Flood Mitigation for Pennsylvania’s Rural Communities: Community-Scale Impact of Federal Policies

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1 This report includes updates to the original report, which was published in September 2017. After the original report was published, the researchers were informed of some factual errors in the case studies. This revised report includes the corrections to the case studies section; the report’s recommendations remain the same.
**EXECUTIVE SUMMARY**

Recent changes to the National Flood Insurance Program (NFIP) are critically impacting Pennsylvania because of its history of flooding, its pattern of development along rivers and streams, the age of its structures, and its system of local government.

In the Biggert-Waters Flood Insurance Reform Act of 2012, Congress mandated that the Federal Emergency Management Agency (FEMA) adopt “full risk” or “actuarial” rates for flood insurance to address what was then a $20 billion budget shortfall caused by damage from recent storms. This resulted in sharp premium increases, especially for those whose rates had been subsidized.

In response, Congress then passed the Homeowner Flood Insurance Affordability Act of 2014, which delayed the rate increases. Despite the 2014 legislation, the move away from subsidized federal flood insurance remains a fundamental shift with profound community-scale impacts across Pennsylvania. At this point, the NFIP officially expired on September 30, 2017; however, it has been extended through a series of continuing resolutions that have also kept the federal government funded.

This research explores the impacts of these changes on Pennsylvania’s rural communities in the following ways: reviews the legal and policy framework at a federal, state, local and individual level; examines the demographic and geospatial information associated with flood-impacted communities in Pennsylvania; examines the economic impacts to the housing market in floodplains; and explores how flooding, flood insurance, and other federal and Commonwealth programs have impacted Pennsylvania’s rural communities by focusing closely on eight communities as case studies. The research offers a number of recommendations.
Summary of Findings

Many Pennsylvanians are facing future flood risk

Flooding in Pennsylvania, already the “most frequent and damaging natural disaster that occurs throughout the Commonwealth,” (PEMA, 2017) may get worse. The Northeast region of the U.S., which includes Pennsylvania, has already seen a 71 percent increase in “very heavy precipitation,” defined as the heaviest 1 percent of all events, from 1958 to 2012 (See Figure 1). Flooding is expected to increase in the future, and precipitation is expected to be more variable, which means more floods, and more drought (Pennsylvania State University, 2015).

This research estimates that, out of Pennsylvania’s 12.8 million people, there are about 831,000 living in floodplains, or 6.5 percent of Pennsylvania’s population. This is more than double the population identified in a recent Pew Charitable Trust report, which estimated around 400,000 people living in floodplains. In addition, the spatial analysis of this research found that roughly 374,000 housing units are in floodplains, or 6.7 percent of the Commonwealth’s total housing units.

Of the citizens affected, many are “older, less financially able to absorb the increased premiums, living in homes less valuable, and in communities where any negative effect on the tax base will have a serious multiplier impact.” (Pennsylvania Department of Community and Economic Development, 2014). Many properties have been flood-proofed but still face high flood insurance premiums, a challenge for smaller, more rural communities.

The Federal Emergency Management Agency (FEMA) has been updating its Flood Insurance Rate Maps (FIRM) to more accurately reflect changing floodplains, land use, and flood risk. At the time of the
research, all but three Pennsylvania counties have been updated, covering 96 percent of the
Commonwealth’s land area and population. Homes or businesses now mapped in the floodplains must
purchase flood insurance at new rates. However, even people living outside mapped floodplains are also
vulnerable to flooding; for example, recent floods in places such as North Carolina highlighted the risk to
those well beyond the floodplain.

Rising flood insurance rates are impacting Pennsylvania’s citizens and communities

Coverage under the NFIP is significant within the Commonwealth. Of Pennsylvania’s 2,562
municipalities, 2,467 participate in the NFIP, but only 28 are enrolled in the Community Rating System, a
program that promotes flood mitigation and reduces individual premiums.

Table 1: NFIP Policies in Force for Pennsylvania (FEMA, 2012 and 2016)

<table>
<thead>
<tr>
<th>Year</th>
<th>Policies in Force</th>
<th>Insurance in Force (Whole Coverage)</th>
<th>Written Premiums in Force</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>73,693</td>
<td>$13.5 billion</td>
<td>$68 million</td>
</tr>
<tr>
<td>2016</td>
<td>61,975</td>
<td>$12.6 billion</td>
<td>$66.5 million</td>
</tr>
</tbody>
</table>

NFIP payments have been crucial to recovery from flooding in Pennsylvania. From 1978-2015, there
were 69,055 NFIP claims filed in 1,982 different jurisdictions (55 cities, 685 boroughs, 1,242 townships).
The total value of claims was around $1.134 billion, with an average value of $16,400 per claim (not
adjusted for inflation). The largest number and value of claims have been filed in Bucks, Montgomery,
Luzerne, Dauphin, and Allegheny counties.

Many properties that pre-date the development of FIRM have been paying subsidized “pre-FIRM”
rates. As of 2012, about 20 percent of policyholders nationwide received subsidized rates (Denk, 2014).
Pennsylvania had more than double that with 46.7 percent of policyholders subsidized: of its 34,477
subsidized policyholders, there were 21,423 primary residential properties, 4,934 businesses, 3,798
second homes, and 613 homes in severe repetitive loss areas. It is unclear how many policies remain
subsidized as this information is not currently available from FEMA.

The shift from subsidized rates to “full risk” or “actuarial rates” has been significant. In 2012, FEMA
provided an example of how rates could increase from $819 to more than $25,000 a year. Such dramatic
increases are not hypothetical. For example, one Lycoming County family saw its rates jump from $591 per year to $9,300 per year in 2013. Others saw actual rate increases of $7,000 to $10,000 per year. Such increases occurred across the U.S., leading to voter pushback and a decrease in policyholders. Since 2012, there are more than 500,000 fewer NFIP policies across the U.S., and more than 11,700 fewer in Pennsylvania. This erodes the NFIP’s ability to cover future losses, and it erodes communities’ and individuals’ ability to recover from flood damages.

In 2014, Congress reinstated pre-FIRM rates for some primary residences and delayed other rate increases; however, FEMA is still mandated to increase rates and decrease subsidies to address a now $25 billion deficit. Even with the 2014 modifications, these changes have and will impact Pennsylvania. For example, increased rates will lead to: decreased housing prices and short-term loss in property values; changes in the amount of housing stock; higher impacts to lower income households; and declines in overall household wealth. Even a doubling of flood insurance rates would lead to a 4 percent decrease in lifetime net wealth; rate increases of up to 1,000 percent would have a staggering effect for both individuals and their communities.

While policyholders with subsidized rates may still be paying lower rates, a trigger event, such as change in ownership, would result in a jump to full actuarial rates. This is already affecting property sales and/or leading to abandonment of property. Loss in property values then impacts property tax revenue.

Federal and Commonwealth programs are critical to Pennsylvania’s rural communities

Federal and state programs help communities mitigate flood risk; however, community needs and priorities are tremendously diverse. Many communities actively seek to reduce risk to their residents and businesses by taking advantage of available federal and Commonwealth programs. However, many are not aware of available resources, have expressed a need for increased resources and institutional support from those programs, and desire additional programs.
**Recommendations**

Without further Congressional action, the NFIP will expire in September 2017. Congress is currently considering several bills. As these bills are being considered, Pennsylvania may be able help its rural communities through policy changes at several levels.

**Federal Level Recommendations**

As federal legislation is being considered, Congress should ensure a balanced approach to address the economic impact on Pennsylvania while addressing the NFIP’s insolvency. Legislation should: explore ways to offer rate reductions, such as credit for structural mitigation measures; modify community-scale activities like the Community Rating System (CRS) so compliance can be done at a regional level; and identify other actions to improve flood risk and reduce future payouts.

FEMA should also provide accessible information about insurance rates, including subsidized rates, complete the FEMA affordability study, and continue to partner with state and local agencies on important flood risk/mitigation studies, weather/hydrologic forecasting and warning systems, and information sharing.

**State Level Recommendations**

Pennsylvania should: create a “comprehensive, integrated statewide floodplain management” program that addresses both flooding and stormwater and sets priorities on a statewide basis; significantly increase financial, staffing, and training support to meet statewide needs; create a center of excellence; provide for county-level coordination and local implementation, including CRS and Hazard Mitigation Plan actions; provide more funding for flood mitigation grants, loans, and/or tax credits; create robust data sharing and communication systems; update the “flood mapper” program; raise awareness of flood risk and mitigation options; and work to increase coverage through the NFIP/private insurance markets.
County/Local Recommendations

Where appropriate, county and local governments are encouraged to: participate to the fullest extent in NFIP, CRS, Hazard Mitigation Plans, and other programs; help local municipalities implement flood mitigation; share county level data with state, federal, and local entities; work with local communities to alleviate impacts to the tax base; and bolster land use planning to alleviate flood risk.

Individual Recommendations

Individuals are encouraged to: access funding to mitigate flood risk by modifying structures and moving key utilities; participate in informational programs and be prepared for emergency response; and purchase NFIP or private flood insurance.
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5.4 FEMA’s Flood Insurance Rate Map (FIRM) process should improve its ability to consider on-the-ground conditions.

5.5 Congress and the States should explore innovative market designs to address flood risk reduction.

5.6 Federal or Commonwealth agencies should create and adopt standardized lender guidelines for flood insurers.

5.7 Pennsylvania should consider creating a comprehensive flood and stormwater mitigation plan for the Commonwealth as a whole.

5.8 Pennsylvania can help address rate increases by better supporting CRS implementation and developing overarching templates or guidelines.

5.9 Pennsylvania should help communities and individuals by providing easily-accessed information, State-level support personnel, and expanded funding for outreach and communication.

5.10 The Commonwealth should develop differentiated procedures, requirements, and guidance for different kinds of communities.

5.11 The Commonwealth’s Hazard Mitigation Plan is an effective blueprint that needs additional support and implementation.

5.12 State level funding, expertise, and incentives should be increased, and can be used to direct funds to areas of greatest needs.

5.13 The Commonwealth should consider developing a Center of Excellence to address these issues.
5.14 Both the Commonwealth and local governments need to address potential impacts to the local tax base. .................................................................

5.15 Local government support of flood mitigation efforts can help address individual concerns. ..............................................................................

5.16 Information about flood insurance premiums must be more easily accessed........

5.17 Resiliency and Sustainability should be promoted at all levels of governance........

5.18 The Commonwealth should continue to explore expanding insurance options ..........

5.19 Counties can continue to play a key role in coordinating mitigation and providing critical information necessary to address increase flood insurance premiums........

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**SUMMARY OF ACRONYMS AND KEY TERMS**

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<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
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<tbody>
<tr>
<td>BFE</td>
<td>Base flood elevation</td>
</tr>
<tr>
<td>CRS</td>
<td>Community Rating System</td>
</tr>
<tr>
<td>DCED</td>
<td>Pennsylvania Department of Economic and Community Development</td>
</tr>
<tr>
<td>DFIRM</td>
<td>Digital Federal Insurance Rate Map</td>
</tr>
<tr>
<td>FEMA</td>
<td>Federal Emergency Management Agency</td>
</tr>
<tr>
<td>FIRM</td>
<td>Federal Insurance Rate Map</td>
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<tr>
<td>HAZUS</td>
<td>FEMA hazard mapping software</td>
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<tr>
<td>HFIAA</td>
<td>Homeowner Flood Insurance Affordability Act of 2014</td>
</tr>
<tr>
<td>HMP</td>
<td>Hazard Mitigation Plan</td>
</tr>
<tr>
<td>HUD</td>
<td>U.S. Department of Housing and Urban Development</td>
</tr>
<tr>
<td>GIS</td>
<td>Geographic Information System</td>
</tr>
<tr>
<td>NAS</td>
<td>National Academy of Science</td>
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<tr>
<td>NOAA</td>
<td>National Oceanic &amp; Atmospheric Administration</td>
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<tr>
<td>NFIP</td>
<td>National Flood Insurance Program</td>
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<tr>
<td>NWS</td>
<td>National Weather Service</td>
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<tr>
<td>PAFPM</td>
<td>Pennsylvania Association of Floodplain Managers</td>
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<tr>
<td>PASDA</td>
<td>Pennsylvania Spatial Data Access</td>
</tr>
<tr>
<td>PEMA</td>
<td>Pennsylvania Emergency Management Agency</td>
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<tr>
<td>RL</td>
<td>Repetitive Loss</td>
</tr>
<tr>
<td>SEDA-COG</td>
<td>SEDA-Council of Governments, multi-county public development entity in Central Pennsylvania covering 11 counties on the Susquehanna River</td>
</tr>
<tr>
<td>SFHA</td>
<td>Special Flood Hazard Area</td>
</tr>
<tr>
<td>SRBC</td>
<td>Susquehanna River Basin Commission</td>
</tr>
<tr>
<td>SRL</td>
<td>Severe Repetitive Loss</td>
</tr>
</tbody>
</table>
1.0 INTRODUCTION

Without further Congressional action, the NFIP expires in September 2017. While both the U.S. Senate and House have already held hearings and introduced several bills in 2017, the path towards extending and/or modifying the NFIP will be a challenge given the $25 billion in debt, the decrease in number of policyholders, the increase in premium rates, and the increase in number and severity of storms. Congress must decide, soon, on how to approach the NFIP. As this happens, Pennsylvania may be able help its rural communities through policy changes at the federal, state, and regional or county levels.

Fig. 2: Complexity of addressing the NFIP insolvency and rate issues

1.1 Background

Pennsylvania, one of the most flood prone states in the U.S., has recently faced more frequent and catastrophic storms with millions of dollars in resulting damage. Although federal, Commonwealth, and local initiatives work to mitigate flood damage, increased development and changing weather patterns continue to increase flood frequency, magnitude, and impact. Pennsylvania’s Department of Environmental Protection estimates there are 86,000 miles of streams and rivers, the most for any U.S. state except Alaska (DEP, 2016). Because of its topography and historic development along waterways, Pennsylvania is naturally prone to
increased flood frequency and impacts. Flooding is the most “frequent and most damaging” natural disaster in Pennsylvania (PEMA, 2017). Although flooding in Pennsylvania’s rivers and streams is a regular occurrence, catastrophic flooding caused by different types of events has occurred across the Commonwealth and at almost any time of year (National Weather Service).

![Statewide distribution of mapped floodplains (PASDA)](image)

Of the 59 federally declared disasters in Pennsylvania since 1953, 26 have been floods and 16 have been severe storms (FEMA).¹ In the Northeast region of the U.S., including Pennsylvania, there has been a 71% increase in heavy rainfall events since 1991 (see Fig. 1, Executive Summary); a heavy rainfall is 2 or more inches of rainfall (NCA, 2014). The Pennsylvania Climate Impacts Assessment Update states that there “are substantial and increasing flooding risks in Pennsylvania for both urban areas and infrastructure in rural areas.” Variability is also increasing: more floods, but also more droughts. (PSU, 2015).

Estimates on the cost of flood damage and payments vary. The Susquehanna River Basin alone suffers a major flood an average of every 14 years at an average cost of more than $150

¹ FEMA data visualization: https://www.fema.gov/data-visualization-summary-disaster-declarations-and-grants

Nationwide, the impact of flood damage is also high and increasing. From 1978 to 2016, total flood insurance claims by calendar year have exponentially increased, with at least $1 billion dollars claimed annually since 2006 (FEMA). In 2016 alone, the U.S. experienced four separate billion-dollar inland flood events, including Hurricane Matthew. Early estimates for Matthew range from $25 billion to $30 billion in damage, $4 billion to $6 billion alone from property damage (Morgan, 2016). Prior to 1980, no more than two of these “billion dollar” events had occurred in a single year (Smith, 2017).³ Between 1978 and 1999, there was an average of 35,570 annual losses paid per year; since 2000, this average has grown to 54,175 paid losses per year (FEMA Losses).⁴ The combination of events has resulted in a more than $25 billion shortfall in the National Flood Insurance Program, with additional pressure from natural disaster declarations.

FEMA has been charged with updating floodplain maps to address these changing conditions and to increase rates to reach fiscal solvency. The process to update floodplain maps has generally included more geographic area as being mapped in the “100 year floodplain.” At the same time and facing a significant budget shortfall, Congress mandated that the National Flood Insurance Program update its rates through the 2012 Biggert-Waters Act (see Section 4.1.6). As the full magnitude of the rate increases began to take effect, Congress delayed rate

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² SRBC flood forecasting: http://www.susquehannafloodforecasting.org/
³ The U.S. National Oceanic and Atmospheric Administration (NOAA) has started to compile statistics about events that incur $1 billion or greater in losses; see https://www.ncdc.noaa.gov/billions/summary-stats.
⁴ FEMA losses by calendar year: https://www.fema.gov/number-losses-paid-calendar-year.
increases under the 2014 Homeowners Flood Insurance Affordability Act (Section 4.1.7). At this point, the NFIP expires in September 2017 unless Congress extends it, raising a number of questions for the United States as a whole, but also for the Commonwealth of Pennsylvania.

1.2 Project Need and Scope

Such changes—both physical and legal—have an impact on Pennsylvania communities and residents that are substantial and not well understood. In 2013, the U.S. Housing and Urban Development (HUD) denied the Commonwealth’s application to participate in a $1 billion call for disaster resilience grant funding (HUD, 2012), noting that Pennsylvania sought baseline planning while HUD was looking for shovel-ready projects. This project helps provide some baseline information, while highlighting the need for additional research and policy changes.

The Commonwealth of Pennsylvania is in a critical position to address flood policy at both a national and state level. Given the flood impacts resulting from its geography, historic development patterns and the age of housing stock, and increasingly intense storms, the Commonwealth has impacts different from many other states. The Commonwealth also shares similarities with other states. As the Pennsylvania Association of Floodplain Managers notes, “[f]lood insurance was originally designed to ease the financial burden on individuals and communities already situated in harm’s way, so that they could get out of danger. People have come to depend on insurance to stay in the floodplain rather than to transition out, and that has proven unsustainable—the insurance trust fund is unable to meet its obligations and is getting worse.” (PAFPM, 2014) (emphasis added). How to address the economic impacts of such reliance is critical: how can both flood damage, and also the impact of flood insurance, be addressed for rural communities and their individual homeowners and businesses alike?

To help provide information, this multi-disciplinary project examined 1) federal and state law related to flooding; 2) explored which Pennsylvania communities, and those living in the
communities, that are impacted by floods; 3) examined the financial impacts associated with flooding and flood insurance; and 4) conducted in-depth case studies to examine how current policies affect local Pennsylvania communities. The research also developed policy recommendations at the federal, state, local and individual levels.

1.3 Related Research

This project incorporates other related research. For example, the Center for Rural Pennsylvania conducted an initial study on the impact of the Biggert-Waters Act; results were presented at a Jan. 2014 joint legislative committee hearing in Harrisburg (Denk, 2014). SEDA-COG, a regional multi-county development agency in the central Susquehanna River valley area, has written a white paper on these issues (SEDA-COG, n.d.), as has the Pennsylvania Association of Floodplain Managers (PAFPM, 2014). The Department of Community and Economic Development reviewed possible state responses to the 2012 changes to the NFIP in 2014 (PA DCED, 2014). Jeremy Young, formerly the Project Manager, Disaster Planning for Historic Properties Initiative with the Pennsylvania Historical and Museum Commission’s State Historic Preservation Office, also compiled information related to historic structures in Pennsylvania’s floodplains (Young, 2016). Mr. Young also put together a conference in June 2016 to address the impact of flooding on Pennsylvania’s historic river towns; this conference provided valuable information and contacts. The Pew Charitable Trusts issued a report on Pennsylvania flood impacts in 2016, and continues to be interested in this topic. Finally, the U.S. Army Corps of Engineers has conducted a study on Lycoming County and is recommending further work with the Borough of Muncy to address floodplain management and the challenge to addressing water quality in the Chesapeake Bay region. References are included in Section 6.

This project has also led to additional research and presentations. For example, a Ph.D. student at Florida Gulf Coast University is now comparing Community Rating System (CRS)
Implementation between Florida and Pennsylvania; information from her interviews is included in this report. The Susquehanna River Heartland Center for Environmental Studies has provided students through Bucknell University to work on this report; results will be shared at Bucknell’s Susquehanna River Symposium in November 2017. In addition, report results will be shared at the Pennsylvania Association of Floodplain Managers’ annual meeting in September 2017.

2.0 Goals and Objectives

The goal of this project is to better understand how flood insurance maps, flood insurance rates, and the Community Rating System (CRS) are impacting Pennsylvania communities. The term “communities” is used because it is a term used by the CRS; it refers to a municipal unit that can apply for CRS recognition and be eligible for flood insurance rate reductions. In Pennsylvania, this could be a borough, township, or city. This project focused on rural communities as larger cities or urbanized areas tend to have more resources to address flooding-related impacts. This project included the following four goals, objectives, and tasks.

Goal 1: Understand the law and policy frameworks under both federal and Pennsylvania law

- **Objective 1.1:** Review the Pennsylvania law and policy framework for flooding and stormwater related issues, particularly in conjunction with federal requirements.

- **Objective 1.2:** Review federal law and policy frameworks with a focus on FEMA mapping; the Biggert-Waters Act of 2012; and the Homeowners Flood Insurance Affordability Act of 2014.

- **Objective 1.3:** Determine the implications of the law and policy drivers on mapping, land use changes, and affected populations, in coordination with other Goals and Objectives.

- **Objective 1.4:** Make policy recommendations for the Commonwealth of Pennsylvania based on project findings. Identify potential impacts of laws like the Biggert-Waters Act going forward.

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5 Although counties can be eligible “communities,” this is only for unincorporated areas. All of Pennsylvania is in a borough, township or a city; therefore, counties are not eligible for the CRS program.
Goal 2: Identify areas and populations vulnerable to flooding impacts in Pennsylvania

- **Objective 2.1:** Research and quantify areas mapped in the 100 year floodplain.
- **Objective 2.2:** Research and quantify basic demographics and characteristics of residents and businesses in the mapped floodplain areas using both historical and current maps.
- **Objective 2.3:** Review and quantify floodplain areas in current CRS communities; in counties with Hazard Mitigation Plans; and in communities that have or lack other mitigation programs.
- **Objective 2.4:** Analyze aggregate statewide floodplain, economic, and social data and compare to estimates created by using community-scale data under the case study analysis.

Goal 3: Examine the potential economic impact of recent federal changes to Pennsylvania communities

- **Objective 3.1:** Review existing studies related to damage costs from Pennsylvania floods.
- **Objective 3.2:** Analyze flood insurance rate scenarios (original set of objectives).\(^6\)
  - Scenario 1 (baseline): Flood insurance rates before changes to new floodplain maps.
- **Objective 3.3:** Work with the demographic, housing, and business information developed under Goal 2 to determine the economic impact on various populations of interest.
- **Objective 3.4:** Determine the potential costs or benefits for communities participating in the Community Rating System, including land values.

Goal 4: Identify community-level impacts of the Biggert-Waters Act and other federal programs on community costs and strategies for flood mitigation

- **Objective 4.1:** Develop and refine a methodology for selecting Pennsylvania communities for focused case studies, then select six to eight case study communities.
- **Objective 4.2:** Acquire information from case study communities using local demographic, economic, and floodplain data; local communities’ existing and planned mitigation strategies; and interviews with key stakeholders.
- **Objective 4.3:** Analyze community information; assess the impact of Biggert-Waters and other federal laws and policies related to flooding; and identify location-specific costs and impacts of flooding and flood mitigation strategies on these case study communities.
- **Objective 4.4:** Determine whether statewide aggregate data approaches are adequate to

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\(^6\) Objective 3.2 could not be completed due to lack of available data from FEMA.
estimate cost/effectiveness of flood policies or if community-scale quantification is more successful (see Goal 2, Obj. 2.4).

The methodology differs for each set of goals and objectives, so it is described in more detail below (Section 3.0), followed by the results for each goal and objective (Section 4.0). Finally, the policy recommendations for the project overall are compiled into Section 5.0.

3.0 Methodology

Different methodologies were used to achieve each set of goals and objectives outlined above. This section provides a brief overview of the following: 1) the legal review; 2) geospatial and demographic information gathering; 3) the economic analysis, and 4) the case studies.

3.1 Legal Review

This research examines federal and state laws and local ordinances related to flooding and stormwater. The researchers gathered pertinent laws and regulations from a federal, state and local level, then reviewed the legislative history, related documents, and any relevant news or litigation. Proposed legislation was also tracked through an alert system, along with Congressional testimony. In addition to reviewing the direct legislative text and associated commentary, the research also analyzes other government reports, documents, and related news stories. Local ordinances were gathered and reviewed in the case study portion of the research.

In addition, the researchers interviewed key personnel at a federal, state, regional and local level. At the federal level, interviews included personnel with FEMA, the U.S. Army Corps of Engineers, the National Park Service, and Representative Glenn Thompson and his staff. Interviews were also conducted with the Susquehanna River Basin Commission staff. At the state level, interviews were conducted with personnel from the Department of Community and Economic Development (DCED), the Pennsylvania Emergency Management Agency (PEMA),
the Pennsylvania Insurance Department, and the Pennsylvania Historic and Museum Commission. Local personnel were also interviewed, mainly through the case study process.

3.2 Geospatial and Data Acquisition

This portion of the project involved gathering geospatial maps and data to help answer key questions: How have flood boundaries changed over time? How much of the population is in flood zones? What demographic and economic characteristics are in the selected communities? How do these intersect with NFIP enrollment? Data acquisition for the project was approached in two phases: 1) identifying existing data, and 2) identifying and acquiring data to fill gaps.

3.2.1 Identification of Existing Data

The first phase was to identify readily accessible data via data portals, particularly Pennsylvania Spatial Data Access (PASDA, http://www.pasda.psu.edu). Developed in 1996 by Penn State, PASDA is Pennsylvania's official public access geospatial information clearinghouse. Serving as the clearinghouse for Pennsylvania for over 20 years, PASDA houses significant data assets including aerial photography, elevation, transportation and infrastructure, and environmental data.

PASDA has actively acquired FEMA flood related data throughout the last 20 years. Therefore PASDA not only provided access to the most recent FEMA data but also provided the project with historic digital data sets dating back to 1996. In addition to acquiring data from PASDA, the team researched the FEMA and Pennsylvania Emergency Management Agency (PEMA) sites to identify additional data not on PASDA. New data generated as a result of this study was generally incorporated into the PASDA site.

Of particular importance was the data created by FEMA’s “HAZUS” risk analysis software program, which provides “a nationally applicable standardized methodology that contains models for estimating potential losses from earthquakes, floods, and hurricanes”
In 2006, PEMA completed a statewide study of a 100 year flood event using HAZUS. In 2007, PEMA concluded a statewide study using the latest version of HAZUS-MH MR 2.0 that includes damage estimates for 10, 50, 100, 200 and 500 year flood events. The study computed damage in dollars for total economic loss, building and content damage, and other economic impacts. The study also estimated the number of damaged homes and the degree of damage to those homes. This data has been integrated into the project database. HAZUS data statewide has not been updated since 2007; however, several counties, including Allegheny, and local governments, including Pittsburgh and Washington, have completed new HAZUS studies.

In addition, the team contacted other data providers including the U.S. Geological Survey (USGS), the Pennsylvania Topographic and Geologic Survey (PAGS), the Pennsylvania Historic and Museum Commission (PHMC), the Pennsylvania Geospatial Technologies Office (GTO), and the Susquehanna River Basin Commission (SRBC). USGS and PAGS data include topographic maps, elevation data, and additional historic aerial photography. The PHMC provided data on historic sites across Pennsylvania. The SRBC provided recent flood inundation mapping studies for Jersey Shore, Lewisburg/Milton, and Harrisburg as well as information from studies in the 1980s, though no digital data was available for these older studies. The team also acquired data from the U.S. Census Bureau, including demographic data and boundary data.

