of a rainfall directly on this tributary to the Delaware (10.5 inches of rain reported locally). A few properties near the confluence with the Delaware River were also flooded in 2005 and 2006 when the Delaware River backed up the Lopatcong.

The pumping station between the Northhampton Street bridge and the toll bridge has been inundated in all three floods, resulting in raw sewage entering the Delaware River. The wastewater treatment plant, built in 1952 with a \$10 million upgrade in the 1990's, near

Lopatcong Creek, was also inundated and damaged in all three floods. The lift station had to be replaced.

Flooding also affects roads, bridges, and a railroad line used to transport coal. Roads most often affected include Union Square, Riverside Way, North Main Street, South Main Street, Saw Mill Street, Morris Canal Way, and Lock Street. The railroad track along the Delaware River was flooded subsequently fixed by Norfolk Southern Railroad. This line transports coal to the Martin Creel power plant and has a bridge crossing over to Easton. The road and retaining wall north of the Northampton Street bridge failed due to one of the floods.

Flood Mitigation:

A private dam was removed on Lopatcong Creek in 2005, which alleviated some of the flooding problem.

Unique Flood Risk to Municipality: None

Local Flood Mitigation Planning Committee:

Richard Hay	EMC
Mabel Cook	DEMC
Kevin Duddy	Const./Zoning Officer
Dennis Viscomi	Public Works Supervisor
Harry Wyant	Mayor
Michele Broubalow	Adm./Clerk
Municipal Engineer	Firm under contract

Ordinances/Plans Reviewed: Floodplain and zoning mapping, incident reports and photographs from 1955, 2004, 2005, and 2006 flood events

Outreach: Army Corps of Engineers, NJDEP, DRBC, Delaware River Joint Toll Bridge Commission

First Public Meeting Date: 10/16/2007

Date and Method of Advertisement for FMP: 10/3/2007, Express-Times newspaper

Questionnaire Distribution Method: mail

Public Response:

1. Do not allow New York City to empty their reservoir overload during flood events
2. Backflow prevention for storm lines that empty into the Delaware River and Lopatcong Creek
3. Stop future development
4. Build barriers to protect water front property
5. Require new development to capture run-off
6. Construct dam on Lopatcong Creek
7. Flood barriers for streets
8. Dredge the Delaware River
9. Prevent the Delaware River from backing up the Lopatcong Creek into low lying areas of South Main Street during high water

Flood Mitigation Goals:

1. Reduce infrastructure and environmental damage as well as health risk, health hazards

Phillipsburg Mitigation Actions**1. ACTION: Modifications to Lift Station on Riverside Way**

Description/Background: Modifications to the lift station will make it more flood resistant and allow for its continued operation during flood events. The existing facility is rendered non-operational as soon as it is impacted by flood waters. The town needs to upgrade, elevate, and waterproof all electrical panels and systems, install waterproof submersible pumps, and provide for a prolonged backup energy source as well as any structural modifications that may be needed.

Hazard: Environmental Health

Existing or new assets: Existing

Existing mechanism through which action will be implemented: Town of Phillipsburg and the Phillipsburg Sewer Utility

Responsible Organization: Town of Phillipsburg

Target Completion Date: ASAP

Estimated Cost: \$500,000

Potential Funding Sources: Grants

Priority: High

2. ACTION: Modifications to Waste Water Treatment Plant on South Main Street

Description/Background: Modifications to the waste water treatment plant on South Main Street will make it more flood resistant and allow for its continued operation during flood events. The existing facility's operations are compromised during flood events. The town needs to upgrade, elevate, and waterproof all electrical panels and systems, install waterproof submersible pumps, and provide improvements to the backup energy source.

Hazard: Environmental Health

Existing or new assets: Existing

Existing mechanism through which action will be implemented: Town of Phillipsburg and the Phillipsburg Sewer Utility

Responsible Organization: Town of Phillipsburg

Target Completion Date: ASAP

Estimated Cost: \$500,000

Potential Funding Sources: Grants

Priority: High

3. ACTION: Modifications to Street and Retaining Wall on Riverside Way

Description/Background: Modifications to street and retaining wall on Riverside Way to make it more flood resistant and to prevent street undermining and collapse and river bank erosion and collapse during flood events

Hazard: Infrastructure protection

Existing or new assets: Existing

Existing mechanism through which action will be implemented: Town of Phillipsburg

Responsible Organization: Town of Phillipsburg

Target Completion Date: ASAP

Estimated Cost: \$400,000
Potential Funding Sources: Grants
Priority: High

4. ACTION: Install Backflow Prevention on Stormwater Discharges to the Delaware River and Lopatcong Creek

Description/Background: Installing backflow prevention on 8 of the 14 stormwater discharges to the Delaware River and Lopatcong Creek will prevent flood waters from backing up into the storm water system and flooding low lying sections of the North End, Union Square, and the lower South Main Street, Sawmill Street area.

Hazard: Protection of existing property and infrastructure

Existing or new assets: Existing/New

Existing mechanism through which action will be implemented: Town of Phillipsburg

Responsible Organization: Town of Phillipsburg

Target Completion Date: ASAP

Estimated Cost: \$500,000 to \$1,000,000.

Potential Funding Sources: Grants

Priority: High

5. ACTION: Provide for an Engineering Feasibility Study of the Lopatcong Creek to determine Mitigation Actions to Prevent Backflow of Creek when the Delaware River is at Flood Stage

Description/Background: There is a need to determine methods to prevent flooding of the lower South Main Street, Sawmill Street area due to backflow of the Lopatcong Creek when the Delaware River is at flood stage. The area study will include the entire length of the Lopatcong Creek within the corporate limits of the Town of Phillipsburg including the confluence of the Lopatcong Creek and the Delaware River.

Hazard: Protection of existing property and infrastructure

Existing or new assets: Existing/New

Existing mechanism through which action will be implemented: Town of Phillipsburg, New Jersey Department of Environmental Protection

Responsible Organization: Town of Phillipsburg

Target Completion Date: ASAP

Estimated Cost: \$200,000

Potential Funding Sources: Grants

Priority: High

Pohatcong Township, Warren County:

Location:

Pohatcong Township is located in the southernmost tip of Warren County. It is home to 3,416 people within 13.61 square miles. It is bordered by Riegelsville to the west, the communities of Phillipsburg and Lopatcong to the north, Greenwich to the north and east, Bloomsbury to the east, and Holland and Bethlehem to the south. The township also surrounds the Borough of Alpha.



Geology:

The township lies in the Highlands of New Jersey. The topographic relief of the township is moderate and characterized by rolling steep uplands. The hills, which rise about 500 feet above the valleys are composed of gneiss and other hard crystalline rocks. The valleys are mainly composed of carbonate rocks and shale. Elevations range from 116 feet at the Delaware River to 725 feet in the southeastern corner of the township.

Hydrology:

The *Delaware River* flows along the western boundary of the township and is the largest waterway in the township.

The *Lopatcong Creek* loops into the township for a distance of only 2,400 feet. The creek drains a small area in the northern part of the township.

The *Pohatcong River* is a tributary to the Delaware River and flows from northeast to southwest. It flows through the central part of the township and drains most of the central and northern portion of the township.

The *Musconetcong River* is the major waterway in Pohatcong Township. It originates at Lake Hopatcong; it then loops to the northwest after flowing through Lake Musconetcong. The river then flows southwest forming the border of Warren County until it gets to the Delaware River.

Recent Flood History:

The township was affected by the June 2006, April 2005, September 2004, and September 1999 flooding events. During June of 2006, the Musconetcong, Pohatcong, and the Delaware River flooded River Road, Snyders Road, Manor Road, Route 627, Mt. Joy Road, Musconetcong Street, and the residential villages of Carpentersville, Riegelsville, and Finesville. Seventy-six (76) residential structures sustained basement damage and thirty (30) residential structures sustained first floor damage. Waters contaminated individual wells and septic systems.

During April 2005, all 4 major waterways flooded. Eighty (80) homes incurred basement damage and forty-four (44) incurred first floor damage. The September 2004 event affected Ninety-five (95) basements and forty (40) first floors. In addition, the Pohatcong Emergency Operations Center at Huntington Volunteer Fire Company 1 was flooded. Roadways were washed away and Pohatcong's drainage system was destroyed. Damage from the 2004 storm

can still be seen in parts of the township. FEMA estimated repair for public damage at \$600,000 to \$750,000. Repair for private damage was estimated at over \$1,000,000. The 4 waterways also flooded roads and homes in 1999.

Flood Mitigation:

There have been 4 properties elevated with NFIP and 2 that have been acquired with help by FEMA and New Jersey Green Acres. Approximately a dozen more homeowners are interested in elevation but lack funding.

Unique Flood Risk to Municipality: None

Local Flood Mitigation Planning Committee:

Donald Grube	EMC
Richard McIntyre, P.E.	Municipal Engineer, Floodplain administrator
Gwen Steckel, P.E.	Stormwater Management Coordinator
Samuel Souders	Council/Land Use Board
Wanda Kutzman	Township Clerk
Alan Pyatt	Property Owner
Charity Pyatt	Property Owner
Manny Couto	Property Owner
Walter Banfield, Jr.	Property Owner
Ron Stueber	Property Owner
Louis Hajdu	Property Owner
Judith Forbes	Property Owner
Richard Forbes	Property Owner

Ordinances/Plans Reviewed: Flood Damage Prevention Ordinance, Zoning Ordinance

Outreach: DRBC, FEMA, NJDEP, NJOEM

First Public Meeting Date: 10/23/2007

Date and Method of Advertisement for FMP: 10/6/2007 The Express-Times

Questionnaire Distribution Method: Hand delivered with instructions by deputy management coordinators and available at the municipal building

Public Response:

1. Mandate controlled releases from the New York reservoirs and require them to remain at or below 80% capacity
2. Don't allow a particular subdivision development to be built

Flood Mitigation Goals:

1. Protect human life and health
2. Minimize expenditures of public money for costly flood-control projects
3. Minimize the need for rescue and relief efforts associated with flooding and generally undertaken at the expense of the general public
4. Minimize prolonged business interruptions
5. Minimize damage to public facilities and utilities such as water and gas mains, electric,

- telephone, and sewer lines, streets and bridges that are located in the floodplain
6. Help maintain a stable tax base by providing for the use and development of floodplains so as to minimize future flood blight areas
 7. Insure that potential buyers are notified that property is in a floodplain
 8. Ensure that those who occupy floodplains assume responsibility for their actions
 9. Establish standards for development in floodplains

Pohatcong Mitigation Actions

1. ACTION: Elevation of flood-prone residences

Description/Background:

Hazard: Flood

Existing or new assets: Existing

Existing mechanism through which action will be implemented: Flood damage prevention ordinance / NFIP participation

Responsible Organization: Property owners

Target Completion Date: As soon as funds become available

Estimated Cost: \$50,000 to \$100,000 per structure

Potential Funding Sources: NFIP; Various FEMA grant programs

Priority: High

2. ACTION: Adopt new flood damage prevention ordinance

Description/Background:

Hazard: Flood

Existing or new assets: New and existing

Existing mechanism through which action will be implemented: Flood damage prevention ordinance

Responsible Organization: Township Council

Target Completion Date: 2008

Estimated Cost: \$5,000

Potential Funding Sources: Municipal funds

Priority: High

3. ACTION: Install a pipe with backflow prevention device under railroad from River Road to the Delaware River

Description/Background: When the river floods, water seeps under the railroad embankment and onto River Road. There are no storm drains or culverts under the railroad to allow the water to drain quickly back into the river once the flood waters recede. During flood events, this portion of River Road remains impassible for several days.