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7 FEMA HAZUS information: https://www.fema.gov/hazus
8 The PASDA site includes data layers from such studies; see http://www.pasda.psu.edu/.
3.2.2 Identification of Data Gaps and Acquisition of New Data

The gaps in available data tended to be data generated by local governments, particularly county governments. In Pennsylvania, local governments are not required to provide free access to the data they create; there is often a charge for this data. It is often not provided as readily downloadable data via PASDA or other portals. Therefore, the team contacted local governments to discuss acquiring locally created data.9 These counties were Lycoming County, York County, Monroe County, and Bedford County. Other counties of concern to the project already provided data via PASDA. These six counties provided parcel and assessment data, with the exception of Bedford County, which only provided parcel data. York and Lycoming counties also provided floodplain analysis data from projects they had completed in 2015. Appendix 7.1 includes a complete list of data acquired for the project.

The most important gap related to data is the lack of widespread availability of more detailed local data. This lack of access is due to the fact that Pennsylvania does not include free access to GIS data as part of the Commonwealth’s Right-To-Know Law, 65 Pa. Stat. 67.101 et. seq. Local governments may sell their data and require users to sign a strict license agreement for the use of the data. However, the local governments contacted for this project were quite cooperative and helpful. Easier and more direct access to local data would help decision makers, FEMA, and PEMA to develop updated and higher resolution secondary data sets more readily.

3.2.3 Data Processing and Integration

To determine state and county demographics, the team developed a spreadsheet of general characteristics for Pennsylvania and a selection of counties that may be relevant to flood impacts. Variables include a number of Census figures, area in floodplains, and percent

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9 Of the data collected, this local data has not necessarily been added to the PASDA site due to agreements with the local governments on how the data could be used.
impervious surface area. These characteristics are developed for Pennsylvania in total, statewide floodplain areas, the total area of select counties, and the floodplain areas of select counties. Additionally, total and mitigated repetitive loss statistics, from the Pennsylvania Repetitive Loss and Severe Repetitive Loss Inventory (PEMA, 2013), were divided by county population (to adjust for counties with larger populations having greater impacts due primarily to having more people) to develop a rank of most affected counties. Counties were selected to include the project study areas and some other counties to get representation at various positions in the rank. The row in the table that contains each county's rank is called, "Rank According to Repetitive Loss Properties per Capita." A summary of results is in Section 4.2.

To process this data, PASDA staff downloaded the Census variables in Table 2 as a TIGER/Line geodatabase for Pennsylvania Block Groups; this includes selected demographic and economic attributes from the American Community Survey (ACS) 5-year estimates from 2010 - 2014. The ACS provides the most recent available data; attributes are available only to the block group level. Consequently, block-level data was not used in this study.

Table 2: Census Variables Used in this Study (2014 ACS 5yr) ([http://www.census.gov/geo/maps-data/data/tiger-data.html](http://www.census.gov/geo/maps-data/data/tiger-data.html))

| fB01001e1 | SEX BY AGE: Total: | Total population (Estimate) |
| fB02001e3 | RACE: Black or African American alone | Total population (Estimate) |
| fB03003e3 | HISPANIC OR LATINO ORIGIN: Hispanic or Latino | Total population (Estimate) |
| fB23025e7 | EMPLOYMENT STATUS FOR THE POPULATION 16 YEARS AND OVER: Not in labor force | Population 16 years and over (Estimate) |
| fB25002e1 | OCCUPANCY STATUS: Total | Housing units (Estimate) |
| fB25002e2 | OCCUPANCY STATUS: Occupied | Housing units (Estimate) |
| fB25003e3 | OCCUPANCY STATUS: Vacant | Housing units (Estimate) |
| fB25003e2 | TENURE: Owner occupied | Occupied housing units (Estimate) |
| fB25003e3 | TENURE: Renter occupied | Occupied housing units (Estimate) |
| fB25087e2 | MORTGAGE STATUS AND SELECTED MONTHLY OWNER COSTS: Housing units with a mortgage | Owner-occupied housing units (Estimate) |

The block groups were processed using ESRI ArcGIS Desktop GIS software. A map of floodplains created by Penn State’s Environmental Resources Research Institute (ERRI) in 1996 was used to select only those block groups that fall within the boundaries of a floodplain.
The ERRI floodplain layer was used because it is statewide. Despite being much more current, the National Flood Hazard Layer (NFHL) floodplains were not used because they are missing for three Pennsylvania counties (Butler, Fayette, and Lackawanna); Warren County maps were just released (Figure 4).

Ideally, the NFHL floodplain features would be used, but due to missing data in three counties and a visual comparison of the two layers shows that they align relatively closely, the 1996 ERRI layers are used here. However, the NFHL floodplains are used to perform the parcel processing in subsequent steps for case-study counties. This data generally includes both residential and commercial areas; however, it was not always possible to differentiate between the two types of uses across all counties. In addition, the parcel data was continuous, so would also include all agricultural lands. The ratio of each block group’s area that falls inside versus outside floodplains allows adjustment of the census variables proportionally to estimate the characteristics of population inside floodplain boundaries.

The impervious surface layer in the 2011 National Land Cover Dataset (Homer, et al., 2015) was also downloaded from PASDA. Values in the dataset represent % impervious surface for each 30x30 meter pixel. Pixels falling within floodplain boundaries were selected; the mean value of those pixels was reported as the average imperviousness of floodplains in each county.
3.2.4 Case Study Counties and Parcel Characteristics

The final portion of the project involved detailed case studies in 8 different communities (Sections 3.4, 4.4). A geodatabase that contains parcel features for the case-study counties was developed. Each parcel was analyzed for whether it is in a current flood zone, and if so, the flood risk level, distance from the nearest flood zone, whether it was in a flood zone according to the 1996 floodplain data, its center point (centroid) elevation, and its Base Flood Elevation (BFE).

There were a number of steps to process this data. First, parcel feature data was acquired from case-study counties (Allegheny, Chester, Cambria, Lycoming, Bedford, Monroe) and loaded into a file geodatabase. By overlaying the 2015 National Flood Hazard Layer (NFHL), each parcel’s flood risk was labeled depending on the type of flood feature intersected. Possible values include “Low or no risk of flooding,” “Medium, .2 percent (500-year) flood risk,” “High, 1 percent (100-year) flood risk.” For parcels that do not intersect floodplain features, their distance to the nearest floodplain was calculated and recorded. Second, by overlaying the 1996 floodplain layer, each parcel was labeled depending on whether it intersects a historic floodplain feature. Third, to calculate the elevation of each parcel, the National Elevation Dataset (NED) 30m DEM was downloaded from PASDA; elevation was determined at the parcel’s centroid. Finally, each parcel’s BFE was determined by calculating the minimum value observed in the NFHL features that the parcel intersects.

3.2.5 Data and Methodology Validation

To validate estimates of population and housing within floodplains, estimates of housing units were compared to estimates of parcels within floodplains, which were calculated using different methods. There is high confidence in this method of identifying parcels that intersect floodplain boundaries, which is a straightforward spatial overlay of parcel features with floodplain features. Estimates of population and housing units in floodplains are less confident
and benefit from validation for two reasons: (1) an even distribution of people and houses within each census block group is assumed, and (2) the proportion of total population and housing that is within a floodplain is assumed to be equal to the proportion of each block group’s geographic area within a floodplain. The absolute values of this validation exercise are not expected to be precisely equal between housing units and parcels because parcels and housing units are different units; however, it is intended to show general agreement in relationships and trends.

First, a simple comparison was made between the number of housing units and the number of parcels contained within a sample of counties, both in total and within floodplains. While the relationship between housing units (defined by the U.S. Census Bureau) and parcels is not necessarily one-to-one, it is assumed that there will be a comparable number of housing units to the number of parcels within each county. The table below shows the total numbers of housing units and parcels within each county and within the county’s floodplains.

Table 3. Housing Units and Parcels: Total vs. Floodplains for Selected Counties

<table>
<thead>
<tr>
<th>County</th>
<th>Housing Units</th>
<th>Parcels</th>
<th>Housing Units</th>
<th>Parcels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allegheny</td>
<td>589,211</td>
<td>579,486</td>
<td>29,653</td>
<td>22,801</td>
</tr>
<tr>
<td>Bedford</td>
<td>23,984</td>
<td>33,474</td>
<td>1,807</td>
<td>7,630</td>
</tr>
<tr>
<td>Lycoming</td>
<td>52,586</td>
<td>50,991</td>
<td>6,650</td>
<td>10,255</td>
</tr>
<tr>
<td>Monroe</td>
<td>80,569</td>
<td>100,283</td>
<td>5,790</td>
<td>7,358</td>
</tr>
</tbody>
</table>

Allegheny County demonstrates the closest agreement between the absolute numbers of housing units and parcels both in total and within floodplains. Lycoming County has mixed results, and Bedford and Monroe counties present greater disagreement in absolute value. However, the relative difference between housing units and parcels is consistent; in other words, where there are more parcels than housing units at the county-level, there are more parcels than housing units at the floodplain-level. Only Lycoming County shows inconsistent results with more parcels at the county-level and fewer parcels at the floodplain-level.
Second, the percentage of *housing units* that intersect floodplains is compared to the percentage of *parcels* that intersect floodplains for a sample of counties. This approach does not rely on the assumption that parcels and housing units have a one-to-one relationship, but rather tests that the method for identifying locations within floodplains yields consistent ratios regardless of whether parcels or housing units are targeted. The following table presents the percentages of total housing units and parcels that intersect floodplains for a sample of counties.

### Table 4: % of Parcels vs. Housing Units in Floodplains for Selected Counties

<table>
<thead>
<tr>
<th>County</th>
<th>% of Parcels in Floodplains</th>
<th>% of Housing Units in Floodplains</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allegheny</td>
<td>3.93</td>
<td>5.03</td>
</tr>
<tr>
<td>Bedford</td>
<td>22.8</td>
<td>7.53</td>
</tr>
<tr>
<td>Lycoming</td>
<td>20.1</td>
<td>12.7</td>
</tr>
<tr>
<td>Monroe</td>
<td>7.33</td>
<td>7.19</td>
</tr>
</tbody>
</table>

Allegheny and Monroe counties demonstrate strong agreement between parcel and housing unit estimates, suggesting that this method of identifying locations within floodplains is consistent between housing units and parcels. Bedford and Lycoming counties show less agreement.

Generally speaking, this validation exercise lends credence to the methodology of identifying population and housing numbers within floodplains state-wide. It also highlights some of the inherent challenges in making these estimates, in particular the need to use Census data, which is aggregated to the block group level, and the assumption of even distributions within block groups when identifying populations proportionally to the geographic area of block groups that fall within floodplains. Furthermore, counties that are more rural with smaller populations are likely to have block groups that have larger geographic extents. This presents additional challenges as floodplains may only intersect a relatively small portion of the block group that doesn’t equate to the proportion of the population that actually lives there, a challenge perhaps more common in a rural county like Bedford than an urban one like Allegheny. Without performing direct surveys on the ground, which are not practical for state-wide analysis, these kinds of assumptions and challenges are unavoidable.
An earlier study performed by The Pew Charitable Trusts (2016) used a similar methodology, but estimates a population total living in Pennsylvania floodplains that is approximately half of what this current study calculated, approximately 400,000 versus 800,000 people. The Pew study used floodplain boundary maps created around 1996, similar to the floodplain data used in the current study. However, the Pew study was national in scope and relied on source population data developed for global coverage. Notably, the Pew study mentions that its results are also approximately half of the estimate produced by an even earlier effort. Nationwide, the Pew and the previous study estimate that 5.8% and 11.8%, respectively, of the U.S. population lives in flood zones. Because the Pew study estimates half the population of two other studies, this suggests the source data used for population distribution may skew results toward more conservative estimates.

The most significant difference between the Pew study and the analysis in this report is that the Pew study used Landscan population figures as its primary data source, rather than U.S. Census data like used here. Landscan is a raster (grid-based) dataset that has a spatial resolution of approximately 1km square cells. These cells were resampled to a more fine resolution, evenly distributing the total population of the original cell among the smaller ones, to artificially enhance the resolution of the data without adding any new information. A zonal statistics operation was used to aggregate the Landscan population data into Census block groups by taking the sum of all cells that fall within each block group feature. To determine the flood zone population for a census block that straddles the boundary of a floodplain, the proportional area of the block group within the floodplain was applied to the Landscan cells to estimate the proportional population within the flood zone. This is similar to the methodology used in this study, with the exception being the source data from Landscan versus the Census.
A 1km pixel resolution is larger than most block groups in more densely populated areas, and much smaller than large block groups in rural areas. This provides more resolution and information in rural areas, but not necessarily in urban areas, where much flooding occurs. Furthermore, the benefit of some areas of increased resolution may be negated by the fact that Landscan captures average, ambient population, rather than the population distribution of where people live. Ambient population incorporates daily movements of people as they commute to work, and presents an average population distribution that doesn’t necessarily capture where people live. This may be an appropriate measure of population relative to impacts of certain weather events during the day, but it fails to capture the housing, structures, and populations of people where they live; it is less well suited to the flood insurance context of this report. On the other hand, census data explicitly captures where people live and is a measure of population distribution more relevant to the current study, despite its more coarse resolution in rural areas.

Interestingly, the Landscan dataset is largely based on demographic data like that produced by the U.S. Census Bureau. Dasymetric mapping techniques are used to approximate more precise distributions of population through manual interpolation and visual interpretation. While this technique produces cartographic representations that appear more detailed than Census block groups or tracts, they may not be more accurate than the underlying source data.

Landscan is a powerful and useful dataset, but has inherent flaws and uncertainties. Likewise, the Census data used in this study has inherent flaws and challenges. The two approaches provide different opportunities and different results, in this case estimates of 400,000 people versus 800,000 people living in flood zones from the Landscan and this study, respectively. This discrepancy in population distribution estimates is an indication of the challenge of performing this kind of analysis and the importance of source data. Both studies are
informative, but the methodology and source data used in the current study are justifiable given the context of flood insurance.

3.3 Economic analysis

In addition to understanding the data outlined in this section, this study examines the economic impact of flooding and flood insurance. To determine the potential economic impacts, two intertwined sets of analyses were conducted. The first examines the user cost of housing, and the second looks at potential impacts of a range of flood insurance rates in the five sets of counties used in the more in-depth case studies (Goal 4). The results section (4.3) contains more information and analysis on the economic impacts.

The economic framework depends on modeling the supply and demand of houses in floodplains. This is a system of two interdependent equations that determine change in the stock of houses and the change in the price of houses. The change in the stock of houses, $\Delta S$, equals the construction (supply) of new houses, which depends on the price of houses, $Y(P)$, minus the depreciation of houses, $\delta S$.

$$\Delta S = Y(P) - \delta S$$

The change in the price of houses, $\Delta P$, is more complicated. The price of houses is broken into two components: the value of the services provided by housing and the asset value of owning a house. First, houses provide benefits to owners and renters of homes because it gives them a place to live along with the many nonfinancial benefits of housing. These housing services can be valued by looking at the demand for housing, given a certain stock of houses, $R(S)$. Second, owning a home involves owning an asset that can accumulate (or lose) value. The user cost of housing is a way to measure the asset value of housing services provided to the homeowner (Poterba, 1984). The user cost framework provides the theoretical basis for how the U.S. and other national-level governments calculate housing price indexes and the value of
housing to help measure the economic activity of the country (such as the Consumer Price Index). The user cost of housing can be decomposed into three components (Diewert, 2004):

1. The cost to a household of purchasing a house at the beginning of a period (thus tying up funds that could have otherwise earned interest),
2. Living in the house during the entire period (and receiving the value of housing services but also paying maintenance costs and property taxes), and
3. Selling it at the end of the period at the prevailing market price (perhaps back to oneself) (losing depreciation value and losing or gaining value due to the expected changes in prices over this time period).

The user cost is an appropriate framework to understand the economic impacts of flood insurance premiums because (1) it accounts for both housing price changes and housing supply changes, and (2) is grounded in economic theory. Given the recent housing bubbles and busts, models of short-term housing responses are prone to be influenced by these short-term cycles instead of long-run equilibrium housing markets.

To model the user cost framework, the change in the price of houses, $\Delta P$, is modeled as the asset value of owning a house, $\psi P$, minus the value of housing services, $R(S)$. For example, an increase in flood insurance premiums will decrease the asset value of owning a house immediately but it will not change the demand for houses (until the supply of houses adjusts to the changing prices), which will lead to a decrease in the change of house prices ($\Delta P < 0$). An equilibrium will emerge when neither the price nor the stock of houses change.

Data was collected on the housing markets in the case study counties (see section 4.3). The market equilibrium point is defined to be the current number of single-family houses in the floodplain and the current value of these houses. To apply the model to data, the housing supply and demand functions were adjusted until they intersected at the equilibrium point in the data. There are a number of assumptions used in calibrating the model. First, the function form of housing supply function is assumed to be

$$Y = aP^{\epsilon_Y}$$

(1)
where $a$ is a constant that represents a housing starts shifter and $\varepsilon_{yp}$ is the (constant) elasticity of housing starts to house prices, using the estimate $\varepsilon_{yp} = 1.8$ from Harter-Dreiman (2004).

Second, the functional form of the rental inverse demand function is assumed to be
derived from the estimate $\gamma = 0.2$ from Tonti & Mace (2007).

\[ R(S) = \frac{b}{S} \]  \hspace{1cm} (2)

Second, the functional form of the rental inverse demand function is assumed to be

where $b$ is a constant that represents a demand shifter or shift in demand. The models are then calibrated to the data by adjusting the constants $a$ and $b$ until the predicted average housing price and housing stock equals the values observed in the data. Third, the housing depreciation (i.e. the yearly loss of housing net of repairs and maintenance) rate is assumed to be 0.02 (Harding et al., 2007; DiPasquale & Wheaton, 1994). Finally, the user cost of housing is assumed to be 5.9%. Poterba & Sinai (2011) estimated the user cost of housing by income level and found that households with incomes below $40,000 per year, between $75,000 and $125,000, and above $250,000 to have user costs of 6.8%, 5.4%, and 4.6%, respectively.\(^{10}\)

A range of premium increases is simulated due to the political uncertainty surrounding these changes. The Congressional Budget Office estimated that 355,000 policies nationally would be subject to premium increases under Biggert-Waters 2012; once subsidies are completely phased out, annual premiums would be about 2 ¼ times greater, on average, than previously charged rates (CBO, 2011). Documented rate increases have also ranged up to 1,000% higher. The model outlined above has been calibrated to the Pennsylvania case study counties (see Section 3.4); the results of this model are included in Section 4.3.

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\(^{10}\) The analysis assumes a constant relationship between housing construction and prices, constant per-unit housing service flows and constant user costs of housing (net premiums). These assumptions were made to isolate the impacts of flood insurance premiums, but of course, changes in other relevant factors would affect housing markets too.
3.4 Case study review

Case studies were selected to capture the diversity of flood management approaches in Pennsylvania communities to the extent possible given the project’s limited scope of six to eight case study communities. Factors considered were:

- Diversity in location, coverage of main river basins (Ohio, Susquehanna, Delaware);
- Diversity in type of government structure – township, borough, or city;
- Rural nature of the community and/or the county in which the community is located;
- Diversity in types of flood mitigation programs employed by the communities;
- Degree of participation in existing federal and Commonwealth programs;
- Historic and continuing susceptibility to flood damage, especially in historic districts of small rural communities, which drives the communities to select and implement the most effective practical flood-mitigation approaches and techniques;
- Availability of information, including reports and knowledgeable personnel who made themselves available for interviews.

The report team led by L. Donald Duke and students from Florida Gulf Coast University developed a detailed table with data about each of the factors for Pennsylvania’s municipalities to be used in assessing potential case study locations and making a final selection (Appendix 7.3). The table was provided to CRP staff, who reviewed the criteria and lists of potential case study communities, made recommendations, and participated in the ultimate selection of candidate case study locations (Appendix 7.4). Because there are many municipalities in the Commonwealth that would make excellent case studies for this analysis, the municipalities analyzed were not intended to be statistically representative of all of them. The purpose was to choose some municipalities that would be instructive about flood mitigation approaches actually applied by Pennsylvania’s small and rural communities, and to ensure they represented the diversity in the Commonwealth’s extensive variation in geography, institutional settings, economic base, and history and future risk of flood impacts.
Once the case studies were selected, L. Donald Duke and student researchers from Bucknell University conducted a series of site visits, phone conversations, and review of publicly available reports and documents for each of the eight case study communities and the six counties in which they are located. The document review and interviews were designed to understand the various types of flood mitigation, response, and recovery strategies pursued by each case study municipality. Interviews were conducted with multiple staff members from each case study municipality; these staff members were selected by a process of expanding contacts: initial contact calls included questions about which personnel were most familiar with the flood mitigation process, and contacts continued until all personnel identified as knowledgeable had been contacted. This included a range of community staff, whose specific titles and responsibilities varied from one community to another, including but not limited to those with responsibilities for emergency management, community planning, economic development, and code enforcement. In some but not all communities, one staff member was designated as floodplain manager. The eight case study communities were grouped into six counties; in four of the six counties, the process included interviews with one or more county-level personnel.
regarding the activities of the case study communities. All document reviews, phone interviews, and on-site interviews were conducted between May and August of 2016.

A further analysis of one aspect of the communities’ activities was conducted by L.D. Duke and Michele Weitzel of Florida Gulf Coast University. A targeted set of interviews with staff of each of the eight case study communities focused on their understanding of the benefits, limitations, and implementation in municipalities of the Community Rating System (CRS), a component of FEMA’s National Flood Insurance Program. This was a formal, “semi-structured” survey procedure, conducted from mid-October through early December 2016. The survey used a questionnaire instrument (Appendix 7.5) and a “semi-structured” approach, where all respondents were asked the prepared list of questions and encouraged to speak about other relevant information. The survey attempted to reach at least one person from each of the eight case study communities, and at least one person from each of the six counties where those cases are located. Personnel were identified using extensive telephone and in-person outreach in June and July 2016, supplemented by asking each contact if other people should be contacted. Not all municipalities were available for phone contact, and a relevant and informed person from all counties could not be identified. For a few cases, detailed notes acquired during the summer 2016 on-site interviews were substituted when no person could be contacted to complete a telephone survey. Ultimately, data were acquired for a total of 10 municipal or county agencies. Not all respondents answered every question; this resulted in a relatively large number of "not applicable or did not answer" responses in the results below. The identities of those personnel, and of the agencies that employ them, are not included in this report; interviewees were told at the time that their identity would not be included to encourage them to speak freely.

The main purpose was to ask case study personnel about the CRS program: their knowledge and experience with the program, benefits received, problems experienced, and
factors that encourage or inhibit their participation. Those results are important to this report’s analysis of this federal program, and ways in which it is helpful – or could be helpful – to Pennsylvania’s rural communities. The survey also touched upon many of the same flood-mitigation issues and concerns discussed during the case study visits.

4.0 RESULTS

This section provides the results of this analysis: 1) an overview of pertinent laws and regulations from the federal, state, local, and individual level; 2) review of the data and mapping information; 3) review of economic impacts, and 4) analysis of the eight case study communities.

4.1 Legal and Regulatory Framework: Federal, State, Local, and Individual

The legal and institutional structure for flood management and reduction operates at many levels: driven by federal law, supported at the state or county level, implemented at the local level, and impacting individuals. At the federal level, the National Flood Insurance Program, its related mapping requirements for special flood hazard areas, and the Community Rating System are meant to provide flood insurance protection in return for sound floodplain management. Federal disaster relief is supposed to provide a backstop. However, recent and increasingly severe storms have profoundly stressed the NFIP: currently more than $25 billion in debt, the NFIP expires in September 2017 without further Congressional action. Federal programs in turn affect how flood impacts are managed at the state, local, and individual levels.

Pennsylvania also has its own laws and institutions related to both flooding and stormwater to flood mitigation implementation more locally, either by counties or by local governments. These laws and regulation combine to make a patchwork of jurisdiction and management that directly impacts local communities (See Section 4.4, Case Studies). Finally, individuals can both mitigate their own flood risk, and in some cases, seek private insurance.
Section 4.1 lays out the legal and regulatory framework at each of these levels.

4.1.1 The NFIP: Development and Function

Congress created NFIP in 1968 “to provide flood insurance protection to property owners, in return for local government commitment to sound floodplain management and related flood disaster mitigation efforts” (FEMA). This followed several attempts to address flood impacts—beyond providing federal disaster relief—after private companies stopped offering flood insurance after the Great Mississippi River Flood in 1927 (NRC, 2015). The first significant call for addressing flood damage through a federally endorsed flood insurance program arose during the Truman Administration, but no legislation passed. During the Eisenhower Administration, Congress was again called upon to address the growing need for flood insurance and passed the Federal Flood Insurance Act of 1956, establishing the Federal Flood Indemnity Administration, which lasted just a year.

In 1966, President Lyndon B. Johnson created a task force to examine what role the federal government should play in flood mitigation. The Task Force recommended that individuals who build in a floodplain should be educated about risks and bear the responsibility for living in a risky area. Based on this report, Congress passed the National Flood Insurance Act in 1968 (NFIA), which created the National Flood Insurance Program (NFIP) to provide guidelines to encourage development away from floodplains and ensure flood insurance coverage through a collaborative program between the federal government and the private sector. The original Act includes a sunset clause, thus requiring Congress to extend it periodically.

To accomplish the goals laid out in the NFIA, communities must “opt in” to the NFIP for individuals or businesses to be able to purchase federally backed flood insurance. Under the NFIA, communities are defined as “a State or a political subdivision thereof which has zoning and building code jurisdiction over a particular area having special flood hazards” (FEMA, 42
U.S.C. § 4003). FEMA’s Flood Manual defines “special flood hazard areas” as an area that experiences special flooding, erosion, or mudflows and is zoned as such on floodplain maps (see Section 4.1.2 below) (FEMA Flood Insurance Manual, 2017).  

To participate in the NFIP, a community must first adopt a “Floodplain Management Ordinance” that meets specified minimum requirements to address special flood hazard areas, and then apply to FEMA for coverage. The minimum requirements have been gradually modified since NFIP was created in 1968, and now require a rather detailed set of actions from participating communities. In principle, floodplain ordinances are solely the province of local communities; in practice, however, they are powerfully affected by guidance and conditions specified by the NFIP and the Commonwealth’s programs. Because the local community can offer waivers, implementation varies at the local level (see Section 4.4).  

Once FEMA approves such coverage for the community as a whole, individuals may buy federally backed flood insurance from a private insurance company, subject to a 30-day waiting period. A property owner can work with a “Write-Your-Own” (WYO) private insurance company that writes individual policies for up to $250,000 for the structure, and $100,000 for contents. The private insurer receives a fee, and the insurance itself is underwritten by FEMA.

The actual cost of

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12 FEMA’s write your own program: [https://www.fema.gov/write-your-own-wyo-program](https://www.fema.gov/write-your-own-wyo-program).
insurance depends on the zone on a Flood Insurance Rate Map (see Section 4.1.2) and the “base flood elevation” (BFE). The BFE is “the computed elevation to which floodwater is anticipated to rise during the base flood.”¹³ The BFE is the lowest level that can be damaged by flooding, including basements. Properties outside high hazard areas pay much less.

A purchaser with a federally-backed mortgage who wishes to purchase property or build a structure in a special flood hazard zone must purchase flood insurance through the NFIP; private insurance is usually not sufficient (Section 4.1.13 discusses private insurance in detail). Lenders are required to ensure that they have “Mortgage Portfolio Protection” to comply with the Flood Disaster Act of 1973, as amended by the National Flood Insurance Reform Act of 1994 (FEMA Definitions, Cost, 2017). This requires federally-regulated or insured lenders to mandate the purchase of flood insurance on any loan in a Special Flood Hazard Area. This insurance must cover the outstanding principle of the loan, the maximum amount of coverage under the NFIP for that kind of building, and the full insurable value of the building and its contents. If the Special Flood Hazard Area is expanded based on updated maps, properties newly mapped in this zone must also have flood insurance. Property owners in low to moderate risk areas are not required to buy flood insurance, but can do so, including private insurance.

For homes or businesses impacted by flooding and with coverage under the NFIP, the claimant reports the loss to the insurance company for payment. The insurance agent or carrier assigns an adjuster to calculate the damage estimate. If the claimant and the insurer agree on the damage, the insurer pays, then is reimbursed by FEMA. If a claimant disputes the decision, the claimant has three options: 1) file an amended proof of loss with supporting claims information;

¹³ FEMA base flood elevation: https://www.fema.gov/base-flood-elevation
2) appeal to FEMA, or 3) file a lawsuit against the insurer (FEMA Claim Process).14

This process is not necessarily seamless. In the aftermath of Superstorm Sandy, the New York Attorney General (AG) filed criminal charges and fraud against insurers for systematically underpaying flood claims. In a 2016 report entitled “Murky Waters: Increasing Transparency and Accountability in the National Flood Insurance Program,” AG Eric Schneiderman found that there is lack of clarity in the scope of policy coverage; structural engineers lacked sufficient training and certification requirements; and that there was poor administration and supervision of the NFIP claims process. This report recommended that 1) the scope of coverage and corresponding exclusions should be transparent and succinct (and in plain language); 2) expert reports prepared for a flood claim should be provided to the policyholder in a timely manner; 3) individuals retained to provide engineering services must be subject to a national certification; and 4) fees charged for expert services must be transparent (Schneiderman, 2016).

If a property is flooded repeatedly, it may be defined as a “Repetitive Loss” or a “Severe Repetitive Loss” property. Repetitive Loss (RL) properties are those for which someone has filed two or more separate claims of at least $1,000 each within any 10-year period since 1978 (FEMA Definitions).15 As of 2008, FEMA identified 126,351 such properties within the U.S. and estimated that such policies account for 1% of all NFIP policies but account for about 30% of dollars paid through the program (GAO, 2008). A Severe Repetitive Loss (SRL) property is one with two claims in any 10-year period since 1978, with losses totaling more than the property’s value, or one with four claims, with two in a 10-year period. As of March 2011, there were about 9,000 SRL properties nationwide (FEMA, 2015).

15 FEMA definitions: https://www.fema.gov/national-flood-insurance-program/definitions
4.1.2 Special Flood Hazard Areas and Flood Insurance Rate Maps (FIRMs)

Mapping of floodplains is significant for flood insurance and building standards. Insurance rates are based on a “Flood Insurance Rate Map” or FIRM. Such maps demarcate whether a property is located within a “Special Flood Hazard Area” (SFHA), or the “area that will be inundated by the flood event having a 1-percent chance of being equaled or exceeded in any given year. The 1-percent annual chance flood is also referred to as the base flood or the 100-year flood” (FEMA Flood Zones). The reference to a 100-year flood is the cause of confusion; people often think that this means a flood is likely to occur in a particular area no more than once every 100 years. However, it is the 1% chance of a flood occurring in any given year (and could happen more often). Different insurance rates and building standards apply for areas within the SFHA (considered high hazard), or within moderate to low hazard or underdetermined areas.

Table 5: Insurance Rates Based on Risk Zones from Mapped Floodplains

<table>
<thead>
<tr>
<th>Low to Moderate Risk</th>
<th>High Hazard or Risk (SFHA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insurance Required?</td>
<td>No</td>
</tr>
<tr>
<td>Preferred Rates</td>
<td>Yes for B, C, and X zones</td>
</tr>
<tr>
<td>Available?</td>
<td></td>
</tr>
<tr>
<td>Range of Rates</td>
<td>$48 ($8k, contents only)</td>
</tr>
<tr>
<td>(Annual premiums)</td>
<td>$474 ($250k, structure; $100k, contents)</td>
</tr>
<tr>
<td>Factors that Determine Rates</td>
<td>Basement, attached/ unattached garage, above ground contents, building and/or contents covered</td>
</tr>
</tbody>
</table>


Flood maps have been modified over time. FEMA conducted the original “Flood Insurance Study” reports and developed paper maps to demarcate flood zones. In 2003, FEMA began a “map modernization” process by scanning paper maps into a digital database.  

However, this process highlighted the need for updates: older maps did not necessarily reflect where rivers, streams or shorelines were located. In 2009, Congress authorized additional funding to update and digitize the maps, creating “Digital Flood Insurance Rate Maps” (DFIRMs).\footnote{FEMA risk mapping/planning, \url{https://www.fema.gov/risk-mapping-assessment-and-planning-risk-map}.} FEMA and its contractors undertook a significant process to update DFIRMs, including formal opportunities for contesting the new maps if property owners felt they were improperly included in the SFHA.\footnote{FEMA flood hazard mapping updates: \url{https://www.fema.gov/media-library-data/1468504201672-3c52280b1b1d936e8d23e26f12816017/Flood_Hazard_Mapping_Updates_Oversview_Fact_Sheet.pdf}.} Criticism about this process led Congress to require FEMA to issue monthly notifications about map updates in a “notice to Congress;” however, the last notice was issued in December 2016.\footnote{FEMA Notice to Congress: Monthly Update on Flood Mapping: \url{https://www.fema.gov/media-library-data/1481916977308-e6b600ed41d1963760f0e343301c5fb0/Notice_to_Congress_December_2016_Update.pdf}.}

Overall, the “map modernization” process has been challenging. In most locations, the updates expanded the amount of area mapped within the 100-year floodplain: land use changes have increased runoff due to the amount of impervious or paved land at the same time weather patterns have changed, resulting in more frequent and more severe floods. The map changes and continued population growth in many areas have resulted in more people and structures in designated floodplains, subject to flood insurance and updated insurance rates and building requirements. This has led to property owner concern about being newly subjected to insurance requirements and high rates. On the other hand, the updated maps have also been criticized for failing to capture the impact of sea level rise on coastal areas or climate change in riverine areas; there is increasing concern that flood maps fail to account for changing climactic conditions because they look only at annual flood risk (Joyce, 2016; GAO, 2017) (see also Section 4.1.8).

In Pennsylvania, the entirety of the Commonwealth was mapped as of 1996 (Section 3.2.3). As of May 2017, the DFIRMs for all but three Pennsylvania counties have been updated.
and are available electronically, both on the FEMA Map Service Center\(^{21}\) and the Pennsylvania Spatial Data Access (PASDA) sites.\(^{22}\) Not yet updated and/or approved are Butler, Fayette and Lackawanna counties (see Figure 4, Section 3.2.3). These floodplain maps represent 96% of the Commonwealth's total area and 96% of its population. Maps for Butler and Fayette counties are in “active” status, meaning they are currently being updated: Butler and Fayette counties are expected to be completed by July 2017. Lackawanna County’s mapping update is currently “on hold” and not expected to be finished until 2018.

### 4.1.3 The Community Rating System

While location in a mapped flood zone determines NFIP flood insurance rates, participation in FEMA’s Community Rating System can result in rate reductions. The Community Rating System (CRS) is a voluntary program designed to incentivize communities to mitigate and prevent flood damage by reducing costs of insurance and reaching out to individuals less likely to participate in independent insurance (CRS Coordinator’s Manual, 2017).\(^{23}\)

Communities must meet certain prerequisites before they can be inspected and rated by FEMA. First, communities must be in full compliance with the NFIP at the time of application. Second, they must have a certification of compliance from the regional FEMA office. Third, they must have elevation certificates on all new or substantially improved buildings within the Special Flood Hazard Area (SFHA). Fourth, if communities have one or more repetitive loss (RL) properties, they must provide a map of the area and a description of the causes of losses and proof of outreach to those areas. Fifth, communities must provide proof from their chief financial officers that all buildings within the Special Flood Hazard Area (SFHA) have flood insurance. The sixth deals with coastal areas (CRS Coordinator’s Manual §230).

\(^{21}\) FEMA map service center: https://msc.fema.gov/portal/
\(^{22}\) PASDA: http://www.pasda.psu.edu/
\(^{23}\) CRS coordinator’s manual: https://www.fema.gov/media-library/assets/documents/8768.
Participating communities can acquire credits based on the implementation of various mitigation measures and prevention management practices. Such measures and practices can be classified as 1) public information, 2) mapping and regulations, 3) flood damage reduction, and 4) warning and response. The acquired credits place the communities in various levels of classes ranging from Class 10 (lowest or worst ranking) to Class 1 (highest or best ranking), each class with a unique reduction on insurance premiums. To qualify, a FEMA official conducts a verification visit. Once qualified, every community begins as a Class 10 with no reduction in insurance rates; undertaking additional activities results in a better ranking.

Participation in the CRS program offers both individual and community benefits. If a community participates by implementing and documenting actions from the detailed menu to achieve a certain level of ranking, individual NFIP policy-holders receive insurance rate reductions ranging from 0% to 45% reductions, depending on the class ranking.24 Such insurance premium reductions would soften the impact of recent rate increases (Section 4.1.6). In addition to individual premium reductions, a community participating in the CRS can also access the full range of FEMA’s public-information materials and adapt such materials for its own use. Both the individual insurance rate reduction and the information are reported to be useful features by Pennsylvania.

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24 FEMA CRS program: https://www.fema.gov/national-flood-insurance-program-community-rating-system
communities participating in the CRS program (Section 4.4).  

However, participation of Pennsylvania communities in the CRS program is low. Out of the 2,468 Pennsylvania communities participating in the NFIP and eligible to join the CRS program, only 28 (or 1%) participate in the CRS. This is low compared to the national average, where approximately 7.2% of all NFIP eligible communities participate in the CRS program. Of the top 50 Pennsylvania communities in terms of flood insurance policies-in-force, 15 participate in the CRS. Harrisburg has achieved one of the higher rankings in Pennsylvania with a CRS rating of 6, thus receiving a 20% discount for individual premiums. Other communities are ranked less well, with ratings of 7-10 (FEMA CRS Communities, 2016).

Fig. 8: Number of Participating Communities by CRS Class in the U.S. vs. Pennsylvania

There are several factors that contribute to low participation in Pennsylvania, including the burden of providing the documentation; resource constraints and competing demands for funding and staffing; institutional understanding and support; and the focus on municipal versus  


26 CRS Communities and Their Classes: https://www.fema.gov/media-library/assets/documents/15846.
county level implementation. The documentation is one barrier. For example, the Lycoming County Hazard Mitigation Plan includes input from a mitigation solutions workshop indicating that the administrative documentation procedures and costs for the CRS program may hinder participation (Michael Baker Int’l, 2015). Providing information, such as all elevation certificates on all new or substantially improved buildings within the SFHA, is a complex task: one Pennsylvania community (not participating in the CRS) has over 800 buildings in the SFHA. Even if many of the activities credited through the CRS program are already being carried out, there is often insufficient staff available to accomplish the paperwork.

The need to compile sufficient documentation is exacerbated by resource constraints, including funding and staffing, competing demands for time and money, and lack of readily digestible information. Municipal representatives interviewed for the case studies stated lack of staff overall, as well as staff time, as barriers to implement the program, and noted that city or borough councils, township supervisors, and other elected officials representing their taxpayers’ interests are in many cases reluctant to make funds available to pay for staff time and flood-mitigation activities that may be needed for effective CRS implementation. In some cases, staff charged with flood mitigation attributed this to lack of knowledge among elected officials or higher-level staff about the consequences of ineffective flood mitigation, and in turn to incomplete understanding among taxpayers about the importance of the programs. Because many of the small municipalities outsource their permitting and code inspectors, all of these respondents expressed difficulty getting documents returned in time for the yearly verification visit if they were a participating community. Finally, information about the program is another barrier. Although recently updated, the CRS Coordinators Manual, a reference for each

27 A verification visit is a yearly in-office review and site visit by the state Insurance Office Service Specialist (ISO) to ensure the stated CRS activities are being implemented.
The municipality’s CRS coordinator, is over 600 pages in length (crsreasources.org).

In addition, there is a disconnect between who must implement the program versus who benefits: FEMA does not allow the CRS program to be implemented at a regional or county scale except in unincorporated areas, so individual communities must meet the requirements because there are no unincorporated areas in Pennsylvania. While counties conduct hazard mitigation plans (HMPs) (Section 4.1.11), individual communities must implement the CRS program; many are too small to bear the cost of doing so.

County HMPs in Pennsylvania are quite extensive in describing flood risk throughout their territories and have a county floodplain ordinance used by most of the municipalities. In fact, most Pennsylvania municipalities rely heavily on their overlying counties for guidance making a case for the CRS program to allow counties to control floodplains on a regional or watershed scale. One county official discussed the need for a comprehensive coordinated effort for floodplain management at a regional or watershed scale. Small municipalities "simply do not have the capacity to manage the documentation required of the CRS." In addition, the Cambria County Hazard Mitigation Plan (HMP) mentions the CRS program as either something the County would like to implement; however, the draft plan states that "[t]here are only a small number of Repetitive Loss properties in several municipalities and the expense and effort needed to maintain CRS points, would outweigh the savings of participating in the program." (Cambria County Hazard Mitigation Plan Draft, 2016).

Pennsylvania could also play a stronger role. At the national level, strong state support is seen as critical: "state assistance is imperative to broadening participation in the program," (Interviewee, CRS Federal Task Force Member and Florida CRS Specialist). For example, Florida implemented a CRS Initiative with the goal of taking the administrative burden off communities by sending trained CRS specialists to various areas of the state. The specialist visits
the communities, assesses their level of mitigation, and helps them initiate required
documentation. This type of program could help the small, high-risk communities in this study
gain the lacking information to implement higher regulatory standards, improve existing
mitigation, expand the flow of information to neighboring communities and receive the reduced
insurance benefits from the CRS program. In Pennsylvania, however, one interviewee noted that
lack of support at the state level is a strong factor for lack of CRS participation: “work coming
out of PEMA is good but not adequately staffed.” Interviewees confirmed this; state assistance
for participating communities was not mentioned.

4.1.4 Federal Disaster Relief

Federal disaster assistance is available to individuals, businesses, and local governments
through various grants, loans, and technical assistance supported by FEMA. Eligibility assistance
depends on a number of factors including, but not limited to, one’s income, the type of disaster,
home ownership, and whether the county an individual resides in falls within a declaration
(FEMA Emergency Management Institute, 2003). In general, federal relief supplements, not
supplants, state and local resources in times of need when major disasters occur.

Once the President formally declares a federal disaster, the funding mechanisms available
to affected individuals are determined through coordination of federal and state personnel.
Disaster declarations detail the counties within a state that fall within federal jurisdiction, the
time period of the disaster, and the types of assistance available to applicants. Assistance is
broken down into three categories: (1) assistance for individuals and businesses, (2) public
assistance, and (3) hazard mitigation assistance. Types of aid range from grants, low-interest
loans, housing repairs, and other needs assistance to Farm Service Agency funds, legal services,
and crisis counseling. Some forms of assistance are available without presidential declarations,
but individuals are required to apply for aid directly to the agencies such as the Small Business

For flood disaster events, aid is available to individuals, regardless of whether they have a
flood insurance policy (although Pennsylvania requires counties to have a Hazard Mitigation
Plan for individuals to be eligible for aid). In most cases, federal financial assistance can help
citizens pay for some of the costs not covered by their policy or lack thereof, depending on the
types of damage and services requested. However, such relief usually falls far short of actual
damage incurred. In the case of Hurricane Mathew, about 29,000 Individual Assistance
applications have been approved by FEMA as of May 11, 2017 for a little over $97,000,000.\(^{28}\)
This averages out to about $3,350 in aid per application (includes insured and non-insured
applicants). Damages in North Carolina from the hurricane are estimated around $5 billion of
which only $1 billion was insured loss (AON, 2017). In addition, first-time uninsured federal aid
claimants are only eligible for future assistance if they have obtained a federal flood insurance
policy.\(^{29}\)

Since the 1860s, Congress has funded post-disaster relief for specific flood events in
Pennsylvania alone on more than 100 occasions (Duke et al., 2016). Such disaster relief funding
has caused profound land-use changes in many of the Commonwealth’s communities, often in
pulses of activity, such as after the flooding caused by Tropical Storm Agnes in 1972. Several of
the case study communities, and many others across Pennsylvania, have seen their historic land
uses in the floodplains dramatically changed as funding was used to remove damaged structures
and eliminate businesses and residences within the floodplains, a common process after
damaging floods through about the 1970s. In other cases, funding was made available to private

\(^{28}\) FEMA, North Carolina Hurricane Matthew (DR-4285), Financial Assistance,

owners—through municipal programs subject to funding approval by federal and Commonwealth programs—to renovate damaged structures or to acquire or modify single structures or small clusters of properties that have experienced repetitive losses. From 2004 through 2013, funding was primarily focused through the Severe Repetitive Loss Program, modified in 2013 to the broader Hazard Mitigation Assistance (FEMA, 2015a). Those programs allow municipalities to target high-risk properties for acquisition and removal of structures, and to prompt other property owners to elevate or modify some at-risk structures to be more flood-resistant. These actions are a prominent feature in the case study communities; see Section 4.4.

4.1.5 Severe Economic Losses: “Structural Weaknesses” and “Actuarial Rates”

Because of recent storms and payouts through both the NFIP and disaster relief, the NFIP is facing significant financial shortfalls. As noted above, total flood insurance claims have increased exponentially, with events resulting in more than $1 billion in claims occurring each year since 2006. In 2016 alone, the U.S. experienced four separate billion-dollar inland flood events from non-tropical storms; since 1980, no more than two of these events have occurred in a single year (Smith, 2016). Between 1978 and 1999, there was an average of 35,570 annual losses paid per year; since 2000, this average has grown to 54,175 paid losses per year. Until 2005, FEMA was able to borrow money to repay losses that exceeded income from the NFIP; however, the 2005 hurricane season, including the record-breaking four Category 5 Hurricanes Katrina, Rita, Emily and Wilma, exceeded FEMA’s ability to repay such debts. Hurricane Irene and Tropical Storm Lee in 2011 worsened the issue, as did the $65 billion in damage caused by Hurricane Sandy in 2012. In Nov. 2012, FEMA owed the U.S. Treasury $20 billion; by March

2016, $23 billion (GAO High Risk, 2017), and by 2017, more than $25 billion (Insurance Journal, 2017). Using new authority from the 2012 and 2014 Congressional actions (see Sections 4.1.6 and 4.1.7), FEMA secured reinsurance in September 2016, and again in early 2017 to help offset claims and spread the risk of large claims to reinsurance companies.32

The NFIP has been and still is considered a “high risk” program by the U.S. Government Accountability Office. While the GAO notes that the NFIP “is a key component of the federal government’s efforts to limit the damage and financial effect of floods,” it further states:

[The NFIP] likely will not generate sufficient revenues to repay the billions of dollars borrowed from the Department of the Treasury (Treasu) to cover claims from the 2005 and 2012 hurricanes or potential claims related to future catastrophic losses. This lack of sufficient revenue highlights what have been structural weaknesses in how the program is funded. Since the program offers rates that do not fully reflect the risk of flooding, NFIP’s overall rate-setting structure was not designed to be actuarially sound in the aggregate, nor was it intended to generate sufficient funds to fully cover all losses (GAO, 2017).

The High Risk Report further notes that “Two important federal insurance efforts— the FEMA National Flood Insurance Program (NFIP) and USDA’s Federal Crop Insurance Corporation (FCIC)—face climate change and other challenges that increase federal fiscal exposure and send inaccurate price signals about risk to policyholders.” The risk of a changing climate is coupled with concerns over “repetitive loss properties” (Section 4.1.1) and subsidized rather than “actuarial” rates.

The “actuarial soundness” and “actuarial rates” under the NFIP have been the topic of significant debate. While the NFIP does not define the term "actuarial" rate, the term has been the subject of significant research and guidance. In October 2006, a FEMA contractor published a report about the actuarial soundness of the NFIP, and noted the following.33

An insurance program is considered actuarially sound when its premium

rates offset the expected value of all future costs associated with the sale of each flood insurance policy. In particular, the rates account, as best as possible, for the contingency of losses from expected future catastrophes. The private insurance industry predicates its ability to set actuarially sound premium rates on the availability and continuous updates of the information necessary to provide a full understanding of the risks involved in insuring, if not individual units, each class of unit. Although the Program’s non-subsidized policies are actuarially based, its subsidized premium rates, which are based on the historical average loss year, understated actuarial risks by not accounting for losses from future low-frequency but high-severity floods (internal reference omitted).

In October 2011, FEMA published what is supposed to be an annual Actuarial Rate Review.\(^{34}\)

The 2011 report, the most current available, references a 1966 U.S. Department of Housing and Urban Development Report that created a formula that “follows in principle the ‘hydrologic method of estimating flood damage risk’ first outlined in the 1966 U.S. Department of Housing and Urban Development (HUD) report.”\(^{35}\) The use of “actuarial risk” and “actuarial rates” has become the centralized piece of legislative reforms to the NFIP in 2012 and 2014.

4.1.6 The Biggert-Waters Flood Insurance Reform Act of 2012\(^{36}\)

The impact of recent hurricanes and floods highlighted FEMA’s lack of resources and the continuing nationwide issue of flood insurance. In 2012, Congress passed a bi-partisan bill to address the NFIP’s insolvency called the Biggert-Waters Flood Insurance Reform Act (Biggert-Waters, 2012). Included as Title II of a broader bill entitled “Moving Ahead for Progress in the 21st Century Act,” Biggert-Waters included several components and changes to the National Flood Insurance Act (1968), including the following:

- Extended the NFIP through September 2017.
- Adjusted the structure of premium rates by phasing out subsidies for second homes, business properties, severe repetitive loss properties, and substantially improved/damaged

\(^{34}\) FEMA actuarial rate review: https://www.fema.gov/national-flood-insurance-program-actuarial-rate-review


properties. Mandated rate increases of 25% each year until full premium or “actuarial rate” is met.

- Adjusted rates for all other properties not subject to the subsidy phase out to a premium rate increase of 20%.
- Subjected all properties to premium rate increases to reflect flood risk of the property; this was phased in at a 20% rate each year following the remapping analysis.
- Required FEMA to establish a reserve fund and to set up a repayment plan for its debt.
- Established the Technical Mapping Advisory Council (TMAC) to report to Congress the issues and findings concerning modern mapping.
- Established the National Flood Mapping Program that FEMA must use to adjust rates.
- Established various routes, mechanisms, and panels in which individuals can appeal their flood insurance rates and question mapping techniques.

Soon after Congress passed Biggert-Waters in July 2012, FEMA began its own analysis of the changes to the NFIP. In August 2012, FEMA issued an advisory bulletin stating that while it was still reviewing the impacts of Biggert-Waters, the agency would indefinitely extend the Preferred Risk Policy (PRP), which offers reduced flood insurance to residents in low-to-moderate flood risk zones (FEMA Intergovernmental Advisory Committee, 2012; Assoc. of State Floodplain Managers). Over the course of the next few months, FEMA continually released Write-Your-Own (WYO) bulletins, sifting through Biggert-Waters and its impacts on national flood-insurance. Policy periods were extended, clarifications issued, and documents offering explanations, guidelines, and example documents for residents and property owners released.

Under the Biggert-Waters Act, all flood insurance rates were set to reflect the newly

![Fig. 9: Example NFIP Rate Change (FEMA, 2012)](image)
updated Flood Insurance Rate Maps (FIRMs). Although the rate hikes under Biggert-Waters were supposed to address realistic flood risk, the Act did not allow any leeway for buildings built to code prior to the new FIRMs. Under Biggert-Waters, these pre-FIRM buildings would be put on the same level as post-FIRM buildings and subject to huge increases in flood insurance rates (see Figure 9) even though the buildings complied with past regulations.

The move towards “full risk” or “actuarially sound” rates removed the subsidy for many, leading to property owners receiving significantly increased invoices for insurance premiums. In July 2013, a bipartisan group of 26 members of the U.S. House of Representatives wrote to FEMA Administrator Craig Fugate citing concerns over financial impacts. The letter states:

A small percentage of homeowners are learning that they may be subjected to flood insurance rates that are ten, a hundred, and in some cases, more than a thousand times higher than their current subsidized rates. These rates, which are upwards of $28,000 per year, are unaffordable and could have devastating impacts on these homeowners and their communities if they are implemented.

While actuarial rates are critical to the program’s success, we strongly believe that we should not burden homeowners with punitive or unaffordable rates that will slow our housing market recovery and force families out of their homes. (Congressional Letter, July 2013).

In September 2013, a bipartisan group of 73 members of the U.S. House of Representatives wrote to their leadership, stating that “the economic ramifications surrounding unaffordable flood insurance has the potential to devastate home values, small businesses, and entire communities across the country” (Congressional Letter, Sept. 2013). They cited examples from Oregon and Louisiana where premiums would increase from $600/year to $10,000, and from North Carolina where premiums were increasing by 1,000%.
Such dramatic rate increases hit in Pennsylvania as well. For example, one family bought a home in Lycoming County in 2012 with the understanding that it was in the floodplain, and subject to premiums of $591/year. Upon receiving their 2013 renewal, they were informed that changes to the NFIP required them to get an elevation certificate to rate their policy going forward. After paying $800 for survey work and the certificate, the resulting premium jumped to $9,300/year, payable within 90 days. Their only recourse was to allow their financier to “force place” insurance on the property; in other words, the bank or mortgage service provider bought insurance and required the homeowner to pay for it. This happens when “a homeowners’ own property insurance may have lapsed or where the bank deems the homeowners’ insurance insufficient” (NAIC, 2017). Stories like that of the Lycoming County family led to complaints, and for Congress to take action.

4.1.7 The Homeowner Flood Insurance Affordability Act of 2014

Worried about the Biggert-Waters Act effect on FEMA’s policies, including the impact of unprecedented rate hikes on families and homeowners across the nation, Congress passed H.R. 3370, the Homeowner Flood Insurance Affordability Act of 2014 (HFIAA). HFIAA repealed and changed various sections of Biggert-Waters (see generally NAIC, 2014). HFIAA includes several provisions that

- Restored grandfathered rates for buildings/homes built to code prior to mapping changes;
- Reduced the annual rate increase for risk classified buildings from 20% to 15% and required FEMA to offer monthly installment plans;
- Established an 18% rate cap for Special Flood Hazard Areas, phasing in each year at a rate between 5-15% until the risk premium is achieved;
- Imposed two types of surcharges ($25/residence and $250/non-residence buildings) with revenue being directed into the NFIP reserve fund;
- Required FEMA to conduct an affordability assessment;

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Required FEMA to take into account flood prevention and mitigation actions taken by owners/lessees when setting premium rates;

Required FEMA to disclose rate increases, mapping updates, and any guidelines.

To address the disparity caused by Biggert-Waters on already built properties, HFIAA re-incorporated a grandfather clause into pre-FIRM building rates, allowing homeowners to pay previous rates so long as their buildings complied with previous floodplain maps (Hollanda, 2015). However, this does not apply to businesses, which face a 25% rate increase/year until “full actuarial rates” are reached. For homeowners, the grandfathered rates cease when and if the property owners change, modify, or rebuild their property, allow their insurance to lapse, or sell their property. In addition, a property owner must keep continuous coverage or be subject to increased rates. Continuous coverage requires the property to remain insured without a lapse in the insurance policy for more than 90 days,\(^38\) switching to private insurance results in a lapse.