Hazard: Flood

Existing or new assets: Existing

Existing mechanism through which action will be implemented: N/A

Responsible Organization: Township Council

Target Completion Date: 2009

Estimated Cost: \$150,000

Potential Funding Sources: FEMA's Hazard Mitigation Grant Program

Priority: Medium

4. **ACTION: Install backflow prevention device on several existing pipes/culverts that discharge to the Delaware River**
Description/Background: Backflow prevention devices are needed on several existing storm drains and culverts to prevent flood water from backing up into them causing flooding of residential areas and roads that would otherwise not be flooded.
Hazard: Flood
Existing or new assets: Existing
Existing mechanism through which action will be implemented: N/A
Responsible Organization: Township Council
Target Completion Date: 2009
Estimated Cost: \$300,000
Potential Funding Sources: FEMA's Hazard Mitigation Grant Program
Priority: Medium

5. **ACTION: Construct a stormwater detention basin along Mountain Road to control runoff from the mountain**
Description/Background: In the past, Mountain Road required total reconstruction due to damage from erosion. Additionally, the eroded material completely filled in and blocked an existing drainage system. Controlling the rate of the runoff should alleviate this during future storms.
Hazard: Flood
Existing or new assets: Existing
Existing mechanism through which action will be implemented: N/A
Responsible Organization: Dept. of Agriculture; Soil Conservation Service
Target Completion Date: 2010
Estimated Cost: \$250,000 to \$350,000
Potential Funding Sources: Hazard Mitigation Grant Program
Priority: Medium

6. **ACTION: Review development ordinances including density of development and stormwater management requirements**
Description/Background:
Hazard: Flood
Existing or new assets: New
Existing mechanism through which action will be implemented: Land development ordinances
Responsible Organization: Land Use Board and Township Council
Target Completion Date: 2008
Estimated Cost: \$5,000
Potential Funding Sources: Municipal funds
Priority: Medium

7. **ACTION: Study the impact of the removal of the Musconetcong River dams on flooding**

Description/Background: There will be no removal of the dams until study proves that their removal will not worsen flooding.

Hazard: Flood

Existing or new assets: Existing

Existing mechanism through which action will be implemented: N/A

Responsible Organization: Musconetcong Watershed Assoc.; Army Corps of Engineers

Target Completion Date: 2010

Estimated Cost: \$300,000

Potential Funding Sources: NJDEP, Army Corps of Engineers, FEMA

Priority: Medium

8. ACTION: Landscape Block 97, Lots 53 & 54 which are in the riparian zone of the Delaware River

Description/Background:

Hazard: Flood

Existing or new assets: Existing

Existing mechanism through which action will be implemented: N/A

Responsible Organization: Rutgers Forest Restoration Program

Target Completion Date: 2009

Estimated Cost: \$20,000

Potential Funding Sources: Rutgers Univ. & EPA

Priority: Low

White Township, Warren County:

Location:

White Township is located in the west-central portion of Warren County along the Delaware River. It is home to 4,245 people within 27.75 square miles.

It is bordered by the Townships of Knowlton and White to the north, the Townships of Liberty and Oxford to the east, the Township's of Harmony and Washington to the south, and the Delaware River to the west.



Geology:

White Township has mostly hilly terrain with some flatter areas near the Delaware River. It is more hilly and mountainous in the eastern and northern part of the township with elevations exceeding 1,200 feet. Most of the township is characterized by well drained soil overlying limestone or gneissic bedrock.

Hydrology:

The *Pequest River* drains into the Delaware River in White Township and flows from northeast to southwest. *Mountain Lake Brook* and the *Beaver Brook*, both tributaries to the Pequest, flow south and joins the Pequest River in White Township.

The *Delaware River* flows south along the western border of the township alongside a

residential area. White Township surrounds Belvidere Township and exists to both the north and south of Belvidere along the Delaware.

The *Pophandusing Brook*, a tributary to the Delaware, flows west through the center of White Township and forms the southern border of Belvidere Township.

The *Buckhorn Creek* originates in the southern portion of the township and joins the Delaware within the boundary of Harmony Township.

Recent Flood History:

Although Buckhorn Creek, Beaver Brook, and the Pequest River flow through the township, White is primarily affected by Delaware River flooding due to development patterns.

White Township was affected by the June 2006, April 2005, September 2004, and September 1999 flooding events. During the events, approximately 60 residential and commercial structures sustained basement damage and 35 sustained first floor damage. There were major road closures and damage as well as septic tank damage. Route 46 along the Delaware River, River View, and Foul Rift Road are repeatedly flooded.

Unique Flood Risk to Municipality:

White is affected by several tributaries and the Delaware River. When the Delaware River rises to flood stages, it blocks off the tributaries with debris. The Pequest River and its tributaries back up. Water flowing from the north is blocked by the Delaware, the build up is quick, and White Township gets inundated. White is at least a foot below the flood stages in Belvidere. This needs to be investigated because of timing factors.

Local Flood Mitigation Planning Committee:

Bryan Vande Verde	Mayor
Frank Panetta	EMC/OEM
Mick Ennis	Deputy EMC
Sam Race	Committeeman
Jim Ashe	Committeeman
Mike Grossman	Resident
Elaine O'Neil	Flood Property Resident
Bob Mackey	Resident
Jeff Herb	Resident
Ron Beck	Public
Sue McEvoy	Public
Linda Heilman	School CSA
Brian Vander Verde	Mayor
Kathleen Reinalda	CFO
Jim Hothouse	DPW

Ordinances/Plans Reviewed: Zoning and land use ordinances, slope ordinances, Master Plan, Wetlands, Land Preservation

Outreach: Belvidere, Harmony, Oxford, Washington Township, Liberty Township, Knowlton Township, Pequest Watershed

First Public Meeting Date: 8/1/2007

Date and Method of Advertisement for FMP: Local newspapers two weeks in advance

Questionnaire Distribution Method: Phone calls, word of mouth, advertisement

Public Response:

1. How much advance warning will be given in the event of another flooding incident?
2. How would residents be notified?
3. Where would shelters be set up?

Flood Mitigation Goals:

1. Keep residents safe at all times
2. Ample public notification during events by going door-to-door, radio notification, or Reverse 911

White Mitigation Actions

1. ACTION: Early Warning

Description/Background:

Hazard: Flood

Existing or new assets: Existing

Existing mechanism through which action will be implemented: EOP

Responsible Organization: Township

Target Completion Date: 2008

Estimated Cost: \$15,000

Potential Funding Sources: Township

Priority: High

2. ACTION: Remove debris from tributaries

Description/Background:

Hazard: Repetitive loss

Existing or new assets: Existing

Existing mechanism through which action will be implemented:

Responsible Organization: DEP, DPW

Target Completion Date: 2010

Estimated Cost: \$100,000

Potential Funding Sources: DEP/FEMA

Priority: High

3. ACTION: Keep entrance from tributaries to the Delaware River clear to prevent backup

Description/Background:

Hazard: Repetitive loss

Existing or new assets: Existing

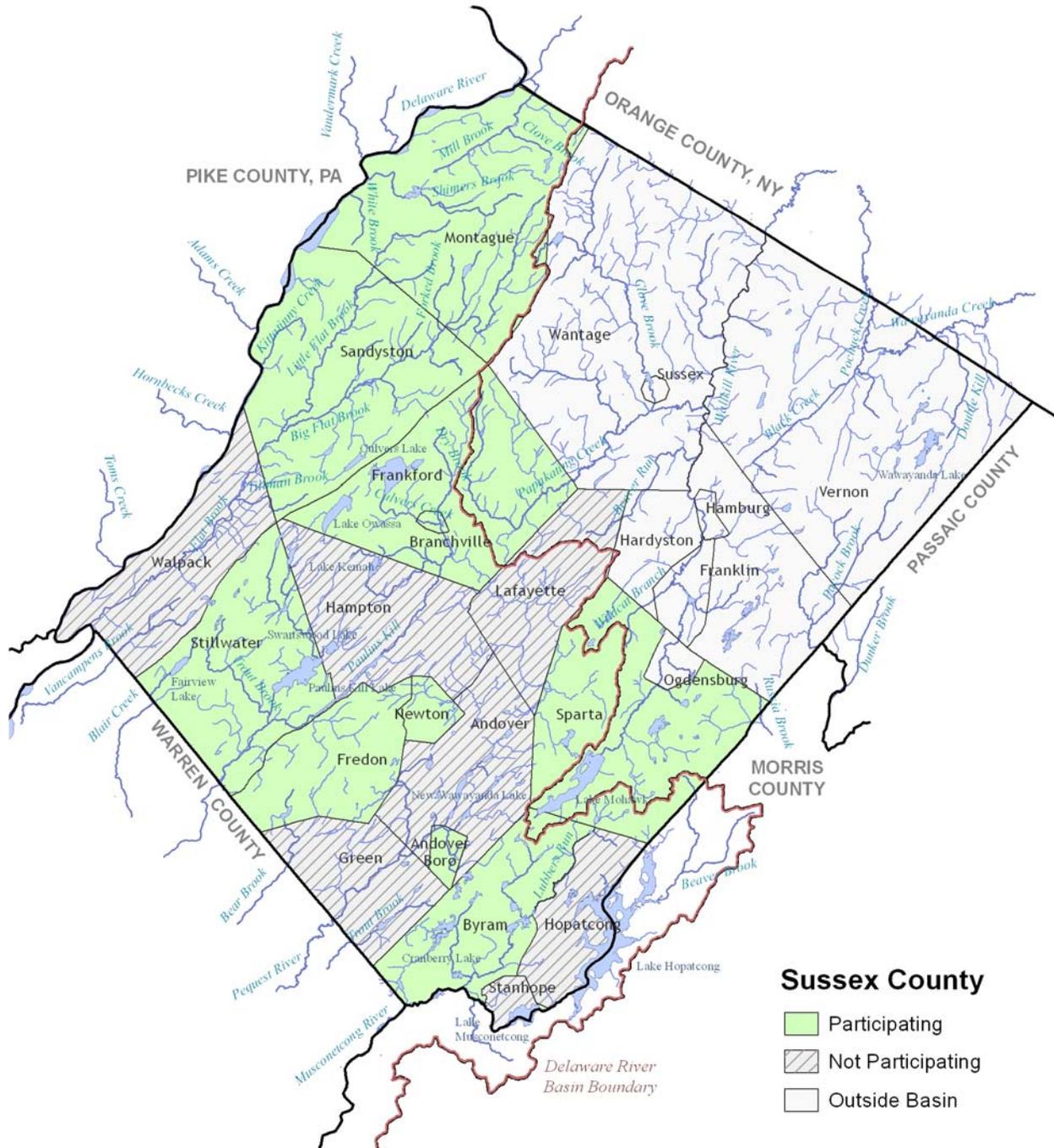
Existing mechanism through which action will be implemented:

Responsible Organization: DEP, Federal
Target Completion Date: 2010
Estimated Cost: \$100,000
Potential Funding Sources: DEP/FEMA
Priority: High

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SUSSEX COUNTY:

Participating municipalities in Sussex County include Andover Borough, Branchville, Byram, Frankford, Fredon, Montague, Newton, Sandyston, Sparta and Stillwater.