<table>
<thead>
<tr>
<th>Table 6: Comparison between Biggert-Waters and HFIAA</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Table 6: Comparison between Biggert-Waters and HFIAA" /></td>
</tr>
</tbody>
</table>

HFIAA became law in 2014 with the purpose of softening the actuarial risk rate increases established by Biggert-Waters. Although HFIAA maintains the idea that federally backed flood insurance (NFIP) rates must reflect the actual risk of flooding within a designated area, HFIAA allows the increased flood insurance rates to be paid incrementally and/or to only increase up to a

certain percentage. As one interviewee noted, however, the ultimate “actuarial rate” for many homeowners in Special Flood Hazard Areas is not actually known. Lycoming County has created its own rate calculator to compute such rates, but FEMA does not offer a similar tool. The changes made by both Biggert-Waters and HFIAA continue to go into effect, including increasing rates over time.

4.1.8 Current Status of FEMA and Federal Flood Insurance in the United States

At this point, the NFIP is struggling. Increases in premium rates has caused policyholders to drop their coverage (Figure 11, Table 7), with more than 500,000 fewer NFIP policy holders nationwide, and 11,700 fewer in Pennsylvania since 2012. This exacerbates budget shortfalls even as flood risk is increasing. Despite FEMA’s efforts to comply with Congressional mandates, the Government Accountability Office and Congressional Budget Office continue to issue report after report reviewing the NFIP. How to address the NFIP is critical because it expires in September 2017.

![Fig. 1 Total Policies in Force by Calendar Year (FEMA, 2016)](https://www.fema.gov/total-policies-force-calendar-year)
Table 7: NFIP Statistics at the Federal and Commonwealth Level

<table>
<thead>
<tr>
<th></th>
<th>Federal</th>
<th>Pennsylvania</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td># of policies in force</td>
<td>Insurance in force</td>
</tr>
<tr>
<td>10/31/2012*</td>
<td>5,542,867</td>
<td>1.268 trillion</td>
</tr>
<tr>
<td>12/31/2012†</td>
<td></td>
<td>73,693</td>
</tr>
<tr>
<td>11/30/2016*</td>
<td>5,058,482</td>
<td>1.249 trillion</td>
</tr>
<tr>
<td>12/31/2016†</td>
<td></td>
<td>61,975</td>
</tr>
</tbody>
</table>

† Data provided from David Bollinger, FEMA Region III. Included as Appendix 7.2.

Table 8: Number and Value of NFIP Claims Filed by Policyholders in PA Statewide

<table>
<thead>
<tr>
<th></th>
<th>Number of Jurisdictions with Claims Filed</th>
<th>Number of NFIP Claims, 1978-2015</th>
<th>Value of Claims, $ million *</th>
<th>Average Value of Claims, $ / claim</th>
</tr>
</thead>
<tbody>
<tr>
<td>PA total</td>
<td>1,982</td>
<td>69,055</td>
<td>1,134</td>
<td>16,400</td>
</tr>
<tr>
<td>PA all Cities</td>
<td>55</td>
<td>9,304</td>
<td>133</td>
<td>14,300</td>
</tr>
<tr>
<td>PA all Boroughs**</td>
<td>685</td>
<td>22,501</td>
<td>376</td>
<td>16,700</td>
</tr>
<tr>
<td>PA all Townships</td>
<td>1,242</td>
<td>37,250</td>
<td>625</td>
<td>16,800</td>
</tr>
</tbody>
</table>

* Dollar value includes claims as reported from all years 1978-2015 (not inflation adjusted).
** Includes one Town. Data from J. Young, PHMC, 2015 (included as Appendix 7.2).

In 2014, FEMA estimated that it had met requirements for about half of Biggert-Waters and about one-third of HFIAA standards. In 2015, the National Academy of Sciences (NAS) reviewed FEMA’s policy and implementation options for affordable flood insurance (NAS, 2015). NAS proposed that FEMA use a microsimulation to model flood risks and appropriate rate increases. However, because FEMA lacks data and resources to conduct appropriate simulations, the Academy suggested that FEMA conduct more limited analyses in the interim. As FEMA tries to comply with the Acts, NAS observed that FEMA faces a deficiency of resources, a lack of understanding of the complex legislation, and a questionable future for NFIP’s financial stability, which will hinder the agency’s ability to model and raise rates adequately and accurately.

There have also been several U.S. Government Accountability Office (GAO) reports about the NFIP. In February 2015, the GAO published a report on the status of FEMA’s
implementation of Biggert-Waters and HFIAA. The report found that FEMA had

- Initiated refunds to policyholders under HFIAA;
- Prioritized HFIAA rate changes;
- Established a new Technical Mapping Advisory Council (TMAC) in Sept. 2014;
- Established the Scientific Resolution Panel;
- Implemented the mitigation assistance programs under Bigger-Waters and has begun research on mitigation methods required under HFIAA;
- Established outreach and affordability programs, including the Office of the Flood Insurance Advocate;
- Communicated with Congress about mapping notifications and methods for data accessibility for property owners.

In April 2016, the GAO released a report commenting on the nation’s level of preparedness, and found that FEMA continues to operate on a level of inefficiency and disorganization. The GAO recommended that FEMA set goals and milestones with quantitative values to make better progress. Although FEMA has yet to set such a comprehensive plan, NFIP rates continue to increase; rate changes occurred on April 1, 2016, October 2016, and more in 2017.

The GAO also published a report about actuarial flood insurance rates in May 2016. The GAO found that FEMA needed to complete updating FIRMs and collect information regarding grandfathered policies and subsidized properties before being able to completely answer questions pertaining to FEMA’s ability to have rates that truly reflect risk. The report noted that NFIP rates are based on 1 year policies, and do not reflect changing risks due to climate change:

> During [the GAO’s] current review, FEMA staff noted that the agency set NFIP rates annually for 1 year policies; therefore, NFIP rates only reflect the effects of long-term development, erosion, and climate change for the

40 FEMA Technical Mapping Advisory Council: https://www.fema.gov/technical-mapping-advisory-council
one year being priced. FEMA staff said that adequately pricing flood risk requires updated maps, including any changes in flood risk due to climate change. In addition, staff said that they need to be able to evaluate the risk of its actuarially priced policies based on updated maps and charge a price reflecting that risk. Further, FEMA staff noted that the Biggert-Waters Act required TMAC to develop recommendations for incorporating the best available climate science in flood insurance studies and maps and using the best available methodology when considering the effects of sea level rise and future development on flood risk.\footnote{http://www.gao.gov/assets/680/675855.pdf}

In short, what it might take to achieve “actuarial soundness” for the NFIP through “actuarial rates” applied to flood insurance may yet be unknown.

In August 2016, the GAO released another report analyzing an assessment completed by FEMA on community-based flood insurance (CBFI).\footnote{http://www.gao.gov/assets/680/679214.pdf.} HFIAA allocated funds for FEMA to determine whether CBFI is a realistic, efficient, and effective investment for the highly constrained FEMA budget. FEMA contracted with the National Academy of Science to review this idea; NAS found that a large-scale community-based flood insurance program would have challenges that significantly outweigh the communities that show interest. Furthermore, FEMA, NAS, and GAO believe that a better use of the limited budget is reform on the NFIP itself.

Finally, the GAO High Risk Report continues to report the concerns with program implementation by FEMA, particularly given the risk of climate change and more severe, more frequent storms (GAO High Risk Report, 2017). Since the start of the NFIP, FIRMs have been mapped according to existing conditions without consideration of future environments. In January 2015, President Barack Obama signed Executive Order 13690 requiring FEMA to consider climate change in its agency capacity, particularly in flood mitigation and prevention.\footnote{https://www.fema.gov/media-library/assets/documents/110377.} This Executive Order came just before FEMA began its reanalysis and remapping of Flood Insurance Rate Maps (FIRMs) required by law to occur at least once every 5 years. Because

44 https://www.fema.gov/media-library/assets/documents/110377.}
climate change is expected to increase the unpredictability of weather, storm patterns, and
natural disasters’ effects, reassessing and remapping once every 5 years may not adequately
portray the environment’s rapid change (Joyce, 2016).

As noted earlier, the NFIP expires in September 2017 without further Congressional
action this term. Although FEMA is overseen by Homeland Security, the House and Senate
Committees overseeing the NFIP are on the financial side. This includes the House Financial
Services Committee (including Pennsylvania Representative Keith J. Rothfus), and the Senate
Committee on Banking, Housing and Urban Affairs (including Pennsylvania Senator Pat
Toomey). Both Committees have already held hearings on the NFIP.

The House Financial Services Committee held a hearing entitled “Flood Insurance
Reform: A Taxpayer’s Perspective” on June 7, 2017. The Senate Committee has also held a
series of hearings. On March 14, 2017, FEMA’s Deputy Associate Administrator for Insurance
and Mitigation testified during a hearing entitled “Reauthorization of the National Flood
Insurance Program, Part I.” Part II took place on May 4, 2017, with witnesses from Taxpayers
from the “SmarterSafer Coalition,” the Coalition of Sustainable Flood Insurance, and the
Association of State Floodplain Managers. In addition, Senators Bill Cassidy (R-La.) and
Kristen Gillibrand (D-N.Y.) are working on draft legislation that would reauthorize the NFIP for
10 years. The so-called “Flood Insurance Affordability & Sustainability Act of 2017” would
address flood insurance affordability, coverage limits, solvency, and private sector insurance.

45 Complete information from this hearing, including a recording, is available online at
46 For more information, see https://www.banking.senate.gov/public/index.cfm/2017/3/reauthorization-of-the-
national-flood-insurance-program-part-i
47 For more information, see https://www.banking.senate.gov/public/index.cfm/2017/5/reauthorization-of-the-
national-flood-insurance-program-part-ii
48 See https://www.cassidy.senate.gov/imo/media/doc/Cassidy-Gillibrand%20Section%20Summary%204_25_17_%20FINAL.pdf, and
At this point, there are several bills pending before Congress. Because the NFIP itself expires in September 2017, the expectation is for legislative activity to pick up.

4.1.9 Other Relevant Federal Laws

There are also other areas of federal law that also impact Pennsylvania and flood policy. These include but are not limited to legal requirements for the U.S. Department of Housing and Urban Development (HUD) to address developments in floodplains, as well as potential legislation to provide flood insurance for the agricultural community. HUD regulates floodplains differently than FEMA and has codified Executive Orders 11988 (Floodplain Management) and 11990 (Protection of Wetlands) under 24 C.F.R. § 55. Within the regulation, floodplains and wetlands are treated similarly, one not favored over the other. HUD’s approach to monitoring the development of wetlands and floodplains together significantly differs from most other federal agencies, which separately recognize and regulate wetlands and floodplains. Further analysis of how HUD and FEMA laws correspond is beyond the scope of this report, but may warrant further research.

Another area that may be of interest to Pennsylvania is the potential modification of flood insurance for the agricultural community. Agricultural flood insurance is under the U.S. Department of Agriculture, and is another area of concern for the United States (GAO High Risk Report, 2017). In 2012, California Congressional Representative John Garamendi introduced the “Flood Insurance for Farmers Act” with the purpose of maintaining agriculture and farming while encouraging the implementation of flood mitigation through grant and subsidy programs. The bill did not receive a vote in either the House or the Senate. In 2013, Doug LaMalfa and John Garamendi introduced the bipartisan “Agriculture Structures Building Act,” which would


allow farmers to receive local variances on agricultural structures. This would essentially permit farmers to not retrofit and modernize agricultural structures to meet floodplain management criteria under FEMA. Although Congress did not pass either bill, the GAO released an “Additional Guidance” report on flood mitigation and flood insurance in 2014 (GAO, 2014). The GAO report highlights a disconnect between modern farming methods and FEMA’s flood mitigation mechanisms. Thus, the GAO recommends that FEMA update its flood mitigation policies to reflect modern agricultural practices and limitations (GAO, 2014). This may be an area for further research given the amount of agricultural land in Pennsylvania.

4.1.10 Flood Damage Reduction and Flood Insurance at the State Level

Although the NFIP is a federal program, states like Pennsylvania play a critical role in flood risk reduction and local implementation. Pennsylvania passed a set of statutes in 1978 that form the basis of floodplain management and regulation, and hazard mitigation (PAFPM, 2014).

- Executive Order 1978-4: Flood Plain Management (All Agencies)
- Act 166: Floodplain Management Act (DCED) (1978)
- Act 323: PA Emergency Management Council (PEMA) (1978)
- Act 325: Dam Safety and Obstructions Act (DEP) (1978)

Different agencies are involved in floodplain management and flood mitigation. These include the Pennsylvania Emergency Management Agency (PEMA), the Department of Economic and Community Development (DCED), and the Department of Environmental Protection (DEP). Also interested in the flood insurance questions are the Pennsylvania Housing Finance Agency (PHFA), the Pennsylvania Insurance Department (PID), and increasingly, the Pennsylvania Department of Banking and Securities. (DCED Memo, 2014). Many of these agencies also coordinate with other federal agencies through Pennsylvania’s Silver Jackets team, one of the

many nationwide versions of this information-sharing informal group led by the U.S. Army Corps of Engineers (USACE). The Silver Jackets meetings bring together staff with flood policy responsibilities from multiple federal, state and sometimes tribal and local agencies to learn about one another’s programs and identify ways they can collaborate in reducing flood risk and other natural disasters (USACE, 2016).

Both DCED and PEMA have critical roles with flood-related issues. DCED helps implement the NFIP, manages grant programs, and ensures compliance under the Community Rating System. For example, DCED’s Office of Flood Plain Management reimburses local governments 50% of their costs in preparing, administering, and enforcing floodplain management regulations. PEMA helps coordinate disaster preparedness, response, and recovery, including distribution of disaster recovery funds. PEMA has also helped with the floodplain mapping updates, as well as public information and awareness. In addition, both agencies handle property buyout programs.

There are two types of buyout programs available to property owners whose homes or properties fall within a floodplain area and may have been damaged by floods: 1) FEMA buyouts implemented by PEMA, and 2) HUD buyouts implemented by DCED. Each program has its own set of qualifications and restrictions. In general, however, a municipality will apply on behalf of the homeowners and property owners to the federal agency program. If the federal agency approves of the buyout, then the state agency receives money to allocate to the municipalities. Funding may be used to buyout property owners or as recovery means to the properties, as long as flood mitigation mechanisms are implemented. Section 4.4.6 reviews the

51 FEMA hazard mitigation grant program: https://www.fema.gov/hazard-mitigation-grant-program.
effect of buyout programs in local communities.

DEP regulates both “stormwater” and dam safety. Stormwater is defined as “drainage runoff from the surface of the land resulting from precipitation or snow or ice melt.” (Act 167, 1978). Pennsylvania’s Act 167 requires the development of stormwater management plans; in addition, stormwater management is regulated under the federal Clean Water Act and requires permits for discharge. Communities across Pennsylvania are facing stricter compliance standards under MS4 (Municipal Separate Storm Sewer)\(^{53}\) permits, particularly those in the Chesapeake Bay watershed. Because of the emphasis on stormwater reduction in the Chesapeake Bay watershed and its tributaries, there is also the potential for additional funding to address stormwater and floodplain management. While some communities have been integrating stormwater requirements with their Flood Hazard Management Plans, some have not; there is opportunity for further integration (Srinivasan, 2013; USACE, 2016). DEP also regulates dam safety, a program that is meant to ensure proper planning, design and construction review, maintenance monitoring and supervision of dams and reservoirs (DEP Division of Dam Safety).

Other state agencies are affected by changes to the NFIP. For example, the Pennsylvania Housing Finance Agency (PHFA) has a “sizable” portfolio of new and existing consumer loans, including approximately 1,200 in special flood hazard areas (DCED, 2014). As of 2014, this represented approximately $80 million in unpaid principle on mortgages where PHFA had the first lien position. PHFA noted that the steep rate increases “may be unaffordable to some of PFHA’s homeowner. Accordingly, there is concern about how the rate increases will affect eventual marketability of all of these properties, whether by the homeowner or by a lender seeking to recapture the value of its loan through a foreclosure process” (DCED, 2014). PHFA

\(^{53}\) Pennsylvania’s MS4 Program: [http://www.stormwaterpa.org/ms4-program.html](http://www.stormwaterpa.org/ms4-program.html)
also noted another immediate impact of homeowners suddenly needing elevation certificates that can cost up to $2,000, depending on the amount of information to be gathered. PHFA stated that “homeowners who suddenly face additional monthly expenses are more likely to default in their mortgage, leaving foreclosure and eventual acquisition of foreclosed properties by PHFA.” Such defaults would lead to substantial losses to PHFA, inability to recover subordinate liens, and curtailment of revolving loan programs (DCED, 2014).

The Pennsylvania Insurance Department is also focused on the NFIP. Among other activities, the department licenses insurance companies and producers/agencies, and reviews and approves insurance policy language and rates. The Pennsylvania Insurance Department provides basic information about flood insurance, outlining why someone should consider flood insurance, how to go about buying flood insurance, and identifying private flood insurance as an option. While private insurance is currently limited, PID is actively “exploring solutions that will promote private flood insurers’ entrance into the market” (DCED, 2014).

Pennsylvania Insurance Commissioner Teresa Miller has been very supportive of creating a private insurance market and has actively testified in Congress. In late 2015, the U.S. House of Representatives introduced a bipartisan bill specifically targeting the notion of private flood insurance. HR 2901, or the Flood Insurance Market Parity and Modernization Act, would have amended the 1973 Flood Disaster Protection Act to provide a statutory alternative to the NFIP through private flood insurance. By redefining flood insurance to include both federal and privately backed flood insurance, the bill sought to encourage a competitive flood insurance market that has so far been limited. HR 2901 also stated that federal agencies (particularly

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54 PID flood insurance: http://www.insurance.pa.gov/Coverage/Pages/Flood.aspx.
FEMA) must accept federal or private flood insurance as proof of coverage. To ensure that the federal government and homeowners do not fall prey to fraudulent schemes, HR 2901 would have required federal entities like the Federal National Mortgage Association and the Federal Home Loan Mortgage Corporation develop and implement procedures that verify the existence of proper flood insurance prior to lending or granting mortgages.

Pennsylvania Insurance Commissioner Teresa Miller testified on behalf of HR 2901 at the House of Representatives Financial Services Committee January 2016 meeting, addressing private sector flood insurance at the state level. The Commissioner spoke about the benefits of private flood insurance: giving the consumer choices, allowing healthy market competition, increasing the amount of coverage for a lower cost, allocating flood risk, and insuring against unique crises. She used Pennsylvania as an example of a successful implementation of private flood insurance. At the state level, she is spurring a movement to create an easy website that allows Pennsylvanians to accurately compare and efficiently shop for private insurance.

Although HR 2901 unanimously passed in the House of Representatives in April 2016 and was introduced in the Senate as SB 1639, the Senate did not take action on this bill. This bill has been re-introduced in the 115th Congress in March 2017 as SB 563 and referred to the Senate Committee on Banking, Housing and Urban Affairs.

Finally, the Pennsylvania Department of Banking and Securities is also starting to track changes to the NFIP and potential impacts on Pennsylvania. This department notes that “given the deteriorating flood insurance situation, our examiners will be giving more attention and

58 http://www.insurance.pa.gov/Coverage/Pages/Flood.aspx.
scrutiny to bank mortgage loan portfolios that contain a high percentage of loans in flood prone areas” (DCED, 2014). Department staff further noted that they had reached out to their federal regulatory counterparts, the Federal Reserve Bank and the FDIC, to take their temperature regarding this issue: “They are not focused on the flood insurance issue and have not provided any updated guidance… due to the uncertainty of the stats of Bigger-Waters and recent and ongoing congressional action. They are in a ‘wait and see’ mode” (DCED, 2014).

Because of the need to address rising flood insurance rates, plus the need to address stormwater, particularly in the Chesapeake Bay region, Pennsylvania may have an opportunity to develop a comprehensive floodplain management approach for the Commonwealth as a whole (PAFPM, 2014b; USACE, 2016). Existing laws split jurisdiction over various elements of floodplain management and flood mitigation into different agencies; “the result is a somewhat disjointed decision-making and funding that now relies mainly on federal guidance and dollars, especially for flood insurance and hazard mitigation. We have ended up treating floodplain management and stormwater management as entirely separate rather than integrated” (PAFPM, 2014b). Accordingly, the Pennsylvania Association of Floodplain Managers identifies the opportunity to create a comprehensive, integrated state floodplain management plan as a key priority. Integration with the updates to the State Water Plan may be a way to start to do this; updates were begun in 2016 for an expected 2 year process (PA Environmental Digest, 2016).

4.1.11 Flood Damage Reduction and Flood Insurance at the County Level

County-level Hazard Mitigation Plans are a Commonwealth program, implemented by the Pennsylvania Emergency Management Agency (PEMA). All counties are required to complete Hazard Mitigation Plans, adopted by county government, and renew them every 5 years. Hazard Mitigation Plans include sections addressing flood mitigation, as well as sections addressing other hazards, such as ice and snow damage, high-wind events, drought, etc. The
Commonwealth has a powerful tool to compel counties to complete and adopt these plans; if counties fail to adopt a plan, PEMA informs them that they would not be eligible for any disaster-recovery funds (federal in origin, but distributed by PEMA) should their counties experience a disaster. There are no counties that have failed to comply with requirements and adopt a Plan. These Plans have emerged as an important tool for some counties and municipalities, though they are less fully developed by others; these are reviewed in the case study results below and addressed overall in Section 4.5.

In some areas, counties serve a critical coordinating role and have been able to effectively leverage flood mitigation activities and funding. Having consistent support, including funding, staffing, and coordination with local municipalities, at the county level may be a critical tool in helping promote flood risk mitigation and charting a comprehensive path forward. For example, counties may be able to help implement key measures under the Community Rating System program to mitigate risk and help offset rising flood insurance rates.

In addition, counties have critical information and could increase their role aggregating such information. County assessor offices have information critical to assessing flood risk, such as property assessment information. Although the counties in the case studies below shared their GIS information, this information is not freely available (Section 3.2). As noted by the Pennsylvania Association of Floodplain Managers, counties could gather existing flood insurance and property data to analyze flood risk impacts and the impacts of flood insurance increases at the county level; this would need support from the Commonwealth to ensure uniformity and consistency (PAFPM, 2014). Such information could then support further

61 The Pennsylvania Association of Floodplain Managers (PAFPM) is an affiliate of the U.S. Association of State Floodplain Managers. The role of both associations is to promote public awareness of integrated floodplain management; serve as a liaison between individuals and groups concerned with floodplain management, including sharing ideas, information, and training; and informing concerned individuals and groups of pending legislation, regulation and related matters. For more, see http://www.pafpm.org/index.php.
analysis at the Commonwealth level.

4.1.12 Flood Damage Reduction and Flood Insurance at the Municipal Level

Under 32 P.S. §§ 679.101 – 679.601 (Chapter 113 of the Floodplain Management Act, 1978), all municipalities identified by PEMA as flood prone regions are required to submit a floodplain management plan. Once approved by PEMA, each plan must be formally adopted by the municipality as an ordinance. While the purpose of the Flood Plain Management Act is to help municipalities better prepare for flooding and aid in rapid response and recovery in the event of flooding, the Act has no standardized floodplain management plan. Consequently, identified municipalities are left to their own devices to create and implement plans. Although the plans emphasize local needs and resources, there are over 2,400 floodplain management ordinances in the Commonwealth, each with different ideas, requirements, implementation plans, mitigation programs, etc. So, instead of creating a robust and effective floodplain management system, the Flood Plain Management Act has created a confusing and unorganized system of floodplain management, flood mitigation, and flood recovery. Some municipalities have had success with their floodplain management plans and have concisely and effectively organized flood information; others have not.

4.1.13 Individual Flood Damage Reduction, Access to Private Flood Insurance

Individual property owners may also ameliorate their own risk through flood risk reduction activities as well as purchasing their own private insurance (Kousky & Shabman, 2014). However, private insurance has significant limitations and a somewhat limited market. Individuals or companies may choose to mitigate and prevent flood damage of their own

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63 See, for example, Etna Borough: [http://crsresources.org/success/etna-pennsylvania/](http://crsresources.org/success/etna-pennsylvania/).
accord, and can apply for assistance to do so.\textsuperscript{64} FEMA’s Flood Mitigation Assistance (FMA) does not directly reduce flood insurance rates, but instead awards grants to qualifying individuals, businesses, and nonprofits looking to implement flood mitigation techniques and infrastructure. To qualify, the person or entity must apply for the FMA grant program through a qualified sub-applicant, such as a state agency, tribe, or local community. Essentially the sub-applicant sponsors the individual, business, or nonprofit. Within the Commonwealth, PEMA directly sponsors various entities if a local community or other sub-applicant cannot.\textsuperscript{65} After acquiring the sponsor, an application must be submitted to FEMA through the agency’s specified web-portal.\textsuperscript{66} If the entity qualifies for the grant, FEMA will award applicants a maximum amount of $100,000. The grant does not prevent property owners from applying for subsidized rates through the NFIP. In fact, the mitigation grants help demonstrate that the entities have mitigation and flood damage reduction practices in place, making it easier to acquire reduced flood insurance rates.

Although private flood insurance has historically been non-existent or limited, an individual or a company can also increasingly buy private insurance outside the NFIP market. Property owners can purchase flood insurance from a private sector company, much like buying car insurance. While private sector insurance may be more cost competitive, it is subject to more regulations, taxes, and fees because it does not fit into the NFIP regulated rate program. In addition, federally backed mortgages do not accept privately backed insurance; only NFIP-backed insurance meets the “mandatory purchase” requirement to hold a federally backed

\textsuperscript{64} Flood Mitigation Assistance Grant Program, FEDERAL EMERGENCY MANAGEMENT AGENCY, http://www.fema.gov/flood-mitigation-assistance-grant-program.

\textsuperscript{65} Hazard Mitigation Grants, PENNSYLVANIA EMERGENCY MANAGEMENT AGENCY, http://www.pema.pa.gov/responseandrecovery/Disaster-Assistance/Pages/Hazard-Mitigation-Grants.aspx#.Vx6ofWNqeLs.

\textsuperscript{66} FEMA Grants Portal: https://portal.fema.gov.
mortgage for property in mapped floodplain. Finally, buying private insurance results in a lapse of NFIP-qualified coverage; if a property owner needs to opt back into the NFIP system, it will be at the full actuarial rate. The disconnect between the NFIP and the private insurance markets is leading to the Congressional action discussed above; see Section 4.1.10.

4.2 Demographics and Geospatial Data

Identifying what areas and population are vulnerable to the impacts of floods and flood insurance is critical. The Commonwealth is approximately 45,323 square miles, with around 2,558 square miles in the floodplain (5.64% of the Commonwealth’s land mass). There are approximately 86,000 miles of rivers and streams.

As noted by DCED, of the citizens affected by changes to flood insurance, many are “older, less financially able to absorb the increased premiums, living in homes less valuable, and in communities where any negative effect on the tax base will have a serious multiplier impact” (DCED, 2014). There is a higher percentage of rentals, and in some areas, high vacancy rates.

Table 9: Percentage of floodplain and impervious surface in Pennsylvania*

<table>
<thead>
<tr>
<th>Description</th>
<th>State-Wide</th>
<th>State-wide Floodplains</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
<td>Total</td>
<td>% of Total</td>
</tr>
<tr>
<td>Total Area (in- and outside of floodplains) (Sq Miles)</td>
<td>45,323.30</td>
<td>100%</td>
</tr>
<tr>
<td>Mean % Impervious surface area</td>
<td>2.90</td>
<td></td>
</tr>
</tbody>
</table>

*Data derived from GIS analysis; see Section 3.2.