The County of Sussex is the northernmost county in the State of New Jersey. Given Sussex County's location at the top of the state, it is bordered by counties in New Jersey as well as in neighboring New York and Pennsylvania. This region is often collectively known as the Tri-State Area.

According to the U.S. Census Bureau, the county has a total area of 536 square miles. As of the census of 2000, there were 144,166 people, 50,831 households, and 38,784 families residing in the county. The population density was 277 people per square mile.

High Point in this county is the highest elevation in the state at 1,803 feet above sea level. The county's lowest elevation is approximately 300 feet above sea level along the Delaware River near Flatbrookville. Much of the county is hilly, as the part of New Jersey most solidly within the Appalachian Mountains. However, the Great Valley of the Appalachians takes in a good deal of the eastern half of the county, allowing for land more amenable to agriculture.

Early industry and commerce chiefly centered around agriculture, iron mining, shifting during the late nineteenth and early twentieth centuries to focus on several factories and the mining of zinc. Today, Sussex County features a mix of rural farmland, forests and suburban development. Though agriculture (chiefly dairy farming) is on the decline and because the county hosts little industry, Sussex County is considered a "bedroom community" as most residents commute to neighboring counties (Bergen, Essex and Morris Counties) or to New York City for work.

County Mitigation Statement:

Sussex County pledges to support the mitigation goals and actions of their municipalities to the best of their ability.

Sussex County Flood Response:

County Mitigation Actions:

1. **ACTION: None specified.**
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Mitigation Action Plan of Participating Jurisdictions for Sussex County

Jurisdiction	Page Number	Status
Sussex County	243	0 actions submitted
Andover Borough	249	3 actions submitted
Branchville Borough	251	3 actions submitted
Byram Township	253	2 actions submitted
Frankford Township	255	1 action submitted
Fredon Township	257	6 actions submitted
Montague Township	260	5 actions submitted
Town of Newton	263	6 actions submitted
Sandyston Township	267	1 action submitted
Sparta Township	269	4 action submitted
Stillwater Township	272	3 actions submitted

Sussex County: Municipal Mitigation Actions by Action Category**1. Prevention (Policy/Ordinances/Studies/Enforcement)**

Municipality	Mitigation Action	Responsible Party	Estimated Cost	Priority
Fredon Township	Support new Master Plan with ordinances as detailed therein	Fredon Township	\$20,000	Low
Frankford Township	Mountain Snowmelt and Rain Runoff Analysis	State, County, Local	\$1M +	Medium to High
Fredon Township	Dam Analysis	Fredon Township	Staff time	Medium
Town of Newton	Dam Analysis	Town of Newton/ Private Property Owners	To be determined	High
Town of Newton	Enforce Municipal Ordinances and Town Master Plan	Town of Newton	N/A	Medium
Stillwater Township	Create County GIS Coverage for Dams and Inundation Areas	To be determined	To be determined	High
Sparta Township	Dam Analysis	Private Dam Owners	To be determined	High

2. Property Protection (Acquisition, Elevation or Flood proofing)

None Identified

3. Public Information and Awareness

Municipality	Mitigation Action	Responsible Party	Estimated Cost	Priority
Montague Township	Public Awareness	County OEM, township	\$1,000	Medium
Sandyston Township	Public awareness	County	To be determined	Medium

4. Emergency Services

Municipality	Mitigation Action	Responsible Party	Estimated Cost	Priority
Fredon Township	Provide power to shelter at Civic Center	Fredon Township	\$65,000	Low
Montague Township	Warning system installation along flood areas on River Road	Municipality	\$50,000	Low to Medium

5. Natural Resource Protection (Floodplain protection, Stream Corridor Restoration, Open space)

Municipality	Mitigation Action	Responsible Party	Estimated Cost	Priority
Andover Borough	Klymers Brook Mitigation	John Risko, Robert Smith, chair	\$10,000	Low
Branchville Borough	Cleanout brooks	Branchville Borough	\$50,000	High
Branchville Borough	Removal of old railroad culvert in brook	Branchville Borough	To be determined	High
Fredon Township	Protect Whittemore Pond from new development	Fredon Township	\$100,000	High

5. Natural Resource Protection (Floodplain protection, Stream Corridor Restoration, Open space) continued

Municipality	Mitigation Action	Responsible Party	Estimated Cost	Priority
Montague Township	Clean up existing debris in the Benekill River	Flood Mitigation Committee and USACE	\$500,000 - \$700,000	High
Town of Newton	Moore's Brook Stream Cleaning and Desnagging	Town of Newton	To be determined	High
Sparta Township	Stream Restoration - Sparta Glen Brook	County, township	To be determined	High
Sparta Township	Stream Restoration - Wallkill River @ Station Park	Sparta Township	To be determined	Medium
Stillwater Township	Bank and Slope Stabilization - Paulinskill River @ Kohlbocker Road	To be determined	To be determined	High
Stillwater Township	Channel Modification and Bank stabilization - Neldon's Brook Stream Cleaning	To be determined	To be determined	High
Town of Newton	Moore's Brook Stream Cleaning and Desnagging	Town of Newton	To be determined	High
Sparta Township	Stream Restoration - Sparta Glen Brook	County, township	To be determined	High
Sparta Township	Stream Restoration - Wallkill River @ Station Park	Sparta Township	To be determined	Medium
Stillwater Township	Bank and Slope Stabilization - Paulinskill River @ Kohlbocker Road	To be determined	To be determined	High
Stillwater Township	Neldon's Brook Stream Cleaning, Channel Modification and Bank Stabilization	To be determined	To be determined	High

6. Structural Projects

Municipality	Mitigation Action	Responsible Party	Estimated Cost	Priority
Andover Borough	Install catch basin on Washer Farm	Andover Borough Building and Grounds Department	\$65,000 (2006 dollars)	Medium
Andover Borough	Re-direct runoff from Route 206 near Whitehall Road to a catch basin	Andover Borough Streets and Roads Department	\$13,000	High
Branchville Borough	Repair Small Pond Dam	Branchville Borough	To be determined	High
Byram Township	Little Paint Drainage Improvements	Byram Township	\$75,000	High
Byram Township	Lackawanna Dam improvements	Byram Township, Lake Lackawanna Investment Corp.	To be determined	High
Fredon Township	Upgrade drain at intersection of Pond Place and Slate Ridge	Fredon Township	\$10,000	High
Fredon Township	Mitigate Runoff from Newton Memorial Hospital	Newton Township	Unknown	Medium
Montague Township	Ice Flow Channel correction in the Benekill River	USACE	\$500,000 - \$1,000,000	High
Montague Township	Elevate River Banks along the Delaware and Benekill Rivers	Flood Mitigation Committee	To be determined	Low

6. Structural Projects - continued

Municipality	Mitigation Action	Responsible Party	Estimated Cost	Priority
Town of Newton	Upgrade of Merriam Avenue School Stormwater Pump Facility	Town of Newton/ Board of Education	To be determined	High
Town of Newton	Stormwater Drainage Improvements in west end section of town	Town of Newton/ County of Sussex	To be determined	High
Town of Newton	Stormwater Drainage Improvements - Route 206 in the area of the Merriam Avenue Intersection	NJDOT	To be determined	High
Sparta Township	Re-direct stormwater in the area of Hopkins Corner Road and Valley Manor Drive	Sparta Township	To be determined	High

Andover Borough, Sussex County:

Location:

The Borough of Andover is a community of 658 people within 1.47 square miles in southern Sussex County. It is bordered by Andover Township to the north, east and west, Green Township to the southwest, and Byram Township to the southeast.



Geology:

The township lies in the Valley and Ridge Province and is composed of Paleozoic sedimentary rocks. The soil composition of the area is greatly influenced by the ice invasion during the Wisconsin Glaciation.

Hydrology:

Klymers Brook is located in the borough and is a tributary to the *Pequest River*.

Recent Flood History:

During flooding events, the community is affected by the Pequest River and its tributary, Klymers Brook. Impervious runoff also contributes to flooding.

Andover Borough was flooded by the June 2006, April 2005, September 2004, and September 1999 events. Creamery Road, Junction, Whitehall Road, and the Washer property were flooded. In each event, about 5 residential structures incurred basement damage. Roads were washed out, agricultural lands eroded, and crops were destroyed. There are no repetitive loss properties in Andover Borough.

Some citizens are interested in farmland acquisition, but are limited by the lack of funds available. The municipality is interested in the containment and alleviation of flood and runoff waters.

Unique Flood Risk to Municipality:

The township’s water supply is near Klymers Brook. In this area, the water table is about 3 feet.

Local Flood Mitigation Planning Committee:

Arthur S Copcutt	Water Spvr./Council/Stormwater Management
Scott Danielson	Emergency Management
Shirlee Bollard	Planning and Zoning
Harold Pellow, P.E.	Town Engineer

Ordinances/Plans Reviewed: Historical maps and data

Outreach: None

First Public Meeting Date: 7/9/2007 and Nov 7, 2007

Date and Method of Advertisement for FMP: October 2007, Andover Borough Newsletter and New Jersey Herald

Questionnaire Distribution Method: Personally interviewed flood-prone residents

Public Response:

1. The farmer who is impacted by flooding is tired of having his fields flooded due to town runoff and the inability of streams to handle rainfall during a significant rain. The township has attempted to propose a catch basin on a small piece of the farm, but the farmer is concerned about liability.
2. The other flooding area is town property and is flooded by Klymers Brook, a stream that runs through the borough. Mitigation is opposed by Kittatinny State Park Manager.

Flood Mitigation Goals:

1. Provide for widening and cleaning of Klymers Brook at the junction
2. Provide some kind of additional water retention at Andover Park adjacent to the farm
3. Re-engineer the Route 206 run off flow from 206 off of Whitehall Road to a catch basin

Andover Borough Mitigation Actions:

1. ACTION: Install catch basin on Washer Farm

Description/Background: The Washer farm is impacted by flooding due to town runoff and the inability of streams to handle rainfall during a significant rain. The township has attempted to propose a catch basin on a small piece of the farm, but the farmer is concerned about liability. The township would like to provide some kind of additional water retention at Andover Park, which is adjacent to the farm.

Hazard: Field Flooding

Existing or new assets: New

Existing mechanism through which action will be implemented: Building and Grounds Department

Responsible Organization: Andover Borough Building and Grounds Department

Target Completion Date: 2012

Estimated Cost: \$65,000 in 2006 dollars

Potential Funding Sources: Grants and borough resources

Priority: Medium

2. ACTION: Klymers Brook Mitigation

Description/Background: Provide for widening and cleaning of Klymers Brook at the junction to increase flow capacity and mitigate flooding in residential yards. This will also help protect the borough's water supply from floodwaters since the normal water table there is 3 feet.

Hazard: Residential property flooding

Existing or new assets: Existing

Existing mechanism through which action will be implemented: Sussex County, Kittatinny State Park, Andover Borough Grounds

Responsible Organization: Andover Borough Building and Grounds Department

Target Completion Date: Unknown

Estimated Cost: \$10,000

Potential Funding Sources: Grants and borough resources

Priority: Low

3. ACTION: Re-direct runoff from Route 206 near Whitehall Road to a catch basin

Description/Background: Re-direct Route 206 runoff flow from 206 off of Whitehall Road to a catch basin.

Hazard: Road wash out, public property destruction

Existing or new assets: Existing

Existing mechanism through which action will be implemented: Streets and Roads Dept.

Responsible Organization: Andover Borough Streets and Roads Dept.

Target Completion Date: 2009

Estimated Cost: \$13,000

Potential Funding Sources: Grants, State Assistance, Borough resources

Priority: High

Branchville Borough, Sussex County:

Location:

Branchville is a small borough of 0.59 square miles located in north-central Sussex County. As of the United States 2000 Census, the borough population was 845. Branchville was incorporated as a borough by an Act of the New Jersey Legislature on March 9, 1898, from portions of Frankford Township. An additional portion of Frankford Township was annexed on March 1, 1951. The Borough is enveloped by Frankford Township.



Geology:

The township lies in the Valley and Ridge Province and composed of Paleozoic sedimentary rocks. The soil composition of the area is greatly influenced by the ice invasion during the Wisconsin Glaciation.

Hydrology:

The *Culver Brook* begins at Culver's Lake, in the western portion of Frankford Township and flows east through Branchville where it merges with the *Dry Brook* that originated in the northern portion of Frankford Township. Following their confluence, the Dry Brook flows south-east to its confluence with the Paulins Kill in Frankford Township.

Recent Flood History:

Poor drainage during heavy rainstorms causes flooding within the borough and, during Hurricane Ivan and Hurricane Floyd, Culver Brook and Dry Brook overtopped their banks and caused further flooding. Both residential and government lands near Mill Street, Recreation Drive, and Mattison Road were inundated with flood waters. One to two buildings sustained basement damage and up to two buildings sustained first floor damage during these flooding events.

Unique Flood Risk to Municipality:

Extreme runoff into brooks, merging of two brooks

Local Flood Mitigation Planning Committee:

Jeff Lewis	OEM Coordinator
Harold Pellow	Engineer
Gerald Van Gorden	Mayor
Frank Sutton	Panning Board
Sue Stark	Zoning Board
Wes Sheton	Property Owner

Ordinances/Plans Reviewed:**Outreach:**

First Public Meeting Date: 5/2/2007

Date and Method of Advertisement for FMP: 5/1/2007 NJ Herald and Borough Office

Questionnaire Distribution Method: Newsletter

Public Response:

1. Concerns over how quickly the brooks have been rising during recent storm events.

Flood Mitigation Goals:

1. Cleaning debris out of the brooks to lower the beds

Branchville Mitigation Actions:**1. ACTION: Clean out brooks**

Description/Background: This will increase the water carrying capacity of the brooks.

Hazard: High beds and debris

Existing or new assets: Existing

Existing mechanism through which action will be implemented: Branchville Borough

Responsible Organization: Branchville Borough

Target Completion Date: ASAP needs approvals

Estimated Cost: \$50,000

Potential Funding Sources: None

Priority: High

2. ACTION: Removal of old railroad culvert in brook

Description/Background: The railroad culvert has caused debris buildup and flooding in the past.

Hazard: Flooding

Existing or new assets: Existing/New

Existing mechanism through which action will be implemented: Branchville Borough

Responsible Organization: Branchville Borough

Target Completion Date: ASAP needs approvals

Estimated Cost: TBD

Potential Funding Sources: None

Priority: High

3. ACTION: Repair Small Pond Dam**Description/Background:** Location = N 41.14788, W 074.74737**Hazard:** Dam breach**Existing or new assets:** Existing**Existing mechanism through which action will be implemented:** Branchville Borough**Responsible Organization:** Branchville Borough**Target Completion Date:** ASAP needs approvals**Estimated Cost:** To be determined**Potential Funding Sources:** None**Priority:** High**Byram Township, Sussex County:****Location:**

Byram Township is located in southeastern Sussex County and is home to 8,254 people in an area of 22.18 square miles. It is bordered by Sparta and Andover Townships to the north, Allamuchy Township to the southwest, Mount Olive Township and the Borough of Stanhope to the south, and the Borough of Hopatcong to the east.

**Geology:**

The township lies in the Valley and Ridge Province and is composed of Paleozoic sedimentary rocks. The soil composition of the area is greatly influenced by the ice invasion during the Wisconsin Glaciation.

Hydrology:

The *Musconetcong River* is the main waterway in Byram Township. It originates at Lake Hopatcong, it then loops to the northwest after flowing through Lake Musconetcong. The river then flows southwest forming the border of Warren County until it gets to the Delaware River.

Lubbers Run is a tributary to the Musconetcong River. It is located in the southeastern part of the township. *Dragon Brook* is also located in Byram Township.

The headwaters of the Wallkill River originate in the northernmost part of the township.

There are 24 lakes in the township.

Recent Flood History:

During the April 2006 flooding event, Waterloo Village, Lake Lackawanna, Tamarack/Little Paint Way were flooded by Lubber's Run, Dragon Brook, and the Musconetcong River. Less than 10 residential homes sustained basement damage and less than 10 homes sustained first floor damage. Historic homes in Waterloo Village were flooded.

Between August 12 and 14, 2000, Lubber's Run and the Musconetcong flooded. Historic

Waterloo Village flooded, around 10 buildings sustained basement damage, and 10 structures sustained first floor damage. During the September 1999 event, Tomahawk Lake, Lake Lackawanna, and West Brookwood flooded. Less than 10 private residences sustained basement damage and less than 10 residences sustained first floor damage. No one is currently interested in elevation or acquisition.

Unique Flood Risk to Municipality: None

Local Flood Mitigation Planning Committee:

Christopher Hellwig	Planning Director
Adolf Steyh	Supt. Public Works
Eskil Danielson	Mayor
Ray Rafferty	Police Chief
Lt. Peter Zabita	Police Department

Ordinances/Plans Reviewed: Township of Byram Master Plan

Outreach:

First Public Meeting Date: 8/16/2007

Date and Method of Advertisement for FMP: 7/22/07 NJ Herald

Questionnaire Distribution Method: US mail

Public Response:

1. There is no flooding problem
2. Can the township conduct an updated flood elevation survey in order to remove people from the FEMA floodplain so they don't have to pay for insurance?

Flood Mitigation Goals:

1. Investigate mitigation options for three flood-prone areas:
 - Dragon Brook where it underflows Little Paint Way through a culvert
 - Lubber's Run below the Lake Lackawanna Dam
 - Musconetcong River that runs along River Road

Byram Mitigation Actions:

1. ACTION: Little Paint Drainage Improvements

Description/Background:

Hazard: Localized flooding

Existing or new assets: Existing

Existing mechanism through which action will be implemented: Capital

Responsible Organization: Byram Township

Target Completion Date: 2012

Estimated Cost: \$75,000

Potential Funding Sources: None

Priority: High

2. ACTION: Lackawanna Dam improvements

Description/Background:

Hazard: Localized flooding

Existing or new assets: Existing

Existing mechanism through which action will be implemented: Capital

Responsible Organization: Byram Township, Lake Lackawanna Investment Corp.

Target Completion Date: To be determined

Estimated Cost: To be determined

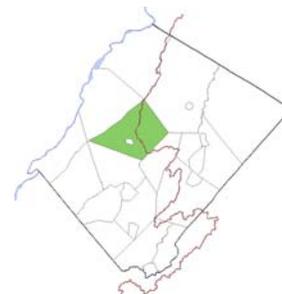
Potential Funding Sources: None

Priority: High

Frankford Township, Sussex County:

Location:

Frankford Township is located in north-central Sussex County and is home to 5,420 people within 35.43 square miles. It is bordered by Wantage Township to the northeast, Sandyston Township to the northwest, Hampton Township to the south, and Lafayette Township to the southeast. Only the western half of this township drains into the Delaware River.



Geology:

The township lies in the Valley and Ridge Province and composed of Paleozoic sedimentary rocks. The soil composition of the area is greatly influenced by the ice invasion during the Wisconsin Glaciation.

Hydrology:

The *Culver Creek* drains into two large lakes (Lake Owassa and Culvers Lake). There is also a large swamp connecting the two. Lake Owassa drains through a 2.5 foot wier. This creek has three dams near US Route 206, County Route 630, and just downstream of Longridge Road.

The *Dry Brook* is a small tributary to Paulins Kill and has a very steep slope as it drains off of Kittatinny Mountain. The *Paulins Kill* is a tributary to the Delaware River located in the central part of the township.

Outside the Delaware River Basin, the *Papakating Creek*, a tributary of the Wallkill River, originates in the northern portion of the township. It flows south and then turns to flow northeast prior to leaving the township boundry. The Wallkill eventually empties into the Hudson River.

Recent Flood History:

In September of 2004, heavy rains fell in Frankford, which caused basement damage in six residential structures on Spring Walk off of East Shore Lake Owassa Road. The municipality spent about \$6,300.00 to repair a section of road in the area. FEMA absorbed this cost.

Unique Flood Risk to Municipality:

Flooding is primarily caused by rain and/or snowmelt from the mountain, which is state

and/or federal property. The rain and/or snowmelt from the upper side of the mountain flows down to the county road. The county has installed drainage to reduce the hazards on the road, but the project has created a larger influx of water that runs down the properties on the north side of Culver Lake and causes flooding, erosion, and silting problems. At the bottom of the mountainside is one of Sussex County's most beautiful lakes. Culver Lake is a feeder to Culvers Creek which feeds into the Paulinskill. The flooding and runoff issue create a silting and sediment problem in the lake, which also affects the water quality of the Lake.

Mitigating this problem would be a very large and expensive project that the township could not undertake on its own. The township is trying to set up a meeting with the County Engineer and hopefully reach out for state and federal assistance.