As growth and development has occurred, increasing amounts of land is covered by impervious surface, or surfaces like concrete or pavement that does not allow water to percolate through. Across the Commonwealth, 2.9% of the total land mass is covered with impervious surface on it, with 3.55% in floodplains. Allegheny County has 24% impervious surface in the floodplains.
Out of Pennsylvania’s estimated population of 12,758,729, this report estimates that approximately 830,906 people live in floodplains, or 6.5% of the population. This is more than double a recent estimate by the Pew Charitable Trust of around 400,000 people in the floodplain (The Pew Charitable Trusts, 2016) (Section 3.2 details this difference). The demographic analysis done for this report estimates that 7.66% of the population in floodplains are black or African American and 5.29% of the population in floodplains are Hispanic or Latino (compared to 10.94 and 6.15% respectively across the state) (see Table 10). Employment status in and out of floodplains is not remarkably different, with approximately 30.12% of the population 16 or over not in the labor force in general, and 30.72% not in the labor force within the floodplains.

Table 10: Statewide and Floodplain Demographic Information

<table>
<thead>
<tr>
<th>Description</th>
<th>State-Wide Total</th>
<th>% of Total</th>
<th>State-wide Floodplains Total</th>
<th>% of FldPln Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total: Total population -- (Estimate)</td>
<td>12,758,729</td>
<td></td>
<td>830,906</td>
<td></td>
</tr>
<tr>
<td>RACE: Black or African American alone:</td>
<td>1,395,718</td>
<td>10.94</td>
<td>63,673</td>
<td>7.66</td>
</tr>
<tr>
<td>Total population -- (estimate)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HISPANIC OR LATINO ORIGIN: Hispanic or Latino:</td>
<td>784,562</td>
<td>6.15</td>
<td>43,924</td>
<td>5.29</td>
</tr>
<tr>
<td>Total population -- (Estimate)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EMPLOYMENT STATUS FOR THE POPULATION 16 YEARS AND OVER: Not in labor force:</td>
<td>3,842,894</td>
<td>30.12</td>
<td>255,268</td>
<td>30.72</td>
</tr>
<tr>
<td>Population 16 years and over -- (Estimate)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Within the case study communities, the population range, income and percentage below poverty vary quite widely, with the Borough of Muncy having the smallest population, and the City of Johnstown with the largest. The below poverty rate range is quite sizable in the case studies, from 35% in Johnstown below poverty to just 3.5% in West Whiteland Township.
Table 11: Demographic information for case study communities

<table>
<thead>
<tr>
<th>County</th>
<th>Municipality</th>
<th>Pop.</th>
<th>Median Age</th>
<th>Median Household Income</th>
<th>Below poverty (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Statewide</td>
<td></td>
<td>12.8 M</td>
<td>40.7</td>
<td>55,702</td>
<td>13.2</td>
</tr>
<tr>
<td>Chester</td>
<td>W. Whiteland Twp</td>
<td>18,410</td>
<td>39.4</td>
<td>92,970</td>
<td>3.5</td>
</tr>
<tr>
<td>Chester</td>
<td>Downingtown</td>
<td>7,930</td>
<td>35.5</td>
<td>58,423</td>
<td>8.4</td>
</tr>
<tr>
<td>Lycoming</td>
<td>Jersey Shore</td>
<td>4,333</td>
<td>33.5</td>
<td>42,306</td>
<td>20.1</td>
</tr>
<tr>
<td>Lycoming</td>
<td>Muncy</td>
<td>2,476</td>
<td>41.5</td>
<td>48,413</td>
<td>9.7</td>
</tr>
<tr>
<td>Allegheny</td>
<td>Etna</td>
<td>3,432</td>
<td>36.8</td>
<td>45,493</td>
<td>11.5</td>
</tr>
<tr>
<td>Bedford</td>
<td>Bedford Twp</td>
<td>2,778</td>
<td>49.3</td>
<td>41,990</td>
<td>13.3</td>
</tr>
<tr>
<td>Monroe</td>
<td>Smithfield Twp</td>
<td>7,357</td>
<td>38.8</td>
<td>69,198</td>
<td>13.2</td>
</tr>
<tr>
<td>Cambria</td>
<td>Johnstown</td>
<td>20,369</td>
<td>42.1</td>
<td>24,415</td>
<td>35.1</td>
</tr>
</tbody>
</table>

There are approximately 5.6 million housing units in the Commonwealth. Of these, approximately 374,000 housing units are in the floodplains, or 6.7%. Of the total housing units, 4.96 million are occupied (89%) and 621,000 unoccupied (11%). In the floodplain, 330,000 are occupied (88%) and 44,000 are unoccupied (12%). There is a larger percentage of renters in the floodplain: overall, 70% of housing units are owner occupied and 30% are renter occupied; in contrast, 66% are owner occupied and 34% renter occupied in the Commonwealth’s floodplains.

Table 12: Housing Statistics for Pennsylvania

<table>
<thead>
<tr>
<th>Description</th>
<th>State-Wide Total</th>
<th>% of Total</th>
<th>State-wide Floodplains Total</th>
<th>% of FldPln Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>OCCUPANCY STATUS: Total: Housing units -- (Estimate)</td>
<td>5,578,393</td>
<td></td>
<td>373,861</td>
<td></td>
</tr>
<tr>
<td>OCCUPANCY STATUS: Occupied: Housing units -- (Estimate)</td>
<td>4,957,736</td>
<td>88.87</td>
<td>329,730</td>
<td>88.20</td>
</tr>
<tr>
<td>OCCUPANCY STATUS: Vacant: Housing units -- (Estimate)</td>
<td>620,657</td>
<td>11.13</td>
<td>44,131</td>
<td>11.80</td>
</tr>
<tr>
<td>TENURE: Owner occupied: Occupied housing units -- (Estimate)</td>
<td>3,446,230</td>
<td>69.51</td>
<td>218,582</td>
<td>66.29</td>
</tr>
<tr>
<td>TENURE: Renter occupied: Occupied housing units -- (Estimate)</td>
<td>1,511,506</td>
<td>30.49</td>
<td>111,148</td>
<td>33.71</td>
</tr>
<tr>
<td>MORTGAGE STATUS AND SELECTED MONTHLY OWNER COSTS: Housing units with a mortgage: Owner-occupied housing units -- (Estimate)</td>
<td>2,131,805</td>
<td>61.86</td>
<td>134,978</td>
<td>61.75</td>
</tr>
</tbody>
</table>

Examining housing units and parcels more closely helps illustrate the actual impact at a county level (Section 3.2). Table 13 denotes the housing unit and parcel totals compared to floodplains, while Table 14 includes the percentages of each.
Table 13: Housing Units Total vs. Floodplains for Selected Case Study Counties

<table>
<thead>
<tr>
<th>County</th>
<th>Housing Units</th>
<th>Housing Units</th>
<th>Parcels</th>
<th>Parcels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allegheny</td>
<td>589,211</td>
<td>29,653</td>
<td>579,486</td>
<td>22,801</td>
</tr>
<tr>
<td>Bedford</td>
<td>23,984</td>
<td>1,807</td>
<td>33,474</td>
<td>7,630</td>
</tr>
<tr>
<td>Lycoming</td>
<td>52,586</td>
<td>6,650</td>
<td>50,991</td>
<td>10,255</td>
</tr>
<tr>
<td>Monroe</td>
<td>80,569</td>
<td>5,790</td>
<td>100,283</td>
<td>7,358</td>
</tr>
</tbody>
</table>

Table 14: % of Housing Units vs. Parcels in Floodplains for Selected Case Study Counties

<table>
<thead>
<tr>
<th>County</th>
<th>% of Housing Units in Floodplains</th>
<th>% of Parcels in Floodplains</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allegheny</td>
<td>5.03</td>
<td>3.93</td>
</tr>
<tr>
<td>Bedford</td>
<td>7.53</td>
<td>22.8</td>
</tr>
<tr>
<td>Lycoming</td>
<td>12.7</td>
<td>20.1</td>
</tr>
<tr>
<td>Monroe</td>
<td>7.19</td>
<td>7.33</td>
</tr>
</tbody>
</table>

Table 15 then examines the household level information for the case study communities in particular. Notable are the vacancy rates in a few areas (19% vacancy in Johnstown, and 33% in Smithfield Township), and differences in owner versus rental occupied where fewer owners occupy their homes in the case study communities. For example, in the City of Johnstown, only 49% of properties are owner-occupied (in contrast to the 74% in Cambria County overall).

Table 15: Household and housing unit information for case study communities

<table>
<thead>
<tr>
<th>County</th>
<th>Municipality</th>
<th># of households</th>
<th># of housing units</th>
<th>vacant housing units</th>
<th>Median property value</th>
<th>Property taxes</th>
<th>owner occupied (%)</th>
<th>County % of owner occupied</th>
</tr>
</thead>
<tbody>
<tr>
<td>Statewide</td>
<td></td>
<td>5 M</td>
<td>5,585,611</td>
<td>12%</td>
<td>170,600</td>
<td>$3k+</td>
<td>68.7</td>
<td></td>
</tr>
<tr>
<td>Chester</td>
<td>W. Whiteland Twp</td>
<td>18,450</td>
<td>7,300</td>
<td>4%</td>
<td>318,200</td>
<td>$3k+</td>
<td>73.2</td>
<td>75</td>
</tr>
<tr>
<td>Chester</td>
<td>Downingtown</td>
<td>3,313</td>
<td>3,415</td>
<td>3%</td>
<td>219,100</td>
<td>$3k+</td>
<td>59</td>
<td>75</td>
</tr>
<tr>
<td>Lycoming</td>
<td>Jersey Shore</td>
<td>1,551</td>
<td>1,727</td>
<td>10%</td>
<td>99,300</td>
<td>800-1.5k</td>
<td>54</td>
<td>70</td>
</tr>
<tr>
<td>Lycoming</td>
<td>Muncy</td>
<td>1,091</td>
<td>1,170</td>
<td>7%</td>
<td>137,100</td>
<td>1.5k-2k</td>
<td>62</td>
<td>70</td>
</tr>
<tr>
<td>Allegheny</td>
<td>Etna</td>
<td>1,568</td>
<td>1,704</td>
<td>8%</td>
<td>81,700</td>
<td>800-1.5k</td>
<td>60</td>
<td>65</td>
</tr>
<tr>
<td>Bedford</td>
<td>Bedford Twp</td>
<td>1,372</td>
<td>1,521</td>
<td>10%</td>
<td>149,700</td>
<td>800-1.5k</td>
<td>53</td>
<td>80</td>
</tr>
<tr>
<td>Monroe</td>
<td>Smithfield Twp</td>
<td>2,330</td>
<td>3,497</td>
<td>33%</td>
<td>192,200</td>
<td>N/A</td>
<td>74.8</td>
<td>77</td>
</tr>
<tr>
<td>Cambria</td>
<td>Johnstown</td>
<td>9,641</td>
<td>11,903</td>
<td>19%</td>
<td>43,100</td>
<td>800-1.5k</td>
<td>49</td>
<td>74</td>
</tr>
</tbody>
</table>

This report also evaluated the number of “property loss events” in each county, divided the values by the county population to adjust for counties with larger population having greater numbers of events primarily due to having more people, and developed a rank of “most affected..."
counties.” A comparison of counties outside of the study area helped determine various positions in the rank. By dividing the Loss Events numbers by Total Population, the data is “normalize” and converted into rates (Losses per capita). This makes things comparable between highly populated and sparsely populated counties; otherwise, the Loss numbers essentially mirror Population numbers. A row in the table that contains each county's rank was created called "Rank according to Repetitive Loss Properties per Capita." (Table 16) For example, Columbia County has 15.1% of its total population in the floodplain, and ranks 2nd statewide for repetitive loss properties per capita. Lycoming County has 12.6% of its population and ranks 3rd statewide for repetitive losses per capita. This makes things comparable between highly populated and sparsely populated counties; otherwise, the Loss numbers essentially mirror Population numbers.

Table 16: Percent population in floodplain and ranking by repetitive loss properties per capita for select counties*

<table>
<thead>
<tr>
<th>County</th>
<th>Total Population</th>
<th>Floodplain population</th>
<th>% of total</th>
<th>Rank according to repetitive loss properties/per capita</th>
</tr>
</thead>
<tbody>
<tr>
<td>Statewide</td>
<td>12,758,729</td>
<td>830,906</td>
<td>6.50%</td>
<td></td>
</tr>
<tr>
<td>Allegheny</td>
<td>1,229,172</td>
<td>60,170</td>
<td>4.90%</td>
<td>46</td>
</tr>
<tr>
<td>Cambria</td>
<td>140,835</td>
<td>11,808</td>
<td>8.30%</td>
<td>62</td>
</tr>
<tr>
<td>Bedford</td>
<td>49,332</td>
<td>3,664</td>
<td>7.40%</td>
<td>8</td>
</tr>
<tr>
<td>Lycoming</td>
<td>116,676</td>
<td>14,759</td>
<td>12.60%</td>
<td>3</td>
</tr>
<tr>
<td>Chester</td>
<td>506,422</td>
<td>36,900</td>
<td>7.30%</td>
<td>42</td>
</tr>
<tr>
<td>Monroe</td>
<td>163,342</td>
<td>11,006</td>
<td>6.70%</td>
<td>52</td>
</tr>
<tr>
<td>Wyoming</td>
<td>28,229</td>
<td>2,596</td>
<td>9.20%</td>
<td>1</td>
</tr>
<tr>
<td>Columbia</td>
<td>67,089</td>
<td>10,131</td>
<td>15.10%</td>
<td>2</td>
</tr>
<tr>
<td>Clearfield</td>
<td>81,472</td>
<td>6,778</td>
<td>8.30%</td>
<td>33</td>
</tr>
<tr>
<td>Franklin</td>
<td>151,517</td>
<td>8,461</td>
<td>5.60%</td>
<td>67</td>
</tr>
</tbody>
</table>

*Counties include case study counties and other counties with high repetitive loss properties/capita for comparison.

Although this project’s original scope included identifying businesses in the floodplain, this number is not as readily tracked in the U.S. Census or the American Community Survey (ACS). Accordingly, businesses in the floodplain are not included in this report, but merits further study. As of 2012, there were at least 4,934 businesses receiving subsidized flood insurance; the number of businesses impacted by floods is likely higher.
4.3 Economic Impact

The NFIP was created to correct a market failure in flood zone housing markets caused by prospective homeowners not fully internalizing the expected damage of future floods. As noted in the background section, “[f]lood insurance was originally designed to ease the financial burden on individuals and communities already situated in harm’s way, so that they could get out of danger. People have come to depend on insurance to stay in the floodplain rather than to transition out, and that has proven unsustainable—the insurance trust fund is unable to meet its obligations and is getting worse.” (PAFPM, 2014) (emphasis added).

As a result of subsidized flood insurance, house prices have been higher than justified by a complete picture of future housing expenses, including flood damage. Excess housing supply has resulted; in other words, there are more houses in the floodplains due to the availability of subsidized flood insurance. The NFIP is designed to correct this market failure by forcing homeowners to internalize the full costs of living in a flood zone by mandating flood insurance; the federal changes from the 2012 Biggert-Waters Act and the Homeowner Flood Insurance Affordability Act of 2014 were meant to correct this “market failure.”

Increasing insurance rates increases the annual cost of owning a house in a floodplain. Increasing insurance rates intentionally lowers property values and reduces the number of houses in flood zones. The idea is to restore housing markets to the prices and stock levels that would have occurred if households had full information regarding flood risks and associated costs and insurance markets existed from the beginning. Under such conditions, the resulting market outcomes are socially optimal in the sense that benefits to society and net costs are maximized.

Currently, homeowners do not recognize the full cost of owning a home in a floodplain because they either lack information about flood risks, or their flood insurance premiums are subsidized. Because household decision makers do not know or pay the full costs of owning a
house in a floodplain, their housing decisions do not reflect the careful balance between full costs and benefits. If they did, their housing decisions would be identical to what they would receive from an all-knowing central planner (who knew everyone’s preferences and resources) with the objective of maximizing the total sum of benefits to the population. Instead, floodplain housing decisions ignore significant costs that eventually get paid by society. This market failure leads to higher housing prices and more housing stock in floodplains than if homeowners had full information about flood risks and flood insurance was offered at actuarially fair rates.

Policy changes that restore the full costs of homeownership onto the homeowner create potentially heavy adjustment costs. For example, it is expensive to relocate, both in terms of moving costs and psychological distress. For this reason, policies that restore market prices and stocks to socially optimal levels are politically contentious. Indeed, while actuarially fair (full cost) flood insurance will restore the market to the long-term optimal prices and stock, the optimal path to get there from the current allocation of housing in floodplains carefully balances the benefits of incremental changes and the adjustments costs faced by homeowners. In light of these considerations, the slow increase in insurance premiums from subsidized to actuarially fair rates can be seen as an attempt to follow an optimal path that carefully considers adjustments costs from a suboptimal to an optimal allocation of floodplain housing.

The impact of flood insurance rate increases will occur over time. In principle, information about increased user costs of housing can spread instantaneously.\(^\text{67}\) Built structures cannot. Therefore, the immediate market response to higher insurance premiums is lower housing prices, but no change in the number of houses in the flood zone. Supply responds slowly.

\(^\text{67}\) Immediate information diffusion is assumed about increased premiums. In reality, information diffusion is likely to happen over time, softening the precipitous short-term price drops, and delaying supply responses. Indeed, interviewees reported that some of their citizens were surprised after closing on a house to learn about high flood insurance rates. Nevertheless, long-term estimates are unaffected by information diffusion, as long as buyers eventually internalize the premium changes.
over the decades as houses naturally depreciate out of the market and lower prices discourage housing construction starts. Counterintuitively, housing prices will partially rebound from post-premium hike lows as supply contracts. This portion of the research focuses on four hypotheses:

- **Hypothesis 1:** Recent adjustments in the NFIP will decrease the asset value of housing.
- **Hypothesis 2:** Recent adjustments in the NFIP will result in an immediate drop in housing prices in flood zones. This adjustment will occur as soon as prospective property owners are informed about the NFIP’s intentions for new rates and coverage.
- **Hypothesis 3:** After an initial drop in housing prices, housing supply will decrease.
- **Hypothesis 4:** After the initial drop in housing prices, housing prices will increase, but will not recover to pre-NFIP levels.

### 4.3.1 Numerical Predictions

The user-cost of housing model, described in Section 3.3, is calibrated to the market of single-family, owner-occupied housing in floodplains in five of the six case study counties (Allegheny, Cambria, Chester, Lycoming, Monroe). The sixth, Bedford County, did not have sufficient housing value data to be analyzed. Although Bedford County’s floodplain parcel numbers could be estimated, the average housing value for parcels could not be calculated due to lack of digitized housing value data. Housing market data was collected from digitized parcel plat maps provided by the counties, with estimates for the average flood insurance premiums per house with flood insurance. Changes in user costs of housing are simulated from changes in the NFIP using housing stock and prices from the counties as initial equilibrium values (Table 17).

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68 FEMA NFIP statistics by county: [https://bsa.nfipstat.fema.gov/reports/1011.htm#PAT](https://bsa.nfipstat.fema.gov/reports/1011.htm#PAT)
<table>
<thead>
<tr>
<th>Floodplain</th>
<th>Number</th>
<th>Median sale price (USD2016)</th>
<th>Number of parcels</th>
<th>Median sale price (USD2016)</th>
<th>Number</th>
<th>Median property value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allegheny</td>
<td>7,864</td>
<td>$91,300</td>
<td>370,179</td>
<td>$131,000</td>
<td>590,680</td>
<td>$129,600</td>
</tr>
<tr>
<td>Cambria</td>
<td>8,863</td>
<td>$52,180</td>
<td>33,937</td>
<td>$58,680</td>
<td>65,126</td>
<td>$87,100</td>
</tr>
<tr>
<td>Chester</td>
<td>13,923</td>
<td>$362,300</td>
<td>179,863</td>
<td>$321,300</td>
<td>192,755</td>
<td>$325,800</td>
</tr>
<tr>
<td>Lycoming</td>
<td>10,516</td>
<td>$91,270</td>
<td>50,985</td>
<td>$106,500</td>
<td>52,671</td>
<td>$138,500</td>
</tr>
<tr>
<td>Monroe</td>
<td>7,335</td>
<td>$154,500</td>
<td>99,311</td>
<td>$125,000</td>
<td>80,720</td>
<td>$174,500</td>
</tr>
</tbody>
</table>

Note: parcels are defined as single-family residential parcels unless otherwise noted.

4.3.2 Prices and Housing Stock

The recent NFIP revision targets a 25% increase in flood insurance premiums until full actuarial rates are met and is used as a simulation. With a 25% increase, housing prices in Allegheny County respond by immediately dropping from $91,300 to $85,256 per housing unit. The market eventually settles at the equilibrium price of $88,437 and supply of 7,423 housing units in floodplains. Thus, a 25% increase in NFIP premiums results in a 6.6% short-term loss in property values, with about half of that recuperated in the long-run as housing stock contracts by 5.6%. This would mean that 1 in 18 houses exit the market by being abandoned or demolished, or never enter the market because they are never built.

Although the price and supply paths for other premium hikes are similar and proportionate to the 25% case, potential rate increases to a full actuarial rate of 1,000% over time highlight significant differences (see Table 18). For example, a 1,000% increase in premiums in Allegheny County results in a short-term drop in average housing price from $91,300 to $28,039 (69% decrease), with an ultimate drop to $58,116 (36% decrease). This also results in a long-term decrease in housing stock from 7,864 to 3,488 (55.7% decrease), and a long-term decrease in value from around $718 million to around $203 million (71.8% decrease). In another example, Lycoming County sees a short-term drop in prices from $91,270 to $35,020 (a 61.6% decrease), a change in long-term supply of housing from 10,516 to 5,346 (a 49.2% decrease), and

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69 Value is calculated as housing price multiplied by housing stock.
a long-term decrease in prices to $62,676 (31.3% decrease). This results in a decrease in long-term value from around $960 million to around $335 million in Lycoming County.

The timing of such impacts is important. A sudden increase in insurance rates directly impacts the current owners: supply is predicted to contract sharply because of the sudden rise in user costs due to increase flood insurance premiums. Although the model predicts that prices will rise over time, most of the price rebound happens in the medium-term. Convergence to a new equilibrium reflecting the additional costs of flood insurance will happen over time, but with nearly all changes occurring in the first half of the duration until convergence. The model predicts that it will take 20 years for prices to rise from their post-rate hike low points or nadirs half way to their long-term equilibrium value.\textsuperscript{70} Approximately half of the housing stock contractions occur over the same timeframe.

\textsuperscript{70} This model has limited capacity to identify the timing of when equilibrium will be reached.
### Table 18: Percent Changes in Housing Market

<table>
<thead>
<tr>
<th>County</th>
<th>Premium Change (%)</th>
<th>Price (% change)</th>
<th>Supply (% change)</th>
<th>Total Value (% change)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Short-Term</td>
<td>Long-Term</td>
<td>Short-Term</td>
</tr>
<tr>
<td>Allegheny</td>
<td>10</td>
<td>1.8 0.9</td>
<td>1.6 1.8</td>
<td>25 6.6 8.7</td>
</tr>
<tr>
<td></td>
<td>25</td>
<td>6.6 3.2</td>
<td>5.6 6.6</td>
<td>25 10.6 13.7</td>
</tr>
<tr>
<td></td>
<td>50</td>
<td>10.6 5.2</td>
<td>8.9 10.6</td>
<td>50 10.6 13.7</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>16.1 7.9</td>
<td>13.4 16.1</td>
<td>100 16.1 20.2</td>
</tr>
<tr>
<td></td>
<td>1000</td>
<td>69.3 36.3</td>
<td>55.7 69.3</td>
<td>1000 69.3 71.8</td>
</tr>
<tr>
<td>Cambria</td>
<td>10</td>
<td>2.8 1.4</td>
<td>2.4 2.8</td>
<td>25 6.6 3.7</td>
</tr>
<tr>
<td></td>
<td>25</td>
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<td>100 1.5 2.0</td>
</tr>
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<td>1000</td>
<td>49.9 24.6</td>
<td>39.8 49.9</td>
<td>1000 1.5 2.0</td>
</tr>
</tbody>
</table>

#### 4.3.3 Affordability

Large premium increases have been reported in some cases, with property owners responding with impassioned backlash (NRC, 2015; see Section 4.1.6). To gauge whether these responses reflect a genuine and widespread economic hardship induced by premium hikes instead of mere anecdotal sensational news stories, consider a doubling of premiums from 1.5% to 3.0%. Such an increase would double yearly premium payments on the median Allegheny County floodplain house from $1,370 to $2,740; payment of higher policy premiums will result in less disposable income. The rise from 2.9% to a considerable 5.8% of the median household income of $48,000 in Allegheny County: an amount sufficient enough to make continued tenure unaffordable to many low-income households. Another way of looking at it comes through a hypothetical example. Assume someone owns a house worth $100,000, paying approximately
$500/month in mortgage payments and $800 for all household expenses, including $100/month in flood insurance. If flood insurance premiums jumped to $1,000/month, household costs are now $1,700 a month. Someone may have difficulty paying these increased costs, and may have difficulty selling the property with these increased monthly costs.

The decline in property values compounds the sting. Housing serves as the primary store of non-wage wealth for low- and middle-income households, accounting for 2/3 of total non-wage wealth for those in the bottom 80% of the wealth distribution (Wolff, 1998). A household facing even doubled premiums (100% increase in premiums), and a consequent 16.1% ($14,731) drop in property value, would experience a precipitous 11% loss of non-wage wealth. This drop would fall to the owners even if the house is mortgaged, lowering the collateral they have to their credit when accessing credit markets, thereby reducing available credit. Further, because assessed property values are not regularly updated, household property tax bills will not reflect lower market values, leaving property tax rates elevated until the next assessment. Taken together, a household experiences a dramatic drop in financial security through the drop in housing prices.

This drop in prices and value affects both annual earnings, as well as the value of all future earnings or someone’s wealth potential. The net present value of expected future income earnings is added to current wealth to get total household lifetime wealth. Again, based on just a doubling of premiums, a household would feel as if its net present lifetime wealth (including future income) had suddenly decreased by 4.2%. This loss of wealth is great and will come to the chagrin of homeowners, many of whom perceive flood insurance costs as an unanticipated government-imposed nuisance. Policymakers are already receiving backlash from many homeowners who will experience legitimate economic hardship from premium increases, both in the form of financial security and lost income flow.
Further compounding the homeowners stress from material loss, homeowners will pay “artificially” high effective property tax rates. This is because property values are assessed for tax purposes every 7 years. Thus taxes will be applied to past high assessed property values, for an average of 3.5 years. Consider the 6.6% drop in property prices that would result from a 25% increase in insurance premiums. The market price drops from $P$ to $(1-0.066)P$, but the tax rate is applied to $P > (1-0.066)P$, and the effective tax rate is 7% higher than the tax code calls for. If premiums double, tax rates will be 19% too high. Thus, user costs of housing in floodplains increase not just through insurance premiums, but also through increased property tax rates.

4.3.4 Local Tax Revenue

Local property tax revenue will drop both in the short-term and long-term when premiums rise, thus eroding the local tax base. Total loss in housing values are exacerbated by the joint reduction in prices and supply. In the short term, lost property tax revenue will come entirely from the precipitous drop in housing prices. It is likely, however, that property assessors are slow to adjust their appraisals downward when flood insurance premiums rise. In fact, there is evidence in the data that flood risks are not fully accounted for in assessed values. Thus, the drop in revenue will be softened compared to the idealized setting that considered here, in which the change in user costs are immediately and fully realized in housing prices.