Local Flood Mitigation Planning Committee:

R. Pumphrey	EMC, CPWM
R. McDowell	Elected Official
C. Kristensen	Mayor
B. Paterson	Fire Sub-Code Official
H. Pellow	HPA Engineering
L. Cular	Administrator
W. Hahn	Elected Official
S. Yarosz	Land Use Board
S. Taffaro	Secretary

Ordinances/Plans Reviewed: Land use ordinances dealing with construction in or around flood areas

Outreach: Branchville Borough EMC

First Public Meeting Date: 7/24/2007

Date and Method of Advertisement for FMP: 6/25/2007 NJ Herald

Questionnaire Distribution Method: Block ad in the newspaper, posted on the township's web site, questionnaire available at the municipal building and township garage

Public Response: None

Flood Mitigation Goals:

1. Prevent construction in any area that could be flood prone

Frankford Mitigation Actions:

1. ACTION: Mountain Snowmelt and Rain Runoff Analysis

Description/Background: The primary flooding problem in Frankford is the result of snowmelt and rain runoff from the nearby mountain. While the county has installed drainage measures to protect the county road, the properties below the road now receive more water than before the drainage measures were installed. The township would like a comprehensive analysis of the mountain snowmelt and/or rain run-off problem with suggested mitigation options. The township will reach out to county, state, and federal representatives to incorporate more stakeholders in the process and hopefully receive outside assistance.

Hazard: Flood

Existing or new assets: Existing/New

Existing mechanism through which action will be implemented: NJDEP Stormwater

Responsible Organization: State, County, Local

Target Completion Date: To be determined

Estimated Cost: \$1,000,000 +

Potential Funding Sources: To be determined

Priority: Medium to high

Fredon Township, Sussex County:

Location:

Fredon Township is located in the southwestern portion of Sussex County and is home to 2,860 people in 17.94 square miles. Hampton and Stillwater Townships border Fredon on the northwest. Newton and Andover Township border Fredon to the east and Green Township is to its south. Officially designated in 1904, Fredon Township was formed from parts of Andover, Green, Hampton and Stillwater Townships, making it the youngest township in Sussex County.



Geology:

The soils in the southern section of the town are mostly Hazen-Palmyra-Fredon association.

Hydrology:

Fredon hosts *Whittemore Pond*, considered to be headwaters of Paulinskill River.

Bear Brook, a tributary to the Pequest, has its headwaters in the southern portion of the township.

Recent Flood History:

The township was affected by Hurricane Ivan in September of 2004. Although no property owners reported flooding, Willows Road at the Whittingham Game Preserve and Slate Ridge Road at Westview Estates incurred flood damage. Road repair and cross drain repairs were required and funded by the municipal's annual operations budget. There is a New Jersey dam operating in Fredon. A joint town-county-land conservancy group acquisition is in process to help maintain open space within the community. The municipality has concerns how proposed new developments near the headwaters of the Paulinskill will impact flooding in the township. The proposed developments include an on-site sewer plant, which would discharge directly into the hillside overlooking Whittemore Pond. The stormwater and sewer runoff would then go directly into lower downtown Newton and threaten the commercial district.

Unique Flood Risk to Municipality:

Fredon hosts Whittemore pond, considered to be headwaters of Paulinskill River.

Local Flood Mitigation Planning Committee:

John Richardson Sr.	Mayor/OEM/Planning Board
Tom Knutelsky	Engineer
Hal Ennis	Zoning Board head
H. Pellow Assoc.	Municipal Engineer
Dave Simmons	Planning Board/Zoning Board

Existing Ordinances/Plans Reviewed: Master Plan, zoning ordinances, RSIS regulations, stormwater management plans, steep slopes, Planning Board application for 376 living units

Outreach: Newton Town

First Public Meeting Date: 10/31/2007

Date and Method of Advertisement for FMP: 10/29/2007

Questionnaire Distribution Method: Hand out at meeting

Public Response:

1. No citizen present reported flooding on their property, and one has lived in Fredon for 70 years
2. All citizens have concern about those properties towards which Fredon's runoff moves in every storm, and for flooding contribution downstream

Flood Mitigation Goals:

1. Preserve open space
2. Protect the headwaters of the Paulinskill River

Fredon Mitigation Actions:**1. ACTION: Upgrade drain at intersection of Pond Place and Slate Ridge**

Description/Background: This action will help mitigate localized flooding in the area and allow for emergency access during flooding events.

Hazard: Flooding

Existing or new assets: Existing

Existing mechanism through which action will be implemented:

Responsible Organization: Fredon Township

Target Completion Date: FY2008

Estimated Cost: \$10,000

Potential Funding Sources: Fredon Township

Priority: High

2. ACTION: Protect Whittemore Pond from new development

Description/Background: The municipality has concerns how proposed new developments near the headwaters of the Paulinskill will impact flooding in the township and downstream in Newton Town. The proposed developments include an on-site sewer plant, which would discharge directly into the hillside overlooking Whittemore Pond. The stormwater and sewer runoff would then go directly into lower downtown Newton and threaten the commercial district. The township will attempt to stop the project from being approved.

Hazard: Flooding

Existing or new assets: Existing

Existing mechanism through which action will be implemented:

Responsible Organization: Fredon Township
Target Completion Date: In process
Estimated Cost: \$100,000
Potential Funding Sources: Fredon Township
Priority: High

3. ACTION: Mitigate Runoff from Newton Memorial Hospital

Description/Background: Fredon would like to request the Town of Newton to mitigate runoff from the Newton Memorial Hospital property onto residential properties in Fredon.
Hazard: Property flooding
Existing or new assets: Existing
Existing mechanism through which action will be implemented:
Responsible Organization: Newton
Target Completion Date: Immediate
Estimated Cost: Unknown
Potential Funding Sources: Newton Town
Priority: Medium

4. ACTION: Dam Analysis

Description/Background: The township would like to determine the status of each dam in Fredon and determine the necessary corrective action if required.
Hazard: Lower dam risk
Existing or new assets: Existing
Existing mechanism through which action will be implemented:
Responsible Organization: Fredon Township
Target Completion Date: Immediate
Estimated Cost: Staff time
Potential Funding Sources: Fredon
Priority: Medium

5. ACTION: Finish infrastructure shelter at Civic Center

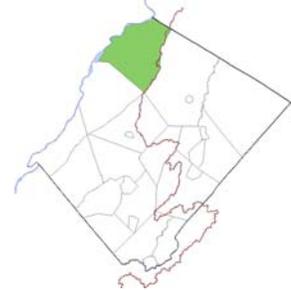
Description/Background: This will provide power for the shelter.
Hazard: Shelter not usable without power
Existing or new assets: New
Existing mechanism through which action will be implemented:
Responsible Organization: Fredon Township
Target Completion Date: FY2008
Estimated Cost: \$65,000
Potential Funding Sources: Grant
Priority: Low

6. ACTION: Support new Master Plan with ordinances as detailed therein

Description/Background: The township will implement the proposed changes in the Master Plan to help prevent flooding.
Hazard: Flooding
Existing or new assets: New

Existing mechanism through which action will be implemented:**Responsible Organization:** Fredon Township**Target Completion Date:** 2007/2008**Estimated Cost:** \$20,000**Potential Funding Sources:** Fredon Township**Priority:** Low**Montague Township, Sussex County:****Location:**

Montague Township is located in northern Sussex County along the Delaware River. As of the census of 2000, the township is home to 3,412 people within 45.34 square miles. Newton is bordered by Wantage to the east and Sandyston to the south.

**Geology:**

Montague Township contains both the northernmost point and highest elevation (1803 ft) in New Jersey. It is highly forested and has many rolling hills and valleys.

Hydrology:

There are numerous waterways through Montague and all ultimately drain to the Delaware River.

In the north, the *Mill Brook* and *Clove Brook* flow north to join the Neversink River in New York State prior its confluence with the Delaware River.

The *Bennekil*, which separates the larger Minisink Island from Everett's Island to the east.

Shimers Brook and *White Brook* both independently drain to the Delaware in the area of the Delaware Water Gap.

The *Delaware River* creates the western boundary for the township and flows south.

Both the *Little Flat Brook* and *Big Flat Brook* originate in Montague Township. The Little Flat Brook flows from the west and the Big Flat Brook from the east to a point in Sandyston Township where they join together to form the Flat Brook. The Flat Brook has its confluence with the Delaware River at Walpack Bend. The *Bierskill* is a tributary to the Little Flat Brook. Both *Forked Brook* and *Parker Brook* are tributaries to the Big Flat Brook.

Recent Flood History:

Recently, the Delaware River, the Bennekil, and the Bierskill have caused flooding. River Road and County Route 521 along the Delaware commonly flood during heavy rain events. About twelve homes have sustained basement damage and six homes sustained first floor damage. After events, branches, vegetation, and even trees are deposited on private property.

The municipality would like help cleaning up these properties.

Unique Flood Risk to Municipality:

The area affected in Montague is an island. The situation is unique because, prior to the cutting of the ice flow channel in 2000, Montague suffered significantly less damage. The township feels that they are now at a greater risk of flooding.

Local Flood Mitigation Planning Committee:

David Coss	OEM Coordinator
David Berhman	DPW Foreman
Jesse Brace Revak	Deputy OEM
Donald Stambaugh	Construction Official
Richard Inella	Land Use Board Chairman
Alicia Batko	Historian
Louanne Cular	Resident
Mark Utter	Mayor
Michael Okrepky	Engineer
Joseph Lashendock	Deputy Mayor
Diana Francisco	Clerk/Liaison

Ordinances/Plans Reviewed: Montague Township Municipal Code, Flood Damage Prevention

Outreach: DRBC, USACE, FEMA, SEP, Governor’s Office, Senator Littell, State Assembly

First Public Meeting Date: 4/25/2007

Date and Method of Advertisement for FMP: 4/5/2007 New Jersey Herald

Questionnaire Distribution Method: US Mail to flood prone residential areas

Public Response:

1. The majority of responses came from long time residents of Montague Township living on River Road.
2. At least ten residents were impacted by the June 2006 storm. Nine of those impacted were also impacted by the April 2005 storm. Six of those residences were impacted by the September 2004 storm as well. One was impacted by the all the storms listed on the questionnaire including Floyd and April 7, 2007. The cost of damage ranged from \$300.00 to \$110,000. Six reported that they have flood insurance, four did not. Seven reported that they were impacted by the Delaware River and six were affected by the both the Delaware River and tributary known as the Bennekill.
3. Several residents suggested improving controlled releases of water from the reservoirs in New York State.
4. Many residents expressed concerns regarding the massive pile of debris from previous flooding of the Delaware River and the Bennekill where the ice channel was cut by the Army Corp of Engineers.

Flood Mitigation Goals:

1. To correct the ice flow channel to permit debris and ice to flow freely
2. The removal of existing debris
3. Better reservoir control
4. Elevate areas to prevent flooding by using berms

5. Investigate and correct condition of dams up river to prevent potential future flooding
6. Research possible moratorium of future development within flood prone areas

Montague Mitigation Actions:

1. ACTION: Ice Flow Channel correction in the Benekill River

Description/Background: In the mid-1990's, the Army Corps of Engineers came up with a plan to ease the ice jamming that was happening upstream. The plan was to cut a deeper channel between Mashipacong Island and County Route 521 (River RD). Now the channel has collected a massive amount of debris and silt that is filling up the channel. Along with the vegetation, rocks etc.

Hazard: Flooding, ice jamming, debris

Existing or new assets: Existing/New

Existing mechanism through which action will be implemented: Survey/study by Army Corps of Engineers and the Township Engineer

Responsible Organization: Army Corps of Engineers

Target Completion Date: 2008

Estimated Cost: \$500,000 to \$1,000,000

Potential Funding Sources: Grants, federal aid, Army Corps of Engineers

Priority: High

2. ACTION: Public Awareness

Description/Background: The township wants to increase public awareness about flooding and other hazards through radio, newspaper articles, and mailings and group meeting. By doing this the community will have a better understanding of what going on around them with any hazard before, during, and after. In addition, the township will also have a better understanding of the community so we may serve them better.

Hazard: All hazards

Existing or new assets: Existing/New

Existing mechanism through which action will be implemented:

Responsible Organization: County OEM, township

Target Completion Date: Ongoing

Estimated Cost: \$1,000

Potential Funding Sources: Municipality, grants

Priority: Medium

3. ACTION: Elevate River Banks along the Delaware and Benekill Rivers

Description/Background: Flood damage to some of the homes along County Rt 521 (River Rd) may be averted if the banks are raised. Currently, the ground level is flat to the river bank. When flood waters hit the top of bank it's a straight shot to the houses. There isn't much of a bank now and as the floods hit more of the bank washed away.

Hazard: Flooding

Existing or new assets: Existing/New

Existing mechanism through which action will be implemented: Construction Department, Township Engineer

Responsible Organization: Flood Mitigation Committee

Target Completion Date: 2008

Estimated Cost: To be determined

Potential Funding Sources: Grants, federal and state aid, capital funding

Priority: Low

4. ACTION: Clean up existing debris in the Benekill River

Description/Background: As in Action 1, the Benekill is in need of massive clean up outside the channel the Army Corps of Engineers constructed. The Benekill is a huge channel between County Rt 521(River Rd) and Mashipacong Island. The Army Corps of Engineers made another channel to the one side and now the whole channel has collected a massive amount of debris and garbage. As the flood waters come it collects more and more and acts like a dam.

Hazard: All hazards

Existing or new assets: Existing/New

Existing mechanism through which action will be implemented: Township Committee

Responsible Organization: Flood Mitigation Committee and the Army Corps of Engineers

Target Completion Date: 2008

Estimated Cost: \$500,000 to \$700,000

Potential Funding Sources: Army Corps of Engineers, federal and state aid

Priority: High

5. ACTION: Warning system installation along flood areas on River Road

Description/Background: The desired warning system is an audio type to warn people of any major emergency or Hazard in or around town. It would be most helpful to alert residents of imminent flooding. Currently, the emergency services personnel go door-to-door numerous times informing the people of forecasted flooding.

Hazard: All hazards

Existing or new assets: Existing/New

Existing mechanism through which action will be implemented: Flood Mitigation Committee, Engineer

Responsible Organization: Municipality

Target Completion Date: late 2008

Estimated Cost: \$50,000

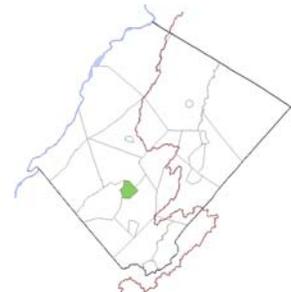
Potential Funding Sources: Grants

Priority: Low to Medium

Town of Newton, Sussex County:

Location:

The Town of Newton is located in the southern portion of Sussex County, in the northwest corner of New Jersey. Newton is bordered by Hampton to the north; Andover Township to the east and Fredon to the west.



Geology:

The terrain of Newton carries from level ground in the eastern and southern sections to hilly in the northern and western sections. Elevation ranges from 560 feet on the eastern edge to 917 feet near the western edge.

The soils in the southern section of the town are mostly Hazen-Palmyra-Fredon association which is deep and varies from poorly drained in the southeast to well drained in the southwest. The eastern portion of the town consists mostly of the Carlisle association of organic and mineral soils. These soils are deep and very poorly drained. The soils in the remainder of Newton are mostly of the Nassau-Bath-Norwich association ranging from shallow to deep and from well drained to poorly drained. They consist of silt and shaly loam with a number of rock and gravel outcroppings.

Hydrology:

The *Moore's Brook* flows east through the northern section of Newton's commercial and residential areas. The *Mill Street Tributary* and *Don Bosco Tributary* flow south, emptying into Moore's Brook.

The *Gravel Run* flows through the eastern and most agricultural section of Newton.

Recent Flood History:

Most flood damage that occurs in Newton's residential and commercial areas is adjacent to Moore's Brook and the Mill Street Tributary in the northern section of town. There is a very extensive flood plain in the undeveloped northeastern section of Newton along Moore's Brook.

Flood protection measures within the Town of Newton include a number of U.S. Department of Agriculture Soil Conservation Service Dams and a series of concrete flumes in the downtown area. The dams control the runoff from the small watersheds and provide protection for the streams immediately downstream from the structures.

Unique Flood Risk to Municipality:

The Town of Newton is the County Seat for Sussex County and was incorporated in 1864. In being the County Seat, the Town has become mostly built out with little room for the construction of flood mitigation measures. This lack of useable area for flood mitigation, combined with the low nature of several locations within the town, results in flooding of residential and commercial areas, substantial property damage and difficulties in providing emergency access.

Local Flood Mitigation Planning Committee:

Kenneth Teets	OEM
Dan Finkle	OEM
Debra Millikin	Town Manager/Zoning Officer
Ken Jeakel	DPW Supervisor
Rick Straway	DPW Foreman
Cory Stoner	Engineer, Harold E. Pellow & Assoc.

Ordinances/Plans Reviewed: FEMA maps, Town of Newton Flood Damage Prevention

General Ordinance, Town of Newton Stormwater Control Ordinance, DRBC/NJOEM Guidance Material, ASFM NAI Toolkit, and Public Comment at February 12, 2008 meeting.

Outreach: Sussex County, New Jersey Department of Transportation

First Public Meeting Date: 2/12/2008

Date and Method of Advertisement for FMP: 1/28/2008 New Jersey Herald

Questionnaire Distribution Method: US Mail

Public Response:

Four responses were received. Residents along Swartswood Road, Mill Street and Clinton Street indicated that debris and sediment have collected in the stream that is running along Swartswood Road, Clinton Street and Mill Street. They also indicated that building in that same area is affecting the amount of stormwater flow.

Flood Mitigation Goals:

1. Address flooding in the Merriam Avenue/Sussex Court section of Town
2. Address flooding occurring in the West End Avenue (CR 519) section of Town
3. Address flooding occurring along Route 206 near the intersection with Merriam Avenue
4. Reduce flooding occurring along Moore's Brook and its tributaries
5. Review dams within the Town to ensure that they are in safe condition and ensure that the general public is aware of emergency actions measures that will be implemented in case of emergency
6. Enforce Town Ordinances regarding development and promote development within the Town that will not adversely impact stormwater runoff conditions on other properties
7. Maintain emergency access to all residents and essential facilities

Newton Mitigation Actions:

1. ACTION: Upgrade of Merriam Avenue School Stormwater Pump Facility

Description/Background: The Merriam Avenue/Paterson Avenue/Sussex Court section of Town is an area where a large section of Newton drains. There are existing low-lying properties adjacent to Paterson Avenue that do not properly drain due to topography, and have to periodically pump stormwater off of their properties to the Town's storm drainage system. An existing stormwater pumping station exists at the Merriam Avenue School to pump the collected stormwater into the Town's municipal drainage system, which in turn drains towards the wetlands area north of Newton-Sparta Road. There is no emergency generator at the pumping station to help ensure that the pumping station continues to operate in the event of a power loss, which could result in flooding of the area. Any increased development may also require the basin and associated pumping equipment to be upgraded.

Hazard: Flooding of school property, Paterson Avenue properties, and Sussex Court properties

Existing or new assets: Existing

Existing mechanism through which action will be implemented: To be determined

Responsible Organization: Town of Newton /Board of Education

Target Completion Date: To be determined (subject to funding)

Estimated Cost: To be determined

Potential Funding Sources: Unknown at this time

Priority: High

- 2. ACTION: Stormwater Drainage Improvements in West End Avenue Section of Town**
Description/Background: Numerous stormwater drainage issues exist in the West End Avenue section of the Town of Newton. The stormwater in this area is collected within the County drainage system along West End Avenue (CR 519) and discharges into the municipal drainage system or onto private properties in the area. A drainage study needs to be completed to determine how to mitigate the flooding occurring in this area.
Hazard: Flood / Property Damage
Existing or new assets: Existing
Existing mechanism through which action will be implemented: To be determined
Responsible Organization: Town of Newton & County of Sussex
Target Completion Date: To be determined (subject to funding)
Estimated Cost: To be determined
Potential Funding Sources: Unknown at this time
Priority: High
- 3. ACTION: Stormwater Drainage Improvements – Route 206 in the area of the Merriam Avenue Intersection**
Description/Background: There is essentially no existing storm drainage infrastructure along Route 206 on the southerly side of Newton near the Merriam Avenue Intersection. During heavy rains, there is localized flooding that sometimes requires shutting Route 206 down to traffic until the flooding recedes. The flooding has prevented the opening of the Route 206/Merriam Avenue intersection due to potential intersection icing in the winter, and shuts down one of the main arterial roadways leading to Newton, that is also used by emergency vehicles. Storm drainage infrastructure needs to be designed and constructed in this area.
Hazard: Flooding of Route 206
Existing or new assets: Existing
Existing mechanism through which action will be implemented: To be determined
Responsible Organization: New Jersey Department of Transportation
Target Completion Date: To be determined (subject to funding)
Estimated Cost: To be determined
Potential Funding Sources: Unknown at this time
Priority: High
- 4. ACTION: Moore’s Brook Stream Cleaning & Desnagging**
Description/Background: Moore’s Brook runs through the northern section of the town. In 1994, the stream was cleaned to remove debris and silt and increase the hydraulic capacity of the stream. This work was completed in order to decrease the flooding that occurs in low areas near Mill Street, Clinton Avenue, Moran Street and Memory Park. Since that time, the stream has been silted in again and is in need of cleaning and desnagging to increase the hydraulic capacity of the stream.
Hazard: Flood / Property Damage
Existing or new assets: Existing
Existing mechanism through which action will be implemented: To be determined
Responsible Organization: Town of Newton
Target Completion Date: To be determined (subject to funding)

Estimated Cost: To be determined

Potential Funding Sources: Unknown at this time

Priority: High

5. **ACTION: Dam Analysis**

Description/Background: The Town currently operates and maintains two dams within the Town borders and one dam just outside the Town line in Fredon Township. The Town has recently worked with the USDA on the preparation of an Inundation Study, Emergency Action Plan and a new Operations and Maintenance Manual for the dam located within Fredon Township (Dam Site #2). The remaining two dams within the Town and other dams that may exist on private properties need to be evaluated to determine if the dams are in good condition or if any corrective actions are needed.