Although this model assumes 100% compliance for those required to have flood insurance in a Special Flood Hazard Area, studies have shown that of those required to have flood insurance by something like a federally backed mortgage, only 75-80% actually have it. For those who live in the SFHA, in general, overall compliances are approximately 50%. (Dixon

71 Possibly longer given the way assessments are made.
et al., 2006). Because of this, actual impacts on housing stock will likely be half of what the model predicts. Interviewees noted that while mortgage brokers may require purchase of flood insurance to acquire the mortgage, subsequent payments may not be monitored by mortgage holders. Potential liability for failure to carry flood insurance is a question beyond the scope of this report, but may merit further study.

Because the individual impact of removing subsidies and incurring this “cost of adjustment” is so high, one way to address this might be to pay homeowners a lump sum of money. One hypothetical way to address this would be for the government to buy all houses with subsidized flood insurance at the assessed value before flood premiums changed and then sell them at their new lower price and allow current occupants to have the first right to the house — this allows current homeowners to get the full value of their house that they paid (or move if they want to) and allows the prices to adjust to the levels they should be. Addressing the adjustment cost may be an important consideration in addressing the NFIP overall.

4.3.5 Calculation of impact given subsidized rates

Because actual insurance rates are maintained by private insurance companies and not released by FEMA, it is difficult to calculate the exact financial impact either nationwide or in Pennsylvania. Using the 2012 rates, Louisiana State University Extension ran a sample scenario based on $2,000/year premium payments with increases of 25% per year until the “full risk” rate is achieved. Premium calculation is for $250,000 building coverage only (no contents), for a single-family, one-story structure without a basement located in a flood hazard zone.

72 Prices remain the same and supply can be scaled in this way by (1) redefining the market as those in flood plains and in flood insurance compliance, and (2) assuming prices in the market defined by (1) are the same.
Because so many policyholders pre-date the NFIP and have grandfathered rates, the rate increases greatly impact Pennsylvania. Under the example above and assuming approximately 46% of Pennsylvania policy holders remain subsidized, this would mean there are around 28,500 subsidized policy holders in 2016. Figure 13 illustrates the total number and percentage of subsidized policyholders by county in Pennsylvania. As long as a property remains unchanged or unsold, the rates would remain the same. However, if a property is sold, the rate jumps to the full risk rate. If rates increased by ~$7,500 per policy holder (depending on the structure’s BFE), this would mean $214.8 million/year more in policy payments for Pennsylvania at a minimum. Businesses, second homes, and repetitive loss properties all face higher premium rates immediately, ramped in over time. As noted above, there approximately 28,500 subsidized property owners in Pennsylvania, spread throughout the Commonwealth. Figures 13 and 14
indicate both the numbers and percent subsidized by county. As subsidized rates are removed, the impact of rising rates will be felt differentially, but also affect the Commonwealth as a whole.

**Fig. 3: Number of subsidized policy holders in Pennsylvania (FEMA 2012)**

![Map of Pennsylvania showing the number of subsidized policy holders by county.](image)

**Fig. 4: Percent of subsidized policyholder by county in Pennsylvania (FEMA 2012)**

![Map of Pennsylvania showing the percent of subsidized policyholders by county.](image)

4.4 Case Study Analyses of Selected Pennsylvania Rural Communities

This report evaluated a number of targeted case study communities to better understand how they differ in their flood mitigation decisions in response to federal and state policies. These case studies are not intended to capture all the ways in which Pennsylvania’s rural communities
conduct flood mitigation; there are far too many communities, and far too many variations in their actions. However, this kind of detailed analysis provides important lessons about how flood mitigation is actually being implemented at the local level.

Case studies were selected to represent a wide range of Pennsylvania communities from various parts of the Commonwealth. The selection process is described in detail in Section 3.4 above, in reports to the Center for Rural Pennsylvania and in Appendix 7.3. Of the case study municipalities chosen, three are in the greater Delaware River basin, three are in the Susquehanna River basin (including upstream on the Raystown Branch of the Juniata, tributary to the Susquehanna), and two are in the greater Ohio River basin. There are three townships, four boroughs, and one third-class city. They have some features in common, and many features that differ because of their very different geographic, demographic, and historical circumstances. This section summarizes the findings of the detailed case study analyses, including sub-sections addressing several major Commonwealth and federal programs that impact these communities. This section also draws general conclusions.

4.4.1 Flood Damage Statistics about Case Studies and Other PA Communities

Insurance claims by property owners through the NFIP process are one way to measure damage in communities from different parts of the Commonwealth. These data are only an
approximation – not all damage is captured – because not all property owners purchase NFIP insurance (only 50% of those required to have flood insurance do so). Further, these data are imprecise because they are not adjusted for inflation, so communities that experienced damage early in the period (the 1970s) will be displayed with lower dollar costs than the same damage incurred in other locations later (2010s). The tables below may be a reasonable but not precise way to estimate the relative financial impacts of one community compared to another, across a fairly long period that captures a wide range of flood events. Three tables of information are presented below, followed by a discussion of the information and results included therein.

Table 19: Number and Value of NFIP Claims Filed by Policy Holders in Case Study Municipalities and Their Counties

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Chester</td>
<td>W. Whiteland Twp</td>
<td>*</td>
<td>1,578</td>
<td>20.3</td>
</tr>
<tr>
<td>Chester</td>
<td>Downingtown</td>
<td>213</td>
<td>71</td>
<td>2.2</td>
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<tr>
<td>Lycoming</td>
<td>Jersey Shore</td>
<td>2,405</td>
<td>3,874</td>
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<td>Muncy</td>
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<td>475</td>
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<td>Bedford Twp</td>
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</tr>
<tr>
<td>Monroe</td>
<td>Smithfield Twp</td>
<td>629</td>
<td>357</td>
<td>12.0</td>
</tr>
<tr>
<td>Cambria</td>
<td>Johnstown</td>
<td>1,067</td>
<td>756</td>
<td>3.0</td>
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</tbody>
</table>

* Data not available at this level of aggregation or not reported in county Hazard Mitigation Plan
** Dollar value includes claims as reported from all years 1978-2015, not adjusted for inflation.
# Multiple claims filed by some policy holders, including those not considered RL or SRL.

Data acquired from County Hazard Mitigation Plans, 2012-2016; from PA Hazard Mitigation Plan, 2013; and from J. Young, PHMC, 2015
Table 20: Number of Policy Holders Filing “Repetitive Loss” NFIP Claims in Case Study Municipalities and Their Counties

<table>
<thead>
<tr>
<th>Case Study Location</th>
<th>Number of Properties Filing Claims Repetitively, 1978-2015</th>
<th>Number of SRL + RL Properties Mitigated **</th>
<th>Proportion of Designated Historic District in 100-Yr Floodplain, %</th>
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<tbody>
<tr>
<td>County</td>
<td>County Number</td>
<td>County Claims</td>
<td>County Number</td>
</tr>
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<td>3</td>
</tr>
<tr>
<td>Chester</td>
<td>Downingtown Twp</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Lycoming</td>
<td>Jersey Shore</td>
<td>27</td>
<td>*</td>
</tr>
<tr>
<td>Lycoming</td>
<td>Muncy</td>
<td>65</td>
<td>*</td>
</tr>
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<td>Allegheny</td>
<td>Etna</td>
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<td>1</td>
</tr>
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<td>Bedford Twp</td>
<td>11</td>
<td>*</td>
</tr>
<tr>
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<td>Smithfield Twp</td>
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<td>2</td>
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<td>Johnstown</td>
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<td>0</td>
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* Data not available at this level of aggregation or not reported in county Hazard Mitigation Plan
** No information available at the municipal level for this category

Table 21: Number and Value of NFIP Claims Filed by Policy Holders in Selected PA Counties: 16 Counties with Greatest Financial Value, Plus Case Study Counties, Divided by Cities, Boroughs, and Townships.

<table>
<thead>
<tr>
<th>County</th>
<th>Number of Claims</th>
<th>Value of Claims, $ million*</th>
<th>Number of Claims</th>
<th>Value of Claims, $ million*</th>
<th>Number of Claims</th>
<th>Value of Claims, $ million*</th>
<th>Number of Claims</th>
<th>Value of Claims, $ million*</th>
<th>County total</th>
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<td>0</td>
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<td>78.3</td>
<td>4,683</td>
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<td>0.0</td>
<td>1,243</td>
<td>27.5</td>
<td>3,776</td>
<td>90.1</td>
<td>5,019</td>
<td>117.6</td>
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<td>Luzerne</td>
<td>784</td>
<td>9.0</td>
<td>1,647</td>
<td>46.5</td>
<td>1,537</td>
<td>34.4</td>
<td>3,968</td>
<td>90.0</td>
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<td>1148</td>
<td>18.6</td>
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<td>39.1</td>
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<td>1,996</td>
<td>29.8</td>
<td>1,415</td>
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<td>4,030</td>
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<td>0.0</td>
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<td>1,084</td>
<td>12.0</td>
<td>2,666</td>
<td>43.1</td>
<td>3,874</td>
<td>56.5</td>
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<td>273</td>
<td>11.4</td>
<td>205</td>
<td>5.4</td>
<td>810</td>
<td>26.5</td>
<td>1,288</td>
<td>43.4</td>
<td>8</td>
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<td>Delaware</td>
<td>166</td>
<td>3.1</td>
<td>941</td>
<td>19.2</td>
<td>1,278</td>
<td>16.5</td>
<td>2,385</td>
<td>38.8</td>
<td>9</td>
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<td>0</td>
<td>0.0</td>
<td>312</td>
<td>6.4</td>
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<td>12</td>
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<td>837</td>
<td>21.8</td>
<td>13</td>
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<td>866</td>
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<td>11.1</td>
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<td>0.0</td>
<td>0</td>
<td>0.0</td>
<td>1,072</td>
<td>19.6</td>
<td>16</td>
</tr>
<tr>
<td>Bedford</td>
<td>0</td>
<td>0.0</td>
<td>239</td>
<td>1.8</td>
<td>1,195</td>
<td>10.9</td>
<td>1,434</td>
<td>12.7</td>
<td></td>
</tr>
<tr>
<td>Monroe</td>
<td>0</td>
<td>0.0</td>
<td>30</td>
<td>2.5</td>
<td>327</td>
<td>9.6</td>
<td>357</td>
<td>12.0</td>
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</tr>
<tr>
<td>Cambria</td>
<td>323</td>
<td>1.4</td>
<td>203</td>
<td>0.9</td>
<td>230</td>
<td>0.7</td>
<td>756</td>
<td>3.0</td>
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</tr>
</tbody>
</table>

* Dollar value includes claims as reported from all years 1978-2015, not adjusted for inflation.
Data acquired from County Hazard Mitigation Plans, 2012-2016; from PA Hazard Mitigation Plan, 2013; and from J. Young, PHMC, 2015.

Flood Mitigation for Pennsylvania’s Rural Communities 91
Statewide, cities show the fewest claims and the lowest aggregate dollar value of damage. This is not surprising because only a small portion of Pennsylvania’s area constitute cities, even though the much denser land use in cities leads to more housing units per square mile and thus more damage per square mile. The dollar amount per claim ($16,400) is also slightly less than for townships or boroughs, which have almost identical proportions at about $16,700 to $16,800, respectively, per claim. The large amount of land in Pennsylvania devoted to townships means more townships are affected by flooding, almost twice as many as boroughs; over 1.5 times as many claims over the years; and over 1.5 times as much dollar value damage during that period. Such data argue for care in supporting rural communities in their efforts to mitigate flood damage, because the aggregate cost to the Commonwealth of damage in these many, smaller-population communities is greater than the aggregate in densely-populated areas. Further, the governing structure of a township tends to mean they have fewer institutional and financial resources to address flooding impacts.

The tables above show how flooding has had sharply different impacts among different counties of the Commonwealth, both in total damage over time and in the value per claim. Highly impacted counties are found in all corners of Pennsylvania. The case studies include five communities in three of the top 15 most impacted counties, along with three communities in three other counties. The case studies in the lesser impacted counties include municipalities with a disproportionate amount of damage compared to the rest of the county: Smithfield Township’s $8.2 million damage (in a township with less than 6,000 people) constituted 2/3 of the dollar damage in all of Monroe County. The other two are similar, but to a lesser degree.

In many of the case studies, the number of claims during 1978-2015 exceeds the number of current NFIP policy holders. That is due to the 35-year period considered: many properties were damaged more than once during this time, and filed claims. Duplicate claims are not only
those classified as Repetitive Loss or Severe Repetitive Loss (which filed more than one claim in a 5-year period). Other properties holding policies may have filed no claims during that period.

4.4.2 Flood Mitigation Strategies Widely Used by Case Study Municipalities

Each case study summarizes the kinds of mitigation measures used by the municipality. Several of the most common approaches were found in multiple case studies; to avoid repetition, this section describes the structure, intent, and main features of such widely used approaches.

Structural barriers to flooding of large areas (levees, dikes, floodwalls) were mentioned by personnel of several of the case study municipalities. Many municipal leaders, and many Pennsylvania residents, see flood walls or levees as a desirable and valuable solution for understandable reasons: a structure that can keep high river or stream flows from inundating a settled area, holding back floodwaters away from populated areas, would allow the municipality to preserve its land use (except for land devoted to the structure itself) and completely avoid flood impacts, assuming the wall or levee functions as designed for all future flood events.

These are discussed only briefly in this report for several reasons. First, the presence of a floodwall completely changes a community’s use of the NFIP: if the wall is considered sound by the U.S. Army Corps of Engineers, then FEMA does not consider the protected land to be susceptible to flooding and thus lenders and insurers do not require NFIP policies, so those land uses are moot for purposes of this report. That is true even though valid arguments exist that those land uses are at risk of a different kind: the low-probability, high-consequence possibility of a wall or levee being overtopped or falling into disrepair through inadequate maintenance. Second, many previous studies and report have been prepared by agencies (U.S. Army Corps of Engineers, U.S. Bureau of Reclamation, the Pennsylvania Department of Environmental Protection, and others) that analyze in great detail the economic and societal aspects of effective siting, design, construction, and operation of dams, levees, and channel protection. There is little
to add by summarizing the work that addresses floodwalls and levees. Third, this report focuses on the kinds of flood mitigation actions and decisions taken by municipalities. Many structures such as walls and levees are so large and expensive that local municipalities do not undertake them without injections of federal and/or Commonwealth funding, which is allocated by Congress or the Legislature through economic decisions well beyond the control of the local communities studied here. Those important decisions are beyond the scope of this report.

The communities selected as case studies intentionally excluded communities protected by floodwalls or levees. Although Johnstown has a wall along its waterways created during the channelization of the Little Conemaugh, Conemaugh, and Stonycreek Rivers in the 1930s, this wall is not a flood wall or a levee. Rather, it is a concrete bank stabilization project, designed to prevent erosion and straighten the channel. It does not extend above the preexisting top of the river bank, nor does it raise the height of the floods that affect the city. In addition, it does not protect any land uses from flooding, and does not eliminate the need for NFIP policies for any residents or businesses in the city. Future research might investigate the ways in which protected communities implement decisions, as that topic is not well studied: a cursory review of available documents suggests it is not a simple matter even to count the number of communities, or value of property, currently protected in Pennsylvania by the large variety of federal-built, Commonwealth-built, and locally-built structures protecting regions of varying sizes, and built to varying heights that protect from widely varying levels of flooding.

Streambed and channel maintenance and improvements are used by many communities. A wide variety can be found. At one extreme are from major construction projects, many constructed or funded by state or federal entities (such as the Johnstown bank stabilization), which are beyond the scope of this report in the same way as the flood prevention structures described above. Many communities implement medium-sized projects such as removing
channel ‘choke points;’ for example, Muncy and Etna raised overpass bridges. Many communities seek partnerships with private entities for grants from Commonwealth or federal agencies, sometimes multiple agencies provide funding if projects can meet multiple objectives. At the other extreme are myriad stream channel improvements, stabilization, or removal of rubble deposited after a major storm; such measures are typically temporary and commonly funded by municipal maintenance funds. As a rule, these are highly location-specific and depend on each municipality’s natural and constructed drainage facilities and flow patterns. Whether these are useful depends largely on geographic and drainage-facility factors (beyond this report). Johnstown’s rivers are examples of very complete streambed channel structural improvements; such aspects of Johnstown’s flood mitigation strategy are not considered in this report.

On the other hand, some municipalities have effectively reduced inundation with well-designed improvements to drainage systems. The lack of funding availability inhibits identified, needed improvements in other locations; the local decision process and availability of funds from Commonwealth and federal programs are important aspects of this study and are discussed.

Floodplain zoning as proactive management of future construction in the floodplain is essentially universal in Pennsylvania communities. The Pennsylvania Flood Plain Management Act, enacted in 1978, requires every municipality that is subject to flooding to participate in NFIP; NFIP specifies participating communities adopt floodplain management ordinances. All case study municipalities contacted for this report – and in fact all townships, boroughs, and cities about which any information was identified as background for this report – have adopted floodplain management ordinances. Personnel from all case studies point to PEMA guidance and requirements as powerful motivators. The Commonwealth incentives and guidance for these ordinances are described in Section 4.4.7. Floodplain management ordinances are instruments at the municipal level that specify requirements for any construction. They require the municipality
to identify the Special Flood Hazard Zone, commonly using data from FEMA’s floodplain mapping services. In many cases, the local municipality is assisted by county and/or Commonwealth personnel to create and supply maps showing exact locations of the floodplain. The ordinances then specify what kind of new structures are allowed in the floodplain.

Case study communities followed one of two courses. Some chose to strictly prohibit any new construction in the designated floodplain. This was the preferred course for municipalities with developable land outside the floodplain; in the case studies, this included townships only, not boroughs or cities. The other course is to allow exceptions to the prohibition, but specify rigorous requirements, such as the elevation of the lowest occupied floor; the kinds of materials that may be used in construction; equipment that will keep floodwaters out of inundated structures; and others. Implementation details are discussed in the case studies below.

Removing existing structures from floodplains: acquisition and conversion of properties to open space. Many of the case study communities utilized FEMA’s Severe Repetitive Loss (SRL) Grant Program, in effect from 2004 through 2013. In addition, some have continued with the Hazard Management Assistance (HMA) grant program that superseded it. The HMA program consists of the Hazard Mitigation Grant Program, Pre-Disaster Mitigation, and Flood Mitigation Assistance (FEMA, 2013). FEMA defines a SRL property as one that has filed two claims within any 10-year period since 1978 with losses totaling more than the value of the property, or one which has filed four claims, two of which were in a 10-year period.

Both programs have several options, but the major emphasis of the SRL program was to promote acquisition by communities of properties with SRL status, to demolish those structures, and then to maintain those properties indefinitely as open space. The rationale is clear: removing those structures from the floodplain permanently eliminates the potential for NFIP payments for
any future damage. The one-time expenditure to acquire the properties gains financial benefit indefinitely for the NFIP, and permanently reduces safety threats in the communities.

These programs can make an important difference on an aggregate basis: as of March 2011, FEMA had identified about 9,000 SRL properties in the U.S. (FEMA, 2013). The tables above show a total of 62 of these within the six counties of target municipalities, along with more than 1,200 Repetitive Loss properties. Records from 2015 show about 150 of these (SRL plus RL together) had been acquired with FEMA funds, though that information is dated. For example, Lycoming County personnel stated that some 200 had been acquired in that county alone. A second designation, Repetitive Loss, is used for properties that filed two or more separate claims of at least $1000 each within any 10-year period since 1978. As of 2005, FEMA had identified about 122,000 such properties within the U.S. (FEMA 2005) – likely many more in the decade since then – about 1,200 of which are in the six Pennsylvania counties studied here. One interviewee noted that there are different federal and state definitions of eligible properties; this can cause confusion on the implementation side.

The funding agreement is between property owners and FEMA, but communities must be involved because the property does not change hands if a municipality does not accept it. The case studies show some of the negative aspects: loss of tax base, an apparently burdensome application process that does not always conclude successfully, and the fact that no purchases go forward unless owners identify themselves as willing to sell. However, no communities show interest in using eminent domain, or in pressuring owners to sell. Further, FEMA specifies no structures can be placed on these spaces, including any recreational equipment (ballpark backstops, certain kinds of pavilions or stands), nor any trees or large vegetation that might impede the flow of potential future floodwaters. Most municipalities expect to plant these spaces in grass; thus decreasing the tax base and increasing maintenance costs to mow.
Rebuilding or remodeling existing structures in floodplains with federal funds. Federal funds under the former SRL Program, and the subsequent HMA Program, allowed for some options besides the acquisition-and-demolition approach described above. The programs provide a limited amount of funding (usually 75%) toward renovations by floodplain homeowners, approved by FEMA, which will reduce flood damage. These include physically lifting a building so that its first occupied floor is higher than the projected height that would be reached by a 1%-probability flood. Some communities require a ‘freeboard’ margin of safety higher than that elevation. This is an expensive option; consensus among case study personnel is that elevating a structure costs at least $100,000, or more, depending on the type of the structure and the height that must be added, whether a few inches or the 10 to 15 feet observed in some communities.

There are also options for dry or wet flood-proofing. “Dry flood-proofing” includes permanent or movable barriers at windows or doors designed to keep water out of the building. This is effective for properties where the 1% flood will exceed its first occupied floor by only a small margin. Another is elevation of utilities within the structure, on the grounds that furnaces, air conditioners, gas lines to water heaters, electric lines and switchboxes, and other utilities are costly parts of a typical residence, and are damaged by even brief contact with floodwater. In many homes, these can be raised to first or second stories at less cost than elevating the entire structure. “Wet flood-proofing” consists of changing building materials from those that would be damaged by water (hardwood, plasterboard, etc.) to those that would not (ceramic tiles, plastic-based lumber substitutes), so the structure incurs less damage if inundated.

A wide range of all these options have been developed and marketed. The latter are often preferred in historic buildings, where razing, relocating, or remodeling would conflict with goals of historic preservation. All these actions are designed to reduce potential damage to the property. Municipal personnel note that residents likely still will need to be evacuated to safety.
in event of a flood, so it does not help as much with public safety as with dollar savings. The actions are prioritized for SRL properties, though others are considered, and some have been funded. Municipalities note that FEMA appears less likely to provide funds for these options, as it would like to encourage acquisition-and-demolition, which reduces risk to property and safety essentially to zero from these properties. Federal grants pay up to 100% the cost of acquisition, or up to 75% the cost of approved mitigation activities.

**Rebuilding or remodeling existing structures in floodplains using municipal codes.** Most case study communities mentioned the usefulness of municipal building codes to gradually bring their older housing stock and existing businesses, found in the floodplain zones, into alignment with modern flood-resistant designs: elevating, dry flood-proofing, utility elevation, and other measures. Model building codes are widely available; municipalities commonly specify that structures in the floodplain must comply with flood-proofing code requirements if they conduct renovations or repairs that require a municipal building permit. Several case study communities report they work closely with property owners to identify flexibility (within code requirements) to attain the most effective affordable flood-proofing for each situation.

However, building permits are not required for minor renovations. The Pennsylvania Uniform Construction Code (UCC) (PA Dept of Labor and Industry, 2017a) specifies that permits are required when any structure’s repairs or renovations will cost 50% or more of the value of the structure. That commonly occurs after major damage (fires, flood damage), but when owners have a choice, many of them choose to undertake only renovations that cost less than the 50% threshold, specifically to avoid adding the cost of flood-proofing. Reports from some municipalities suggest that Commonwealth changes to the UCC, adopted in recent years, now exempts residential buildings undergoing repair or alteration if those alterations do not make structural changes or changes to means of egress (PA UCC 403.1(b)(8) and 403.1(b)(9)
That means that many residential renovations may now be completed without requiring a building permit from the municipality, regardless of the cost of those renovations. Those changes achieve the desired effect of reducing intrusive paperwork for homeowners, but have the unintended negative consequence that fewer residences need to apply for building permits. Municipalities now have fewer opportunities to require residences to incorporate flood-proofing modifications. This in turn reduced the number of flood-proofing modifications achieved with this method, which serves to slow an already very slow rate of progress in renovating floodplain structures.

**Flood forecasting, information availability, warning and flood response systems.** This aspect is a cornerstone of federal and Commonwealth guidance, and is supported by materials, process descriptions, and methodological suggestions by federal and Commonwealth agencies. Public education and outreach that helps educate a citizenry about risks, how to stay aware of impending risks, what action they should take in event of a disaster, and how to protect themselves and their property is among the most effective means to increase public safety. Many municipalities go to great lengths to implement outreach programs; these are discussed only in broad detail below as they did not vary substantially from place to place. Well-developed materials are available from other sources and are not described in this report. All case study communities identified these as essential to their flood mitigation strategies.

Case studies also identified the importance developing and rehearsing communications with forecast agencies such as the National Oceanic Atmospheric Administration and the National Weather Service, then developing their own preparedness on how to use that information: methods for making citizenry aware of impending emergencies and instructions on how to respond. This may include dividing communities into zones with well-defined triggers about when to evacuate, shelter in place, send emergency requests, and how to respond after the
emergency. This study addresses public information and record-keeping, but does not discuss emergency preparedness equipment, methods, and training. It is certainly true that municipalities report use of training for their crews as essential to their mitigation; however, assessing the value of training information, sufficiency of equipment, and effectiveness of response activities is well beyond the scope, and subject to many carefully developed procedures at state and federal levels. Forecasting is an important service provided by federal agencies – absolutely essential to all case studies – but ways to use that information can vary depending on municipalities’ techniques and available funding, so that aspect varies from one location to another.

County-level Hazard Mitigation Plans are a Commonwealth program, implemented by the Pennsylvania Emergency Management Agency (PEMA). All counties are required to complete Hazard Mitigation Plans, adopted by county government, and renew them every five years. Hazard Mitigation Plans include sections addressing flood mitigation, as well as sections addressing other hazards such as ice and snow damage, high-wind events, drought, and others. Counties that fail to have an active, adopted Hazard Mitigation Plan are advised by PEMA that they will not be eligible for any disaster-recovery funds (federal in origin, but distributed by PEMA) should their community experience a disaster. These Plans have emerged as an important tool for some Pennsylvania counties and municipalities, though they are less fully developed by others. Because they are an important feature of each of the case studies, this program is summarized and critiqued in Section 4.4.4.

4.4.3 Case Study Communities

This section describes the eight communities studied in detail for this report. The four boroughs are presented first because they typify many of Pennsylvania’s most long-established settled places, centers of historic and culture dating back as far as 250 years, and the
infrastructure that supports those historic and cultural centers. Many of these are located in the most flood-prone real estate in the Commonwealth due to historic and development patterns.

Following the boroughs, a case study of a single third-class city is provided. Many of the Commonwealth’s smaller, older cities face problems similar to the boroughs, with long-standing historic and cultural centers but contracting economies, and some with extensive underserved or low-income populations. Many of Pennsylvania’s third-class cities have population smaller than many boroughs and even some townships; however, they have a different governance structure that provides a different set of opportunities to address flood problems. This contrasts with larger cities, whether in prospering or declining regions, with their own urban problems and range of possible solutions, which are very different from the more rural communities in this report.