Hazard: Flood / Property Damage

Existing or new assets: Existing

Existing mechanism through which action will be implemented: To be determined

Responsible Organization: Town of Newton / Private Property Owners

Target Completion Date: To be determined (subject to funding)

Estimated Cost: To be determined

Potential Funding Sources: Unknown at this time

Priority: High

6. **ACTION: Enforce Municipal Ordinances and Town Master Plan**

Description/Background: The Town will continue to enforce current ordinances related to stormwater control, flood control and land use. The Town will make changes to the Master Plan presently being prepared to include references regarding flood prevention.

Hazard: Flooding due to possible enforcement violations

Existing or new assets: Existing

Existing mechanism through which action will be implemented: Town Ordinances & Master Plan

Responsible Organization: Town of Newton

Target Completion Date: Master Plan – mid 2008. Enforcement will be a continued activity.

Estimated Cost: N/A

Potential Funding Sources: N/A

Priority: Medium

Sandyston Township, Sussex County:

Location:

Sandyston Township is located in the northwestern portion of Sussex County and is home to 1,825 people within 43.31 square miles. It is bordered by Frankford Township to the southeast, Walpack Township to the southwest, the Delaware River to the west, and Montague Township to the north.



Geology:

Sandyston Township is highly forested and has many rolling hills and valleys. The elevation ranges from 420 feet in the southwest corner to 1,650 feet in the northeastern section of the township. Soils in the township have been formed primarily from shale, and don't drain very well.

Hydrology:

The *Flat Brook*, a tributary to the Delaware River, runs through the entire township from northeast to southwest. The *Little Flat Brook* (to the west) and the *Big Flat Brook* (in the east) join together to form the Flat Brook in the southern portion of the township. The *Bierskill* is a tributary to the Little Flat Brook. Tributaries to the Big Flat Brook include the *Stony Brook* and the *Criss Brook*.

The *Delaware River* creates the western boundary for the township and flows south.

The *Kittatiny Creek* is a tributary to the Delaware River.

Recent Flood History:

During flooding events, Hague Road and Laurel Lane are flooded and washed out. About two structures sustain basement damage and one structure sustains first floor damage. These properties are surrounded by National Park Service lands. When the Delaware River overflows its banks, the water becomes trapped inland and floods Sandyston. The township is interested in a community telephone notification system.

Unique Flood Risk to Municipality:

Sandyston is unique in that over 70% of its land is National and State Parks and is owned by the State and Federal Government. In the past number of years, only two homes have been severely affected by the flooding. The Sandyston Township Fire Department has pumped some basement homes, but not on a regular basis.

Local Flood Mitigation Planning Committee:

Stan Dukus	OEM
John deJager	Construction Officer/Flood Manager
Keith Utter	Land Use Chairman
George Harper	Mayor/Road Supervisor
Alan Delea	Fire Chief/Road foreman
Betsy Cuneo	Municipal Clerk

Ordinances/Plans Reviewed: Flood Damage Prevention

Outreach: National Park Service, Sussex County Road Department, New Jersey Department of Transportation, New Jersey Department of Environmental Protection, residents in Forty Acres

First Public Meeting Date: 5/9/2007

Date and Method of Advertisement for FMP: 4/23/2007 New Jersey Herald

Questionnaire Distribution Method: Web site, newspaper, mailings, posted at post office

Public Response:

1. One resident mentioned that her home doesn't flood, but her property does. She stated that she recently purchased flood insurance. The Construction Official suggested placing her home on stilts and moving the electrical panel and water softener/furnace to a higher level.
2. One resident said her rental unit gets flooded.
3. Those in attendance suggested improving the release of water upstate when heavy rains are predicted.

Flood Mitigation Goals:

1. Suggest to the Army Corps of Engineers to review the release of water from the upstate dam

Sandyston Mitigation Actions:**1. ACTION: Public awareness****Description/Background:****Hazard:** All**Existing or new assets:** All**Existing mechanism through which action will be implemented:** To be determined**Responsible Organization:** County**Target Completion Date:** To be determined**Estimated Cost:** Unknown**Potential Funding Sources:** To be determined**Priority:** Medium**Sparta Township, Sussex County:****Location:**

Sparta Township is located in southeastern Sussex County and is home to 18,080 people in 39.22 square miles. It is bordered by Jefferson Township to the east, Borough of Hopatcong and Byram Township to the south, the Borough of Andover and Lafayette to the west, and the Boroughs of Franklin and Ogdensburg and Hardyston Township to the north.

**Geology:**

Sparta Township is hilly with two relatively flat river valleys that run in a northeast/southwest direction. Elevation ranges from 520 feet in the deepest river valley to 1360 feet in the mountains in the northern part of the township. Soils in the township are classified as alluvial land, which is very poorly drained fine sand or silty clay loam with the water table at or near the surface.

Hydrology:

The western part of the township drains to the Pequest River, a tributary to the Delaware.

The *Wallkill River* is located in the northern section of the township along with its tributary, the Wildcat Branch.

Recent Flood History:

During the August 2000 event, six structures sustained basement damage and six structures sustained first floor damage. The average assessed value of the buildings was \$300,000. The Sparta Police Department was affected and six bridges were damaged. In addition, the Eagles Nest Water Supply Facility, a 16 inch water main, the Seneca Dam, and the NYS&W Freight rail line were flooded. There were few injuries and emergency access was compromised. Wetlands in the area were permanently destroyed, stream channels were re-routed or silted up, and major forested areas were lost.

Unique Flood Risk to Municipality:

1. Hopkins Corner Road and Valley Manor Drive
2. Lake Grinnel at West Mountain Road (dam safety)
3. Highlands topography – steep slopes and soil types
4. CR 620 Slope Project uphill of Sparta Glen

Local Flood Mitigation Planning Committee:

David Troast	Director of Planning
Charles Ryan	Twp. Engineer
Eric Powell	Asst. Twp. Engineer
Tom Spring	Public Works Manager
David Manhardt	GIS Analyst

Ordinances/Plans Reviewed: Stormwater Management Plan, local ordinances, Master Plan – Land Use, Open Space Plan

Outreach: NRCS, Wallkill Watershed Management

First Public Meeting Date: expected December 27, 2007

Date and Method of Advertisement for FMP: 5/18/2007 Sparta web site; (typical meeting notice)

Questionnaire Distribution Method: No active flood prone residents

Public Response:

Flood Mitigation Goals:

1. Eliminate recurring localized flooding (e.g. Hopkins Corner Road and Valley Manor Drive)
2. Riparian buffer revegetation and stream bank stabilization (Station Park – Wallkill River)
3. Dam Safety
4. Maintain integrity of stormwater control facilities (i.e. catch basins, detention/retention ponds, etc.)

Sparta Mitigation Actions:

1. ACTION: Stream Restoration - Sparta Glen Brook

Description/Background: Sparta Glen is a passive recreation area located within Sparta

Township. In August of 2000, the Sparta Glen Brook experienced excessively high flows due to runoff from a 14” rain event. This caused major stream bank erosion and slope failure of County Route 620. The Township worked with NRCS to restore the stream bank and the channel to allow for better control of stream flows. Additional armoring of the stream bank and restoration of riparian vegetation is ongoing to protect against any future events as well as continued maintenance of the restored slopes of CR 620.

Hazard: Slope stability/stream bank

Existing or new assets: Existing

Existing mechanism through which action will be implemented: TBD

Responsible Organization: County/Township

Target Completion Date: Ongoing

Estimated Cost: TBD

Potential Funding Sources: Grants, capital, operating budgets

Priority: High

2. ACTION: Stream Restoration - Wallkill River @ Station Park

Description/Background: Station Park is an active recreation area consisting of baseball, soccer and softball fields. The Wallkill River dissects the park and creates a complimentary passive attraction to active areas. After the flood of August 2000, the stream corridor was severely compromised hydraulically as well as environmentally. Efforts were made and continue to be made to restore the stream corridor.

Hazard: Stream bank protection, riparian buffer

Existing or new assets: Existing

Existing mechanism through which action will be implemented: To be determined

Responsible Organization: Township

Target Completion Date: To be determined

Estimated Cost: To be determined

Potential Funding Sources: Grants, capital, operating budgets

Priority: Medium

3. ACTION: Re-direct stormwater in the area of Hopkins Corner Road and Valley Manor Drive

Description/Background: Valley Manor Drive is located in the northwest corner of Sparta Township. The development was constructed in the early 1990s and experiences excessive flooding during heavy rain events. Part of the flooding problem is due to an abandoned railroad bed, which sends runoff down to the retention basin. A long-term solution involves drainage work (piping, catch basins, etc) to redirect Stormwater flows away from the existing retention basin.

Hazard: Localized flooding

Existing or new assets: Existing

Existing mechanism through which action will be implemented: To be determined

Responsible Organization: Township

Target Completion Date: To be determined

Estimated Cost: To be determined

Potential Funding Sources: Capital, operating budgets

Priority: High

4. ACTION: Dam Analysis

Description/Background: There is major concern statewide with regards to overall dam safety and funding sources for repairs. Most dams are privately owned (individuals or homeowners associations). Following the flood event of August 2000, major emphasis was directed toward dams labeled as ‘high hazard’. Since that time, there has been limited funding available for individuals and/or associations to complete required repairs to bring these dams up to an acceptable level of safety.

Hazard: Property loss

Existing or new assets: Existing

Existing mechanism through which action will be implemented: To be determined

Responsible Organization: Private Dam Owners

Target Completion Date: To be determined

Estimated Cost: To be determined

Potential Funding Sources: Federal and/or state grants

Priority: High

Stillwater Township, Sussex County:**Location:**

Stillwater is located in the southwestern portion of Sussex County. There are 4,267 people living in 28.4 square miles. It is bordered by Walpak Township to the northwest, Sandyston Township to the north, Hampton Township to the northeast, Fredon Township to the southeast, Frelinghuysen Township to the south, and Hardwick Township to the southwest.

**Geology:**

The soils in Stillwater are mostly Hazen-Palmyra-Fredon association.

Hydrology:

Paulins Kill is a tributary to the Delaware River located in the central part of the township. There is a small dam located near West End Drive creating Paulins Kill Lake.

The *Trout Brook*, which rises on Kittatinny Mountain, flows into the Paulins Kill near Middletown in Stillwater Township. Swartswood Lake feeds the Trout Brook through Keen's Mill Brook. The Paulins Kill continues its course southwest, entering Warren County. In Blairstown, the Paulins Kill is joined by *Blair Creek*, a tributary that originated in Stillwater Township.

Recent Flood History:

The township was affected by the April 2007, June 2006, April 2005, September 2004, and September 1999 flood events. The April 2007 event was the most damaging for Stillwater. Thirty residences received basement flooding and five received first floor damage. Within the

Paulinskill Lake area, Cedar Drive, East Walnut Drive, Edgewood Drive, Maple Terrace, South Shore Drive, and West End Drive were flooded. In addition, Baldwin Gate, Dyke Drive, Kohlbocker Road, Five Points Lane, Mount Benevolence Road, Saddle Back Road, Stone Bridge Road, and Swartswood Road were also affected by flood waters. The Swartswood Fire Department Building was also inundated. During and after the event, there were concerns about drinking water quality, septic systems, oil tanks, road closures, and power outages. Runoff caused erosion and washed nutrients into waterways.