Finally, three case studies focus on townships. Townships differ sharply from boroughs and smaller cities in the kinds of flood mitigation problems they face, the resources and institutions available to face those problems, how they are affected by state and federal programs and regulations, and the kinds of policies that could improve their situations. Some townships are in economic decline while others are relatively prosperous; the more prosperous are within the economic influence of a larger region. Some townships have old infrastructure to match the oldest boroughs, although for the most part, these are very small geographically. Others experienced growth very recently and have infrastructure meeting the most modern codes. Some stand alone in deeply rural areas, and some are in suburbs preserving rural character within more densely populated areas. Townships display by far the greatest variability.

In several of the case studies, county governments play important roles. Discussion of county roles is included in the sections of pertinent case studies. The case study municipalities are organized into a common outline, but with modifications to accommodate varying choices and emphases by the case study communities.
In many ways, Muncy is the archetype of Pennsylvania’s small rural boroughs beset by flooding. Founded as a farming community on the American frontier, settled in 1797 and incorporated in 1826, Muncy grew through the 19th century owing to the confluence of a major transportation route – the Susquehanna River – and Muncy Creek, draining the steep ridges to north and east, with flat lands where millponds could be built for waterpower for grain and lumber mills. By the late 19th century, Muncy was also affected by the orbit of a nearby medium-sized city and became an exurb in the Williamsport metropolitan area, a region of powerful economic activity through the lumbering era and into the manufacturing era, which slowly declined beginning around the 1920s. The Williamsport activity, and the cluster of numerous small and medium-sized boroughs throughout Lycoming County (geographically Pennsylvania’s largest) makes Muncy’s situation somewhat different from other rural boroughs that lack that regional economic engine; however, Muncy shares features with other boroughs.

Muncy is found in Lycoming County, where the Susquehanna River undergoes some profound changes as it moves downstream. At the “upstream end,” the Susquehanna River enters the county from the west, exiting the Plateau region with steep, narrow channels and entering the Ridge and Valley region. The Susquehanna River, and the flooding it generates, changes character sharply in this vicinity. Upstream of Lycoming County, it is a mountain river, with relatively steep gradient and following a roughly west-to-east course with a constricted channel between ridges, fed by multiple tributaries that enter from even steeper, ridge-side watersheds.
that quickly drain and produce extreme, short-term flow crests. Muncy is at the “downstream”
end of the Lycoming County floodplains, where the River exits the county. Muncy lies on a
relatively open, expansive floodplain, surrounded by larger boroughs and townships and near
enough to share in economic activity of Williamsport. The Susquehanna then continues south
from Lycoming County through the ridge-and-valley province in a different manner: it crosses
through multiple ridges into valleys where the floodplain opens into relatively flat, elongated
east-west spaces. These valleys typically are drained by small creeks which gather runoff from
surrounding ridges, and collect floodwaters from local events.

The valleys were chosen as sites for boroughs during the 18th century frontier settlement,
with easily farmed flat fertile soils and access to the Susquehanna for transportation. From the
point of Muncy southward, through the lumber boroughs of the West Branch, the farmland
boroughs of the main stem, boroughs dot the landscape strung along the Susquehanna in its
valleys, most at the confluences of the smaller creeks, providing waterpower for lumber and
grain mills. As a result, the borough sites so naturally advantageous for commerce are the same
places most vulnerable to flooding from the river and from its tributaries. At Dauphin County,
the river exits the ridge-and-valley province and flows through flat lands to the point in York
County where it exits the Commonwealth; those flat lands have their own flooding issues,
primarily along the main stems of major waterways, with little to hold back the flooding.

Muncy shares the ridge-and-valley region’s tendency of historic development within the
floodplain. About 40% of the Borough, and about 60% of its historic district, lie within the 100
year floodplain. The low-lying northern end of the borough developed in the plain of Muncy
Creek just upstream of its confluence with the Susquehanna River. Flooding tends to occur in
one of two modes: runoff from intense local storms in the Muncy Creek local watershed,
originating in steep ridges and hillsides to the north and east of the borough, and more large-
scale storm events collecting runoff from the much larger West Branch of the Susquehanna River, where the crest arrives more slowly and with more advance warning, and where inundation typically arrives in the form of water backing up from the river upstream through Muncy Creek. The inundated areas of the Borough are roughly the same from both types of flood event, though the second is longer in arriving and tends to endure substantially longer. Forecasting the two kinds of events requires two substantially different kinds of information and statistical modeling: local versus regional rainfall and hydrology of small highly-variable creeks vs the long-distance flow of the Susquehanna.

Institutions with Major Flood Mitigation Responsibilities

Muncy’s Borough Manager holds direct responsibility for oversight of floodplain management, codes, and economic development. The Lycoming County Department of Planning and Community Development offers robust support in several ways. It provides important GIS services to document floodplain location and determine whether properties and structures, or proposed structures, lie in the 1% floodplain and thus may be subject to building code restrictions or special requirements for remodeling and upgrading. It facilitates compliance with Commonwealth and federal regulations and requirements, and access to Commonwealth and federal grant and loan applications. It also supports the county’s multiple municipalities through robust implementation of the Hazard Mitigation Plan process, which is discussed at length below in this section and throughout this report.

Current Main Flood Mitigation Strategies; Future Directions/Anticipated Challenges

Muncy pursues a multi-faceted approach, which is strongly integrated with Lycoming County programs and makes use of Commonwealth and FEMA guidance, actively seeking funding from Commonwealth and federal sources when available. The Borough has not chosen to participate in FEMA’s CRS. Several key components include the following:
Muncy implements its Floodplain Management Act of 1978 in a way that allows, but carefully controls, new construction in the floodplain. New buildings are allowed if their lowest occupied floors, including entrances, are at elevations of 18 inches higher than the projected level of a 1% flood; if any unoccupied lower floors follow design codes including water-resistant materials and flow-through vents; and if all utilities (furnaces, air conditioners, water heaters, electrical switchboxes, etc.) are elevated above projected flood levels. The Borough makes known to developers that it applies this flexible approach, doing its best to encourage investment within Borough limits, large portions of which are in the floodplain and might otherwise go vacant. Some examples of successful development have been achieved.

Building codes are written to require flood-mitigation measures for any major renovations of a structure in the floodplain. Structures that undergo substantial renovation, currently defined as dollar value greater than 50% of the building’s value, must receive a municipal permit; that permit can include a flood-hardening requirement. The Borough code officer has some discretion as to what measures are suitable for each building. These may include water-resistant materials (plastics, ceramic tiles) instead of wood or plaster-board; elevation of utilities above the specified flood level; and in some cases, elevation of the building so that the first occupied floor is 18 inches above flood level (this can be a costly requirement). This is one of few tools available to improve existing structures, beyond acquisition and demolition of structures; however, the tool by its nature is extraordinarily gradual. Interviews with Muncy officials estimated about 20 buildings have taken this path in the past 10 to 20 years.

Acquisition of structures in the floodplain using FEMA funds. The Borough emphasizes its readiness to work with willing sellers; no pressure is put on property owners who are not interested in selling. County agencies assist in implementing these sales; the County reports some 200 properties have been acquired in this way. This is a larger number than most
Pennsylvania counties, but relatively modest in a county with just over 115,000 people. Within Muncy, a total of about 10 properties have been acquired, with five more in process as of summer 2016. This kind of acquisition is useful, as it tends to focus on properties filing repeated NFIP insurance claims (a greater proportion of the sale price is provided by FEMA for properties designated “repetitive loss” or “severe repetitive loss). It is, of course, of limited use in a community like Muncy where 60% of the historic district, and 40% of the entire Borough with 3,000 people, lies in the 1% floodplain. No one imagines the community would thrive if all buildings are demolished and converted into open space. Reducing the number of at-risk structures in neighborhoods allows the community to focus other approaches (flood-hardening, etc.) on the remaining properties.

The Borough recognizes the limitation of spreading resources throughout neighborhoods, and is working to revise the approved zone where it will agree to property acquisition from the current approach that encompasses essentially the entire 1% floodplain, to a more compact zone near Muncy Creek that experiences the most frequent and severe flooding. The Borough intends to direct future funding to that zone and inform the community that only structures in that zone are eligible. Concentrating the acquired open space in a single, high-priority area can eliminate risk from an entire neighborhood, reducing damage to utilities and access roads, and minimizing potential needs for evacuation and rescue from the zone, rather than incremental reduction to many different parts of the municipality. Even so, there are many more properties in the zone than could be acquired using funding expected to be available; at the current rate of progress, it is estimated to be 100 to 200 years before all properties in that zone would be acquired.

A valuable function is provided by Lycoming County Department of Planning and Community Development, which conducts audits on a 2-year cycle to visually inspect the acquired properties in all municipalities and verify they remain open space. It appears to be rare,
but not unheard of, for unauthorized structures to be built on designated open-space, municipal-owned properties. The County audits are invaluable in identifying and removing those violations.

Several small hydrologic improvements are under way and are more or less routine. Improving stream channels, raising low bridges, and removing debris from channels can be helpful in avoiding inundation by increasing stream capacity at “choke points” to accommodate flows from small to moderate high precipitation events. Those measures are of limited or no use for the larger, 1% floods, which overflow all channels and occupy the full floodplain; in fact, debris are routinely mobilized by larger floods, creating their own ‘choke points’ from the large rubble they carry and deposit in the channels. Debris clearing activities are funded with Commonwealth and federal sources, as well as County and municipal funds: Muncy has received grants from the Pennsylvania Department of Conservation and Natural Resources, the Department of Community and Economic Development, and others. Effective oversight and construction by Borough and County agencies has targeted these efforts at points on Muncy Creek and smaller tributaries that will increase the size of the storm they can handle without backing up and flooding neighborhoods.

The Borough reports its most vexing problem is the large amount of housing, and some commercial structures, that can be termed “just barely in” the floodplain: that is, they occupy land that receives a few inches to as much as 1 foot of flood waters at the highest extent of the 1% flood. Those structures fall clearly within FEMA guidelines requiring their owners to pay NFIP flood rates, but the inundation of a few inches – while enough to damage property – is a minimal threat to public safety (people can walk away). The resulting damage does not destroy structures, triggers relatively modest renovations, and leads to small NFIP claims. Those structures are very tricky to flood-proof for engineering reasons; the structures are of modest property value, represent important community resources as housing for middle-class families
that have occupied them since they were built 50 to 100 years ago, and the value of any effective flood-proofing often exceeds the value of the property. The cost to elevate a structure is extensive (estimated at $30K to $60K), and the cost lies largely in the act of initiating elevation – raising a structure by a few inches costs nearly as much as raising by multiple feet, because the act of installing equipment and constructing new foundations is nearly the same regardless of the amount by which it is raised. As a result, the Borough has made only limited use of flood-hardening for grants and programs under FEMA such as elevating structures (no examples in Muncy) or promoting homeowners to elevate their utilities (a modest grant in the past 10 years led to a few homes doing this). No incentives would promote that kind of flood-hardening under NFIP or other federal or Commonwealth programs: insurance rates decline only if extensive, costly actions are completed, and no financial gains are made for limited, incremental improvements, even though such improvements would reduce damage and improve safety.

Two examples illustrate Muncy’s approach. One multi-family development constructed in the early 2000s is on land where the uphill end is outside the floodplain but the downhill portion is within the floodplain. In an example of encouraging careful development in the floodplain, code officers approved a design such that the downhill portion has its first occupied stories at the same elevation as the uphill portion, with parking in part of the structure designed to accept flow-through of floodwaters and withstand any damage.
A multi-family residential development, constructed in the 2000s, with part of the parcel within the 1% floodplain. Units at uphill end (left photo, right side) have entrances and first occupied floor at street level, outside the floodplain; units toward downhill with progressively higher entrances; the lowest end has garages with floodwater vents below occupied floors, keeping all occupied space above floodplain. This design complies with floodplain ordinances permitting new residences in floodplains only with verified flood-proofing.

A second example illustrates Muncy’s approach. The County Historical Society created guidelines for historic buildings that accept renovation of historical structures with materials that visually approximate original, historic materials – a flexibility that would not be accepted under the National Register of Historic Places, so locally-important historic structures do not seek that designation can be designated by the County. The Muncy Historical Society and Museum occupies a 200-year-old structure within the floodplain; the shingles are a plastic material and the renovated foundation is of modern materials resistant to water damage. The character of historic properties is preserved, and the ability of the buildings to resist flood damage is enhanced.

County Programs: Integration and Support for Municipalities

Lycoming County is intensely active in supporting, coordinating, and to some extent funding municipalities’ flood-control activities. The Lycoming County Department of Planning and Community Development supports Muncy, and other county municipalities, with GIS mapping and information, allowing careful analysis of which properties and which buildings lie in the designated 1% floodplain. The County also supports communities with public-information outreach materials, and assists with recordkeeping for those items that can effectively be kept centrally rather than onsite at municipalities. The County provides active, hands-on guidance about zoning, code enforcement, and potential mitigation activities, providing expertise that would be difficult for individual municipalities to create on their own. The County actively participates in forecasting, early-warning systems, and emergency preparedness, supplementing individual municipalities’ efforts. County personnel function as a ‘champion’ for flood issues, bringing flood mitigation to a higher degree of visibility and priority than in many other counties.
Integration of Commonwealth and Federal Programs

Muncy does not participate in FEMA’s CRS program, finding that the resources for application, reporting, and routine paperwork are too burdensome for the Borough. On the other hand, the Borough – like many other Lycoming County municipalities – does implement many of the activities promoted by CRS. One feature identified by Borough and County personnel is that participation in CRS is strictly an agreement between FEMA and each individual community; communities receive CRS credit for outreach, recordkeeping, and planning only if the municipality itself conducts those activities and holds records on their sites. The County Department of Planning and Community Development currently conducts many of these activities, gaining the flood-mitigation benefit for its municipalities, but not gaining CRS credit for so doing. Thus it benefits only indirectly from this particular federal program, and fails to attain one crucial benefit – reduced insurance rates.

In some respects, Lycoming County’s active participation in flood mitigation can be seen as attaining the objectives of FEMA’s CRS program, as municipalities are guided and supported in implementing effective planning and outreach, and certainly makes use of federal pamphlets, informational materials, and community-meeting planning and involvement. To some extent the County’s activities are, in turn, driven by PEMA’s County Hazard Mitigation Plan system: the County’s Department of Planning and Community Development leads the development of the plans on their five-year cycle, the most recent being adopted in 2015.

Counties that actively encourage their municipalities to participate in preparation of the Hazard Mitigation Plans, and that promote municipalities’ taking actions outlined in the Plan, can effectively use the Plan process for real on-the-ground improvements, and Lycoming County makes the most of this process. These activities do not, of course, fully substitute for
participation in CRS, because only CRS participation prompts FEMA to reduce insurance
premium rates for NFIP purchasers within the participating municipality.

4.4.3.2 Borough of Jersey Shore, Lycoming County

Geographic and Demographic Setting; Flood History and Impacts

The Borough of Jersey Shore is directly on the Susquehanna River, not far downstream
from where it exits the Allegheny Plateau from the west and enters the broader riverine
floodplain toward the east. (The river actually flows north as it passes through Jersey Shore.) The
Borough occupies a geological ‘pinch point’ formed by plateaus to the west, north, and south;
runoff from major storm events reaches the lower-lying Susquehanna from all three directions,
including the large watershed of the upper Susquehanna from the west. Jersey Shore occupies the
same county, Lycoming County, as another case study in this report, the Borough of Muncy, but
it is starkly different in many ways and provides further instructive information about
Pennsylvania’s small municipalities. While Muncy, described above, is in a relatively open plain
where floodwaters tend to rise slowly and tend to remain at lower flow velocities, Jersey Shore
lies where the Susquehanna River exits the Plateau region from the west with steep, narrow
channels, so that floodwaters can rise quickly and enter the region with high velocity.

Demographically Jersey Shore is very different from Muncy also: Jersey Shore constitutes the
largest population center in the vicinity, surrounded by townships of even smaller populations
(but with space to keep development out of the floodplain), and far enough from Williamsport to
largely miss the economic activity of that city.

Jersey Shore demographics are typical of many of the smaller boroughs. Its population,
ever large, peaked about 1960 at 6,000; its population and economic activities have contracted
since that time. Population in 2016 is approximately 4,500 people. It is also typical of the river-
valley boroughs with much of its development in the floodplain. Incorporated in 1826, the
Borough’s early growth came from lumber milling and shipping that required river access. Today, 100% of the historic district lies in the floodplain of either the Susquehanna River or Pine Creek. Later industrial activity included a sizable steel mill and a regional railroad hub.

Jersey Shore was among the hardest-hit of any communities by the flooding caused by Tropical Storm Agnes in June 1972. In the period of recovery after Agnes, Jersey Shore accepted substantial federal funding from the U.S. Department of Housing and Urban Development to acquire or redevelop much of the central business district, including demolition of about 13 major structures. This deeply impacted the historic district, which is today characterized by stand-alone buildings and small city blocks of historic structures interspersed with open spaces: parking lots, small center-city parks and empty lots.

![Fig. 6: Borough of Jersey Shore](image)

*Main St with historic building block end and open spaces formerly occupied by historic buildings, demolished in recovery from Agnes flooding in 1972. Susquehanna River to photographer’s rear. Photo by L. Donald Duke.*

**Institutions with Major Flood Mitigation Responsibilities**

In a fashion typical of some smaller municipalities, multiple institutions are well-integrated simply because a limited number of personnel conduct all duties. Often the same individuals have multiple responsibilities, and so the integration of offices and activities occurs with a single individual. Here, the Borough’s long-standing mayor has important responsibilities in emergency response, along with multiple other official duties. In such cases, a line of
succession can be crucial, because the loss or retirement of a single person can also mean the loss of much of the institutional memory and practical knowledge upon which the community relies.

*Current Main Flood Mitigation Strategies; Future Directions/Anticipated Challenges*

Jersey Shore does not actively promote acquisition of at-risk properties in the floodplain because economic activity is so starkly limited in the central business district and surrounding historic residential areas, which are entirely in the floodplain. Elevating those buildings above flood level is also not a goal, as agency staff note that the required elevation would be extensive and costly: the 30-year flood level is some 20 feet above grade in most of the historic center.

Efforts focus instead on what may be termed ‘survivability’ of remaining buildings. For example, City Hall is located in an older historic building where all civic operations and record-keeping have been moved to the second floor. That approach has been applied to all major Borough buildings and emergency-service providers. Some private structures also have been renovated: one large private apartment building, occupying a 2-story 1950s-vintage brick former school building, has been hardened by elevating utilities and by an ingenious design to plumb the building’s basement into the storm drain system. Any backups from the river that would flood the Borough will first flood the building’s basement (considered unoccupied). Pre-flooding the basement creates static water pressure inside the basement to counter the inward forces of floodwaters from the surface, which is considered the greatest threat to structures like this.

The Borough’s current efforts for private properties focus on code enforcement, building permits, and informal Borough procedures to actively encourage private property owners to move utilities to a height above the projected 100 year flood. That will substantially reduce financial damage to structures in event of a flood. Borough staff express the opinion that buildings remaining buildings in the floodplain have proven sturdy enough to survive floods,
having experienced multiple inundations over their lifespans. Therefore, they are likely to remain structurally sound indefinitely with appropriate maintenance and improvement activities.

Substantial areas of emphasis include readiness for an emergency and response authority during an emergency. Floodplain managers and code officers work closely with emergency programs, with many activities funneled through the mayor’s office. Many of the preparation activities have been designed and modified effectively owing to a familiarity with the kind of actions, concerns, and past problems that arise during an emergency response. The program to make structures survivable rather than remove them from the floodplain is accompanied by extensive planning and procedures for public safety, including preparedness and early-warning systems so that precautions may be taken early enough in a flood event that residents may be evacuated or guided to shelter-in-place.

The Borough has not sought or received funding under FEMA’s Pre-Disaster Mitigation process over the past decade. Acquisition of properties is not a high priority to the Borough: the extensive loss of taxpaying businesses and homes from the 1972 Agnes flooding left a hollowed-out business district and historic district. The Borough chooses not to promote or participate in acquisition of other at-risk properties. Instead it uses various tools to encourage property owners to remain by flood-hardening in place of removing structures.

County Programs: Integration and Support for Municipalities

Although Jersey Shore is covered by Lycoming County’s County Hazard Mitigation Plan, the Borough did not actively participate in the planning process but did adopt the Plan. Jersey Shore’s location on the far western tip of Lycoming County makes it difficult to be included in the kind of integrated floodplain management that characterizes County activities. The County’s eastern half experiences most of its economic growth (around the City of Williamsport). This area includes many municipalities with a greater dollar value of pre-existing developments in the
floodplains; the powerful burden of serving many interests leads to a perception in Jersey Shore that County activities tend to neglect them. Consultations with County staff early in this project showed that the County does indeed hold deep concern for Jersey Shore: in fact, its inclusion in this project resulted from a County recommendation, in the recognition that Jersey Shore is a particularly difficult situation and the County would like to assist in any way possible.

Integration of Commonwealth and Federal Programs

Jersey Shore participates in FEMA’s Community Rating System program at level 8 classification earning its residents a 10% discount on their flood insurance premiums. The Mayor is also the floodplain manager and directs emergency services. A previous Borough employee took the initiative to complete the CRS applications; the current Mayor supervises staff through required recordkeeping and actions to maintain the Level 8 status. The overriding reason is the reduction in NFIP premiums for which Borough residents are eligible; residents are seen as bearing substantial costs of flood mitigation, not only through insurance but a long-standing burden to the business district and residential neighborhoods. The Borough’s attitude is to support residents in all possible ways, so spends time and effort on the CRS program.

Jersey Shore staff share the observation, as do other case study personnel, that many CRS activities would be more cost-efficient if they were shared among multiple municipalities: many Pennsylvania communities simply do not have enough day-to-day needs to justify a full-time person, yet the task requires skills, longevity, and knowledge that are not well suited to part-time or consulting arrangements. FEMA has declined repeated entreaties by Lycoming County agencies to allow County activities to earn points for multiple municipalities: public-outreach mailings and meetings, floodplain mapping services, record keeping, and others activities could benefit from economies of scale. However, FEMA requires activities be performed and recorded by individual municipalities, not County agencies, except for areas with unincorporated land.
That approach is well-suited to states where counties directly govern large populations in “unincorporated” areas, side by side with a modest number of larger cities in each county. But in Pennsylvania there is no unincorporated territory; all land is governed by a city, borough, or township, many of which are small with populations 5,000 to 10,000 or less. The requirement that boroughs and townships deal directly with FEMA is extraordinarily more burdensome on Pennsylvania’s residents than on states where counties govern unincorporated land.

To counter some of these disadvantages, Pennsylvania municipalities can take advantage of CRS users’ groups, where they can share information and recommendations. FEMA does not permit these groups to conduct business on behalf of the municipalities, but some boroughs and townships are considering forming coalitions so that several municipalities can share the services of a single full-time specialist, who can conduct CRS business on-site at each municipality. The Borough has few natural partners in CRS efforts, as it is not contiguous with other Lycoming County municipalities of the Susquehanna River floodplain, and its surrounding townships have little or no development in their floodplains and do not need CRS. The nearby townships experienced their economic growth in recent decades when floodplain regulation guided their structures to be either outside the floodplain or successfully elevated or hardened to avoid flood damage. Instead, Borough staff are exploring potential collaboration with municipalities of nearby Centre County, geographically more interrelated, but imposing the barrier of cross-County collaboration, a powerful barrier in Pennsylvania’s home-rule regulatory system.

4.4.3.3 Borough of Etna, Allegheny County

Geographic and Demographic Setting; Flood History and Impacts

Etna is a small borough just outside Pittsburgh in Allegheny County. Founded in the 1860s as a steel mill town, it was named symbolically for a volcano and served by the deep water transport on the Allegheny River. Etna’s population boomed from zero to about 5,000 around
1900 with the demand for steel, and peaked in the 1930s at about 7,500 people. Regionally, steel manufacturing declined after the 1940s; Etna’s population declined as well to about 3,500. It continues to be a working-class community, with about 51% low to moderate income families. Other Allegheny County municipalities draw newer development designed for higher-income commuter residents because they have more developable land that can accommodate more expansive land uses.

Etna is not a rural community per se: it exists in an urbanized location, within a densely developed county, and on the edge of Pittsburgh with decidedly metropolitan land uses and developed to serve a major industrial center. However, there is much about Etna’s small-community status that is instructive to this report: its present population is the smallest of any boroughs in this case study, its employment is provided by local small businesses and commercial activities, and it faces land use problems highly typical of historically-dense, declining-population boroughs across Pennsylvania. It was included here as a case study because it is one of the few CRS participants in Pennsylvania, and its flood-mitigation activities are influenced by – that is to say, sharply limited by– the jurisdictional boundary problems typical of so many boroughs and townships in Pennsylvania.

Etna experiences flooding most commonly from local waterways draining the steep hillsides to its west, north, and east, and sometimes from the Allegheny River, bordering Etna to the south. Allegheny River floods are infrequent and truly large-scale precipitation or snowmelt events in the Allegheny watershed. For example, the Allegheny flooded 1995, when an ice jam downstream caused the river to back up. Damage were largely confined to the industrial, warehouse, and port district along the river, which remains a major transportation route. Companies in this area are prepared to pay high insurance and recover from this kind of event.
More often flood damage occur from Little Pine Creek and, to a lesser extent, from smaller creeks and drainages, when they overflow with runoff from steep ridges to the northwest, north, and northeast. These are small catchments, largely outside Borough limits, where local heavy rainfall causes the creeks to rise rapidly, discharge quickly downhill, and overflow their banks where Etna occupies the low, flat ground of the river’s ancient floodplain. Currently about 500 structures are within Etna’s Special Flood Hazard Area. The surrounding townships, on steeper ground or atop the hillsides, commonly receive little or no inundation. Numerous smaller, localized flood events occur when short bursts of heavy rainfall raise the creeks to capacity and spill out of the limited storm drainage system, constructed in previous decades when uphill land use was open space that better absorbed rainfall into the soils. The suburban nature of Etna’s modern existence is a double-edged sword: it allows the Borough to hold enough population and service businesses to stay solvent, but has driven most of the newer development to adjacent uphill areas. Paving and other impervious surfaces uphill from Etna leads to greater peak runoff downhill to Etna’s storm system, which is not sized to accommodate the increased flows.

Three major floods in the past 50 years caused substantial damage in Etna around Little Pine Creek. First, Tropical Storm Agnes in 1972 impacted this area. In 1986, local high rainfall on the Allegheny County ridges caused Little Pine Creek to rise, inundating most of the SFHA to depths of a few inches (and “just covering the rugs” of the Borough municipal building). In 2004, Hurricane Ivan devastated Allegheny County, along with other parts of Pennsylvania; Etna was among the very hardest hit. Some 400 homes in Etna flooded, or about 25% of the community; 200 of those had floodwaters reaching as high as the first floor of the structure. Borough personnel report with intense gratitude that the City of Pittsburgh, and many other nearby municipalities, loaned workers, trucks, and other equipment to “help dig out Etna” from its substantial damage and help meet near-term recovery needs. FEMA provided disaster relief.
Institutions with Major Flood Mitigation Responsibilities

Etna’s flood management takes front and center among the Borough’s many concerns, in part because the Borough Manager currently serves as the certified floodplain manager and takes the lead in the Borough’s CRS activities. The Borough’s flood mitigation efforts are closely tied with the Emergency Management Agency, which also reports to the Borough Manager. The Manager is a strong central figure with many roles; this person pulls together resources from multiple sources to attain multi-purpose activities, most emphatically including flood mitigation activities. The overall strategy is one of pursuing multiple smaller or medium-sized activities, most serving multiple purposes, and seeking funding support from FEMA, PEMA, and other federal and Commonwealth agencies wherever possible.