Earlier flooding events caused less damage. For instance, the June 2006 and September 2004 floods inundated 5 basements and the April 2005 flood inundated 15 basements. In all cases, the Swartswood Fire Department was affected.

In 1955, Paulins Kill suffered from a severe flood with a reoccurrence interval of approximately 400 years. This is because two hurricanes traversed northeastern New Jersey within a week. In addition, a timber crib utility dam on Culvers Creek in Branchville breached flooding Branchville and overwhelming Paulins Kill. This was on top of nearly 8 inches of rain falling in the Paulins Kill watershed.

Unique Flood Risk to Municipality:

Flood-exacerbating debris and snags within Category One (C1) waters exacerbates flooding in Stillwater.

Local Flood Mitigation Planning Committee:

Lt. John Schetting	Stillwater Police Dept./OEM
Robert Klein	OEM
Chief Anthony Kozlowski	PD/OEM
Keith Whitehead	DPW Supervisor
William Morrison	Committeeman
Michael Vreeland	Engineer/Stormwater Program Coordinator

Ordinances/Plans Reviewed: FEMA maps, Township of Stillwater Master Plan, Township of Stillwater Municipal Code: Flood Damage Prevention, Township of Stillwater Open Space and Recreation Plan, DRBC/NJOEM Guidance Material, ASFM NAI Toolkit, Public Comments at meeting

Outreach: Lake Associations

First Public Meeting Date: 9/5/2007

Date and Method of Advertisement for FMP: 9/2/2007 NJ Herald

Questionnaire Distribution Method: Mail

Public Response:

1. Residents along Swartswood Road indicated that debris and snags in the waterway flowing into Swartswood Lake appear to contribute to flooding problems.
2. They also expressed frustration with the likely environmental permitting that may be required to clear the stream.
3. Residents requested flood-exacerbating debris, specifically in the vicinity of their property, be addressed.

Flood Mitigation Goals:

1. Reduce flood damage along Swartswood Road and restore stream/water corridor
2. Prevent flood damage along Kohlbocker Road and protect stream embankments
3. Provide information and awareness regarding potential hazards due to dams within and outside the municipality
4. Maintain emergency access to all residents and essential facilities

Stillwater Mitigation Actions:**1. ACTION: Neldon’s Brook Stream Cleaning, Channel Modification and Bank stabilization**

Description/Background: Neldon’s Brook crosses under a bridge along Swartswood Road and flows into Swartswood Lake. During significant rainfall events, a segment of this waterway flows over its banks and inundates residential dwellings as well as the Swartswood Fire Department building located in the vicinity of Swartswood Road. Snags and debris that have accumulated in the waterway as well as bank erosion appear to be contributing to the problem. This waterway has been identified as Category One (C1) waters.

Hazard: Flooding

Existing or new assets: Existing

Existing mechanism through which action will be implemented: To be determined

Responsible Organization: To be determined

Target Completion Date: To be determined

Estimated Cost: To be determined

Potential Funding Sources: To be determined

Priority: High

2. ACTION: Paulinskill River – Kohlbocker Road Bank and Slope Stabilization

Description/Background: A segment of the Paulinskill River flows adjacent to Kohlbocker Road downstream of the Paulinskill Lake Dam, near the Stillwater Township municipal line. Cracks have developed in Kohlbocker Road in the vicinity of a segment of steep stream bank/roadway embankment. Stream bank erosion and slope instability appear to be contributing to the problem.

Hazard: Flooding and Land Slides

Existing or new assets: Existing

Existing mechanism through which action will be implemented: To be determined

Responsible Organization: To be determined

Target Completion Date: To be determined

Estimated Cost: To be determined

Potential Funding Sources: To be determined

Priority: High

3. ACTION: Create County GIS Coverage for Dams and Inundation Areas

Description/Background: Several dams are located either within or “upstream” of the township. Many dams are privately owned. The “downstream” public and emergency services may not be fully aware of location, condition, and potential hazards of these dams. NJDEP regulates dams and requires owners of high hazard dams to prepare Emergency

Action Plans and GIS inundation maps. The township would like dam location, condition, and inundation maps added to County GIS coverage, and have the updated maps and information disseminated to emergency services and property owners located within inundation areas.

Hazard: Flooding

Existing or new assets: Existing and New

Existing mechanism through which action will be implemented: To be determined

Responsible Organization: To be determined

Target Completion Date: To be determined

Estimated Cost: To be determined

Potential Funding Sources: To be determined

Priority: High

Section 7: Plan Adoption and Plan Maintenance Procedures

This section discusses how the Mitigation Strategy will be implemented by participating jurisdictions and how the overall Flood Mitigation Plan will continue to be evaluated and updated over time. This section also discusses how the public will continue to be involved in the flood mitigation planning process.

Requirement §201.6(c)(5): *For multi-jurisdictional plans, each jurisdiction requesting approval of the plan must document that it has been formally adopted.*

Municipal Review

This Plan was submitted to NJOEM in June 2008. Subsequently, following NJOEM's conditional approval, the Plan will be sent to FEMA. During the summer of 2008, counties municipalities, agencies and other interested parties will be asked to review the Plan. Municipalities are specifically requested to the information they submitted in review Section 6 which contains each municipality's flood profile and mitigation action plan.

All comments should be sent to the Delaware River Basin Commission. Specific contact information is located on the reverse side of the Cover Page of the Plan.

Following the issuance of a conditional approval by FEMA, each municipality will then be asked to proceed with formal adoption proceedings described below.

Municipal Adoption Process

Requirement §201.6(a)(4): *Multi-jurisdictional plans may be accepted, as appropriate, as long as each jurisdiction has participated in the process and has officially adopted the plan.*

Requirement §201.6(c)(5): *[The 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).*

Adoption by the counties and local governing bodies demonstrates the commitment of each jurisdiction to fulfill the mitigation goals and objectives outlined in the Plan. Adoption legitimizes the Plan and authorizes responsible agencies to execute their responsibilities. In order for the Multi-jurisdictional Plan to receive final approval, each jurisdiction included in the Plan must have its governing body formally adopt the Plan.

Once FEMA provides conditional approval of this draft Plan, each participating municipality will be asked to proceed with formal adoption proceedings using the draft resolution language contained in Appendix E. Conditional approval of the Plan will only be provided for those municipalities that meet all planning requirements.

Although the Plan will be adopted at various times by the participating jurisdictions, the process will be the similar. Each jurisdiction will announce Plan availability through a public

notice. Each town also will solicit public comment at a public meeting, and place consideration and adoption of the Plan on the respective agendas of their governing Boards.

The participation in and adoption of this Multi-jurisdictional Plan shall not necessarily imply advocacy of or support for individual mitigation initiatives proposed by other participating jurisdictions. The adoption of this Plan by each jurisdiction shall be subject to limitations as set forth in each jurisdiction's adoption resolution (see Appendix F for the Adoption Resolutions).

Following adoption or formal action on the Plan, each municipality must submit a copy of the resolution or other legal instrument showing formal adoption (acceptance) of the Plan to DRBC. These resolutions will then be submitted to FEMA in order to verify formal Plan adoption and receive official approval of the Plan.

Incorporation into Existing Planning Mechanisms

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.*

Each jurisdiction participating in this Plan is responsible for implementing specific mitigation actions as prescribed in their locally adopted Mitigation Action Plan. In the Mitigation Action Plan, each proposed action is assigned to a specific local department or agency in order to increase accountability and the likelihood of implementation. This approach enables individual jurisdictions to update their unique mitigation strategy as needed without altering the broader focus of the countywide plan elements.

In addition the specific local department or agency, an implementation time period or a specific implementation date has been assigned in order to assess whether actions are being implemented in a timely fashion. It is understood that jurisdictions will most likely seek outside funding sources to implement mitigation projects. Whenever possible, a funding source has been identified for proposed actions listed in the Mitigation Action Plan.

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

Monitoring, Evaluating and Updating the Plan

Requirement §201.6(c)(4)(i): *[The plan shall include a] section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle.*

Periodic revisions and updates of the Plan are required to ensure that the goals, objectives, and mitigation actions are kept current. Further, revisions may be necessary to ensure that the Plan is in full compliance with federal regulations and state statutes. This portion of the Plan

outlines the procedures for completing such revisions and updates.

Five-Year Review and Update

Each municipality is responsible for continual monitoring of those components of the Plan that pertains to their jurisdiction. As part of the monitoring process, municipal liaisons will assess any changes in risk; determine whether implementation of mitigation actions is on schedule or if there are any implementation problems, such as technical, political, legal or coordination issues; and reflect changes in programs that affect mitigation priorities or actions.

This Flood Mitigation Plan will be formally reviewed every five years to determine whether there have been significant changes that might affect the Plan and will be updated based on the findings. The five-year review and update will be conducted by participating jurisdictions under the auspices of their respective Counties. An updated Plan is required to be forwarded to the State and FEMA for review and approval and is required to remain eligible for the mitigation funding.

The review and update will give community officials an opportunity to evaluate successful actions and to explore the possibility of documenting losses avoided because of actions taken. The Plan may need to be revised to reflect lessons learned following a disaster declaration or to address specific circumstances arising from changing conditions surrounding disaster events.

Criteria to be included in the evaluation will include, at a minimum:

- Status of each of their mitigation actions
- Reporting on implementation processes, what was successful, any difficulties encountered, how coordination efforts are proceeding, and which mitigation actions should be revised
- Recommending any changes or amendments to the Plan

Disaster Declaration

In addition to the FEMA-required 5-year review, the municipalities should revisit the Plan after any disaster declaration due to flooding. Following a disaster declaration, the Plan may need to be revised to reflect lessons learned, or to address specific circumstances arising from the event. This review will ensure that the Plan is continuously updated to reflect changing conditions, evaluated to ensure that the recommended mitigation strategies remain relevant and revised if necessary.

Annual Review and Update

Each individual County Office of Emergency Management will be responsible for annually coordinating a review of the progress made towards implementing mitigation activities listed in the Plan. Each County Office of Emergency Management will be responsible for composing an annual report that documents the status of their participating municipalities' mitigation actions, identifies mitigation progress, identifies reasons for delays or obstacles to their completion, and provides any updates or additions to the Plan as necessary. All annual reports generated are required to be kept by each County for use during the official five year review process.

Continued Public Involvement

Requirement §201.6(c)(4)(iii): *[The plan shall include a] discussion on how the community will continue public participation in the plan maintenance process.*

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

Other efforts to involve the public in the maintenance, evaluation and revision process will be made as necessary. These efforts will include:

- Utilizing local media to update the public of any maintenance and/or periodic review activities taking place;
- Utilizing City, County and DRBC websites to post the Plan, where the public is invited to provide ongoing feedback.
- Keeping copies of the Plan in public libraries.