Current Main Flood Mitigation Strategies; Future Directions/Anticipated Challenges

Etna’s multidimensional flood mitigation activities can be grouped into 5 general areas:

A. CRS as a means to reduce NFIP premium costs to policyholders, and to take advantage of the full suite of public outreach, community improvement, and mitigation activities
B. Ordinances, zoning, and code enforcement to restrict / manage structures in the SHFA
C. Land use changes for stormwater management and reducing runoff
D. Stream channel management / stormwater drainage improvement
E. Municipal facilities management

CRS is a centerpiece of Etna’s flood strategies. Etna uses CRS guidance as a template for many of its activities, and implements it more thoroughly than most rural Pennsylvania municipalities. Other case study communities participating in the CRS program, along with many of the other 28 Pennsylvania participants have reached level 8 or 9; they find this is the limit given their sharply limited financial and institutional resources. As of summer 2016, Etna
was at level 8 with plans to improve; the Borough was reportedly “115 points away from a 7,” a very short distance in CRS’s point system. As of May 2017, Etna earned a CRS rating of 7, which provides a 15% discount on individual flood insurance.

The Borough sees the main purpose of CRS as a way “to provide some assistance to our residents who are in the floodplain,” i.e. to reduce NFIP premiums to the extent possible. Staff notes that nearly 1/3 of the properties in the Borough lie in the Special Flood Hazard Area, and that encouraging those property owners to purchase NFIP policies is a basic tenet. Borough efforts toward CRS are seen as having direct financial value to those property owners, and an effort the Borough is obliged to make. Etna staff also recognize the advantages in CRS-listed activities at reducing flood damage; they approve of providing mitigation measures “over and above the basic levels of safety, preparation, and education” as promoted by CRS. One Borough staff member reports being “amazed at how well our residents have received that” – i.e., residents who do not live in the floodplain are among those who support use of borough time and resources to mitigate damage for those who do occupy the floodplain.

The Floodplain Management and Stormwater Ordinances allow for variances to permit new structures in the floodplain, not an outright prohibition of any new structures. Land-use zoning consistent with the floodplain ordinance was adopted in December 2015. Those variances are not often requested, largely because the Borough is nearly fully built-out and few new permits are requested; those requested tend not to be in the SFHA. Engineering permit review is conducted by a contractor, not a Borough department, but Borough agencies oversee the review and instruct the contractor to conduct rigorous review to meet floodplain requirements. Most years see few or no such requests, and the Borough “has not given any” in the past several years.

The zoning and building codes under the Stormwater Ordinance are used to encourage structures, and their grounds, to reduce stormwater runoff, as described below. Permits for
structures outside the SFHA are reviewed for compliance with the stormwater and floodplain management ordinances: “both are above and beyond what is required.” This helps reduce runoff and mitigate flood damage should any structure be constructed in the floodplain. However, it has the downside that compliance with these rigorous regulations is a burden faced by any new construction in the floodplain. It also discourages remodeling or removal of older structures, especially in the SFHA, on the grounds that a property owner who chooses to tear down will need to spend substantially more to replace that structure. Rigorous implementation of the ordinances has the effect of resisting the kind of changeover and modernization that would reduce flood impacts. Outside funding for flood-proofing could overcome that obstacle, but staff report that FEMA funds are rarely provided for this purpose because the Borough has 15 to 20 repetitive-loss properties (in a county with one of the largest numbers in Pennsylvania, with over 350 RL properties), Borough personnel perceive that FEMA’s funding interest is to emphasize acquisition and demolition, rather than mitigation of this kind.

As an example, one large commercial structure, a restaurant/club near the Pine Creek channel, formerly did very strong business but has been vacant since incurring damage in 2004 from Hurricane Ivan. The owners sought permits to rehabilitate and renovate the structure, but renovations would exceed 50% of the structure’s assessed value, so would trigger the more rigorous flood mitigation measures and add substantially to the cost of renovation; renovations were not undertaken. The owners considered acquiring FEMA funding for acquisition by the Borough and demolition, and began negotiations. The Borough planned to make the location a green space, or possibly a retention basin, as it is immediately adjacent to the creek. The owners did not approve of the amount of funding offered by FEMA, and found the application and approval process to be burdensome, so elected to call off negotiations, decline the funding, and hold the property pending some future remodel, presumably hoping for more favorable
conditions from the Borough. The Borough stands by its position that it does not have funds to acquire the property absent FEMA funding, nor to support flood-hardening that would comply with the floodplain ordinance. The building, still vacant, provides no revenue or service to the community, and stands as a potential hazard should future flooding damage it further. If it is acquired by the Borough as an abandoned property, there will be no FEMA funds for its acquisition, and demolition of the structure will be an expense borne by the Borough, accompanied by loss of tax revenue and economic base from that former business.

**Stormwater improvements** are a Borough priority as a means to reduce impacts on its often-overloaded storm drain system. The Borough has a combined stormwater-sewage system, so improvements to drainage in a way that reduces stormwater flowing into drains has the two important missions of reducing inundation from stormwater, and reducing water quality impacts from potential wet-weather overflows of the sanitary sewage. Localized flooding from storm drain overflows is experienced frequently in Etna, typically several times in a given year.

The Borough has undertaken many kinds of activities, many of which contribute relatively little by themselves, but in aggregate can make a powerful difference in peak flow. The Stormwater Ordinance, mentioned above, requires new developments to actively reduce runoff. Public buildings are held to the same high standards, where runoff post construction is required to be no greater than the runoff before the structure was built. Additional public projects are foreseen in the Borough’s Green Master Plan, adopted in 2014, which includes plans for 25 projects on Borough land that would reduce stormwater runoff.

Some of these projects have been constructed. The Borough acquired a parking lot near the central business district and modified it to create a large infiltration bed and rain garden: all flow from the parking lot is captured, directed through the garden, and infiltrated into the soil rather than running off, reducing storm drain burden to nearly zero in most rain events. In the
summer of 2017, the Borough installed a rain park on a site where years previously the Borough had acquired an abandoned hotel. As part of this, the Borough converted the former hotel to a rain park, with substantial infiltration capacity. The block was thoroughly “streetscaped” to promote infiltration: structures’ roof downspouts were disconnected from the storm drains, and directed toward multiple small green spaces leading to a block-long infiltration system. That project had a total cost of about $550,000, partially funded by a grant from the Pennsylvania Department of Community and Economic Development under its “Growing Greener” grants program. Etna staff report that essentially any Borough construction, and any permit filed by private entities, is examined to identify any possibilities for reducing runoff.

These attempts to reduce runoff are, of course, limited to activities within the Borough. Pine Creek has a drainage area of about 67 acres, not large, but Etna encompasses only 0.5 acres of that area. Staff noted that “we are at the bottom of the watershed.” Flooding is experienced in Etna, but any efforts to reduce flows would need to be made upstream; other municipalities through which the creek flows have no incentive to reduce runoff as their drainages are steep and flooding does not occur within their borders. The small scale of Pennsylvania municipalities, especially the historic boroughs (Etna encompasses less than 1 square mile), is a major barrier to any watershed-scale planning: uphill jurisdictions have little incentive to spend any funds on stormwater infiltration, because damage occur outside their jurisdiction. Taxpayers in upstream municipalities would not find it a good use of their limited tax dollars to implement flood control/stormwater flow reduction measures that do not benefit those taxpayers. A multi-lateral collaboration agreement would be able to drive improvements, but Pennsylvania’s borough-and-township structure provides disincentives to that kind of collaboration by creating municipal boundaries that cut most watersheds into multiple jurisdictions that do not share budgets, taxation authority, or agency staff with flood-mitigation responsibilities.
Stream channel/drainage improvements are another means to reduce creek flooding, as well as removing potential choke points of low-lying bridges and overpasses that can lead to backups in heavy flows. After the 1972 flooding, the U.S. Army Corps of Engineers completed a small project on West Little Pine Creek to build barrier walls that would hold back a modest sized flood. In 1986, those walls successfully prevented flooding in a specific neighborhood of about 15 homes; however, other parts of the Borough still experienced flooding. As of 2017, those walls are not certified as effective by current USACE standards, so the neighborhood is not considered to be protected, and NFIP rates scale accordingly for structures in that neighborhood (i.e., as located in floodplain). When those rates increased, several homeowners sold their homes rather than bear the burden of sharply increased flood insurance, and several homes remain vacant. Siltation basin on that same branch assists in keeping downstream channels at full flow capacity; the Borough conducts maintenance and silt removal from that basin. About $2 million of funding has been spent for stream restoration, improving Pine Creek’s ability to convey water.

A choke point that has backed up flows on Pine Creek is a group of three bridges where a main arterial road, a second road, and a railroad cross the Creek. The bridges are low above the water and back up flows when the creek rises, exacerbating flooding in an adjacent commercial/residential district. The bridges’ design reportedly do not provide openings to accommodate even a 10%-probability flood; they backup water whenever Pine Creek experiences high flow events. The Borough acquired a grant from the Pennsylvania Department of Environmental Protection to share costs with the Allegheny Valley Railroad Company to raise the height of its bridge by 18 inches, increasing flow capacity of that part of the stream. Another of the trio of bridge, carrying a State road and owned by PennDOT, bridge was also raised some 18 inches. The third bridge, the most upstream one, was not modified, but ‘debris poles’ were installed upstream in the channel, in attempt to reduce clogging at the bridge pilings.
The floodplain ordinance specifies that property owners near the creek not store items that could be washed away by flooding. Etna strongly enforces these requirements, but is not in a position to determine if they are enforced by upstream communities. A serious problem arises if that storage entails hazardous materials, small fuel tanks, and other materials that can cause harm downstream if they break lose, so enforcement of this restriction is crucial.

Lack of ability to manage on a regional level, even a scale large enough to encompass a 67-acre watershed, seriously limits efforts to mitigate flooding at the Borough. Bilateral work by Etna with some nearby townships has led to some individual projects, including accepting wastewater for treatment at Etna plant in return for reducing stormwater entering the flows, leading to mutual improvements for both parties. The municipalities themselves identified and formed these agreements, because no regional authority exists to promote them.

Retrofit of Borough facilities has been important. Flooding from Ivan caused damage throughout the community, including to the main historic, retrofitted structure that serves as Borough offices (including the police and fire departments). Evacuation of Borough hall is a strenuous task: it requires moving Borough records and equipment; relocating fire equipment in a way that remains ready for potential emergency needs; and relocating the police department, including securing its stores of guns and ammunition to avoid a threat to public safety. After Hurricane Ivan in 2004, three borough employees spent a 13-hour nonstop session sorting wet, contaminated documents to identify those needed to replace, those in condition where they could be dried out and kept, and those to discard. Vulnerability of important records is a serious concern for the Borough. For other events, such as in preparation for projected heavy rains from storm Sandy in 2012, employees were called for emergency duty simply to move documents from the potentially vulnerable Borough building (before its recent floodproofing) to temporary safe locations – a dislocation that reportedly disrupted normal activities for a period of weeks.
Federal and Commonwealth practices address damage claims to public property as a rule not through insurance, but through disaster-relief funds provided to FEMA by Congress. Damage claims were paid to the Borough to recover from Ivan expenses, but FEMA was reluctant to pay for repairing and upgrading the Borough offices; FEMA guidance suggests the Borough should instead relocate its critical functions outside the SFHA. Borough personnel report no location is available that would not require obtaining land (at high cost) from an existing landowner because the Borough is fully built-out other than locations that are in the floodplain. FEMA offered grants of up to $390,000 to relocate the municipal building, and to find other locations in the community for fire and police services, which the Borough estimated would cost about $750,000. Borough resources were not adequate to make up the difference, so the services were not moved. Investigation of elevating all services similarly proved costly, largely because street access is needed for emergency vehicles; this “second-best” option was also not implemented.

Instead the building was flood-proofed: adding waterproofing to first-floor windows and doors in the municipal building, elevating utilities, and moving archived records to other municipal buildings. These measures are intended to keep water outside the building if it is partially inundated, and to remove certain critical functions (records not used on a daily basis) from the potentially inundated structure. The Borough uses this experience to point out that similar flood-proofing for the 500-some Etna residences in the SFHA might be accomplished for funds in the vicinity of $10- $15,000 per structure, a factor of 5% to 10% of the cost per structure for acquisition. Residents could remain in the Borough and the Borough could keep its tax base, and historic core, intact. FEMA prefers acquisition, which permanently removes the risk of damage and the emergency safety risk to human lives. The choice is a stark one.

*Acquisition* is not seen as an effective strategy. Borough personnel report that FEMA personnel have encouraged that kind of mitigation, offering assistance with funding and
promoting acquisition of RL and SRL structures; but the Borough notes FEMA funding would allow acquisition of “maybe two houses per year,” “at most 5-6 homes” in a year when the Borough applied all its resources to that program versus the approximately 500 residences in the floodplain. That remedy would be too slow to make much difference except in the long term.

**County Programs: Integration and Support for Municipalities**

Etna participated in the Allegheny County Hazard Mitigation Plan, last updated in 2015. Etna participated in meetings and submitted projects “for our community” to be considered as action items. In a previous cycle, one of those specified actions was the Borough building flood-proofing, which had been in the planning stages since the 2004 Ivan flood; the Borough credits its appearance in the Hazard Mitigation Plan as documentation that helped acquire funding for that project. That is an example of how the County’s implementation of the Commonwealth’s Hazard Mitigation Planning is useful in prioritizing and gaining traction for community needs.

Etna staff reports little other interaction with County organizations. The large scale of problems throughout Allegheny County, including in densely populated regions around Pittsburgh and multiple urban areas in vicinity, makes this Borough feel distinctly small and rural in character, even though it is considered fully built-out.

The Borough would like to see the County, or some other organization, take the lead in identifying and promoting cross-jurisdictional solutions such as those requiring work in “uphill communities” that would benefit Etna. In 2008, the local Council of Governments adopted a “Multi-Municipality Stormwater Management Ordinance,” an activity where Etna personnel attended meetings and participated in organizing. With a “water is regional” slogan, the ordinance is unified across all participating municipalities, and includes provisions such as stream maintenance, storm drainage reduction, and creekside development buffers. Etna
identifies this as a useful tool, but one which did not include all available actions; to gain agreement, the uniform actions are not very aggressive.

Integration of Commonwealth and Federal Programs

Etna is a strong advocate of the NFIP’s CRS program. The Borough reports that information received through CRS is highly valuable; the Borough extensively uses the CRS outreach and public-information materials. Borough staff also use CRS information as a tool to help demonstrate for the Borough Council the importance of investment in multiple activities. As an example, staff noted that “we had the example floodplain ordinance in place earlier than a lot of other communities in the County.” The Borough also adopted some floodplain management with higher standards than the PEMA-mandated minimum, including prohibiting any new structures in the floodplain. On the downside, staff noted that “CRS is a TON of work” – the application and compliance materials are a major burden on the Borough’s small staff.

Roads and highways have impacted land use and stormwater runoff. In this area, multiple lanes convey traffic toward and away from the Pittsburgh metropolitan area, including arterials and limited-access Interstate routes. As a result of the highway projects, the Borough has lost about 400 homes and multiple businesses since the 1960s; that regional project was beyond the control of the Borough, which bore substantial costs. Projects to improve highways, and accommodate traffic, are evaluated by each municipality per its own needs and issues; there is not a mechanism to address on a watershed-scale basis in ways that might optimize runoff and land uses effectively for the entire route. The highways continue to be widened and expanded, include repaving by PennDOT of a 6-lane arterial, and road-widening work on several routes in the community. Runoff for these is channeled locally, and adds to the stormwater burden on Etna’s system. The Borough does not find a means of communicating, or negotiating, with federal and State agencies about the flooding impacts of these structures.
4.4.3.4 Borough of Downingtown, Chester County

Geographic and Demographic Setting; Flood History and Impacts

Downingtown, Chester County, is an historic, long-established borough, an industrial center from its earliest beginnings. It was a favorable site for watermills on the East Branch of Brandywine Creek, known as Milltown in the 1720s because of the number of mills. Some mills began making paper in the early 18th century; papermaking continued as a major manufacturing activity through the 1950s. The historic center grew up around Brandywine Creek and two small channels, known as Beaver Creek and Parke Run, which enter the Brandywine near the center of present-day Downingtown. The Borough reached a population of about 7,500 by 1970, and has continued to grow modestly since, reaching nearly 8,000 by 2015. Even as manufacturing declined, Downingtown has seen modest residential growth as a commuter suburb because it is located on the fringes of the greater Philadelphia metropolitan area, with the Philadelphia city center less than 35 miles to the east.

The Borough stretches east-west along Lancaster Avenue, which since the 19th century has been the major route known as Lincoln Highway. This was constructed through the “Great Valley” that formed the Main Line for road and rail transportation from Philadelphia to Lancaster, Harrisburg, and westward. Commercial and residential development of the 19th and 20th century generally followed that route, with many structures removed and renovated throughout that period; the remaining historic district consists of some 30 buildings on the National Historic Register in this sector, plus a few scattered buildings that survive elsewhere in the Borough. That broad, flat valley also serves as a floodplain where high flows from the southward-flowing Brandywine find space to spread from their channel, inundating the developed areas, and backing up the smaller channels such as Beaver Creek that drain the valley from east and west. The more recent alignment of US Route 30 functions as a bypass to the
Borough. The most desirable development now is outside Borough boundaries along the higher-speed route. As was common with borough and township layout from the 18th and 19th centuries, Downingtown covers only about 2.2 mi² in area, with fewer people, but far fewer square miles, than its more recently-growing neighbor West Whiteland Township (Section 4.4.3.7).

**Institutions with Major Flood Mitigation Responsibilities**

Flood mitigation efforts in the Borough are led by a small number of personnel, many ‘wearing two hats’ as they fill multiple positions on the Borough’s organization charts, a strategy followed by many of Pennsylvania’s smaller municipalities. As of summer 2016, Downingtown’s Code Enforcement Officer was also an Emergency Management staff member and had been appointed Floodplain Manager after undertaking training in floodplain management – three roles of utmost importance to flood mitigation efforts. (At that time, the same individual also headed the Borough’s recycling program and was temporarily serving as Fire Marshall). The City Engineer also works closely with this person; the Engineer oversees maintenance and improvements for public facilities. Important aspects for flood control include storm drains, which need to be sized to avoid backing up in heavy precipitation, and bridges, streambanks, and channels of streams that flow through the Borough, which need to be adjusted to avoid ‘choke points’ that can back up floodwaters originating upstream.

Downingtown adopted a floodplain ordinance in 2011 consistent with the model ordinance supplied by NFIP. Soon after, FEMA conducted a Compliance Assessment Visit and identified a number of violations in NFIP requirements, including buildings not meeting codes, municipal facilities in need of improvements, and others. The Borough actively worked to correct those violations and received its letter of good standing from FEMA in 2014; the Borough revised its ordinance in 2017.
Current Main Flood Mitigation Strategies; Future Directions/Anticipated Challenges

Downingtown’s position could be said to be an attempt to do as much as possible in a difficult situation with limited resources, such as code enforcement; revision and improvement of relevant ordinances; and other day-to-day measures. Several more-intensive needs are identified (stream improvements, neighborhood improvements), and these are considered incrementally as funds become available, including from County, Commonwealth, and federal programs.

Public outreach programs are pursued. For example, the Borough sent 164 letters to property owners notifying them that they are now within the 1% floodplain in 2016. This resulted from updated mapping that increased the area now within the Special Flood Hazard Area. The Borough held a public meeting: 25 people attended, a small portion of those affected.

The floodplain management ordinance directs any new development outside of the floodplain; however, new development within the floodplain is expected to be at or near zero. Downingtown’s Comprehensive Plan identified the Borough as having achieved its maximum density buildout, so no open space is available for new development. Any new commercial or residential activity must remodel or demolition/replace existing structures. Because the Borough would very much like to encourage any such new development, it does not prohibit new structures of this kind, but instead signals its readiness to work with property owners to implement acceptable flood-hardening. This is usually consists of elevating the structure so that the first occupied floor is higher than the 1% flood level. In practice, this is infrequently seen in Downingtown: within the memory of current staff, not one existing building has been elevated with FEMA funding or to meet FEMA requirements. In a building under reconstruction, utilities have been raised; National Flood Insurance Program rules prohibit utilities in basements of new structures. Some existing structures have raised utilities to higher floors.
Increasingly since adopting its floodplain ordinance in 2011, Borough staff have devoted additional resources and effort to implementing and enforcing codes as written. The code office reviews requests for variances, which essentially allows rather than prohibits land uses in floodplain. Its building code includes a provision that any structure undergoing renovation with a cost exceeding 50% of the value of the structure must also include flood hardening. Inspections are used to verify that existing variances granted prior to 2011 are in fact implemented; the code officer offers inducements or levies fines for structure owners that are not meeting the variances.

The Borough is reluctant to prohibit all development in the floodplain. Instead, for new development, the Borough grants variances to some requests, but is careful not to rubber-stamp or under-scrutinize those properties given the FEMA inspection in 2011. The Borough typically requires flood-proofing such as elevation of utilities, use of water-resistant materials, and other mitigation measures. Some land uses that have been allowed include one auto-sales location, where the value of the structure is minimal, and the value of the inventory can be protected by creating a plan to move it when a flood is forecast. Additionally, the new building was constructed such that it is higher than the base flood elevation, and the existing building was floodproofed. The improved enforcement and compliance with the floodplain ordinance is credited with improvements in mitigation.

The Borough has seen some changes. For example, a recently-constructed set of townhomes were permitted in the floodplain, but with the first habitable story elevated. The ground floor of these townhomes was designed as parking garages. The lowest inhabited floor meets Borough requirements that it be 1.5 feet higher than the projected 1%-probability flood height floodplain. Several new structures are elevated in this manner.

The impression is that some earlier developments, in Downingtown and in other communities on Brandywine Creek, may have been incompatible with flood development. For
example, some efforts at brownfield redevelopment were permitted on the requirement that the land be graded so that the first floor was above the elevation of the 1% floodplain. While this avoids potential damage to the new construction, adding fill to the floodplain is expected to exacerbate flooding elsewhere, especially in downstream locations in the community and in neighboring communities. Developments like this have in the past been found in Downingtown and in neighboring communities, but the spatially integrative approach brought by County agencies have noted this practice has downsides. Such information was well-received by Downingtown; variances are no longer granted for practices that would alter the floodplain.

Mitigating impacts to existing land uses in the floodplain are much more crucial to the Borough, and much harder to address. The Borough is reluctant to acquire and demolish these structures, or to use FEMA funding to require flood-proofing: it finds the numbers are too great, and properties are scattered. Various parts of the Borough have suffered economic decline, including some abandoned structures, which it would like to either renovate to productive land use or acquire and demolish. However, funds are not available for more than gradual conversion, and private owners are reluctant to invest in declining neighborhoods; investment instead seeks one of many thriving neighborhoods in the County.

The Borough includes one neighborhood that has about 20 repetitive-loss properties, in the vicinity of Brandywine Avenue and Jefferson Avenue. Acquiring the entire neighborhood would impact the tax rolls, and produce a large empty quarter. This in turn would burden the Borough with indefinite maintenance and ownership of the open space. That kind of project would also constitute such a larger project, but such a large amount of funds is rarely seen in PEMA and FEMA projects. Requiring flood-proofing might mitigate impacts without losing the properties, but these are noted to be low-value structures: multi-family residences, owned sequentially by a series of absentee landlords, whose values are not high enough to incentivize
owners to pay the 25% of elevation or flood-proofing that would be required above FEMA funding (Hazard Mitigation Grants typically pays 75%). Areas of major importance such as Lancaster Avenue, with commercial development typical of arterial roads from the 1950s, cross floodplains. A number of structures are at risk, including some historic structures, one of which holds the Borough offices. This structure has been renovated with flood-hardening through public funds, but mitigating these buildings one by one is a larger project than the Borough can sustain with available funds. The neighborhood therefore remains at risk year after year.

The Borough is similarly reluctant to address repetitive-loss structures incrementally, either within that neighborhood or elsewhere, due to reported time and effort required for the application process, coupled with uncertainty of successfully acquiring the grants. In recent years, the Borough has tried to acquire two properties under this program; neither succeeded. For one rental property, which the owner reportedly was eager and willing to sell, Borough personnel spent over 100 hours to complete paperwork and applications, but due to miscommunication with FEMA staff, the process was halted. Because the advantage of removing flood risk was so great, the Borough subsequently purchased the property for $5,000, and spent an additional $19,000 demolishing the structure. This presented a financial burden on the Borough and use of funds for a single property that could have been applied to multiple properties if supplementing FEMA funds. The property is now operated by the Borough as parkland and a parking lot.

Emergency response is a major part of Downingtown’s mitigation planning. Forecasting and advance information are crucial, and emergency equipment and personnel are trained to respond. The Borough is divided into nine zones for response; residents need to know their zone to get information as to whether to evacuate. Nearly all evacuations are reported to occur in Zones 1 or 2, the heart of the Borough, including the Borough offices, a restored 19th century
stone building on the banks of the Brandywine where it crosses Lancaster Ave. During most flood events, Borough offices are among the first that must be evacuated.

The Borough would like to improve its forecasting to receive better warning about impending floods. USGS gauging exists on the East Fork of the Brandywine; the Borough would like to add funding to provide more direct, short-term connection to that data source. There is no gauging on the two tributaries where “microbursts” can trigger flooding; these channels experience sudden, high peak flows from brief, intense rainfall. Storm drains are not of sufficient capacity to convey these peaks, and the sudden flooding is a problem and requires emergency response. The Borough needs to improve its ability to quickly convey information to residents as to whether to evacuate, how soon, where to go, and what resources are available to help them.

Drainage and channel improvements through structural projects are addressed in Downingtown. The Borough has completed multiple smaller projects, and has a list of continuing needs. It actively seeks funding from many sources. The 2016 budget contains about $2 million for improvements projects for bridges, drainage/storm sewers, and road to improve drainage overall; these projects have accompanying funding from multiple other sources. Many of these improvements address long-standing problems of storm drainage. The Borough sees future needs for multiple other projects to improve drainage, as the storm drain system contains many components as old as the mid-1950s, a few older still, and with capacity not adequate for modern flows and increasing runoff from evolving land uses and more intense storms.

Inadequate drainage led to inundation during localized heavy rainfalls, including episodes during 2002, 2004, and twice in 2011 from tropical storms Irene and Lee. After these events, the Borough applied for and received disaster-relief from FEMA to cover public expenditures (emergency personnel time, debris removal) and to repair damage to Borough structures.
The Borough actively seeks grants that combine multiple Commonwealth and federal funding sources, especially those with multiple objectives (ecosystem restoration, increased land use availability, and others) along with flood mitigation improvements. For example, a DCED grant provided funding to remove an older stone bridge over Brandywine Creek, which acted as a dam during moderately high flows. It was replaced with a higher bridge, opening the profile of the creek and allowing higher flows through. Another project is a private/public partnership with Norfolk Southern Railway to improve drainage onsite at, and downstream from, a major railway facility, reducing storm drain backups and inundations in brief heavy rainstorms. Stream channel and bank restoration and improvements to improve flows and reduce flooding can also benefit business-district redevelopment and potentially improve habitat. Several of these are in the planning stages, especially at the smaller streams’ confluence near Downingtown’s center.

County Programs: Integration and Support for Municipalities

Chester County is the site of a successful, apparently unique institution in Pennsylvania: the Chester County Water Resources Authority, a municipal authority. The Authority takes a leadership role in planning and protection of water resources, and ensuring regional flood control. In addition to planning support, the Authority operates a series of flood control facilities, including one reservoir (built under the U.S. Department of Agriculture’s former Soil Conservation Service) that captures peak runoff to mitigate flooding on the Brandywine and its tributaries. The Authority helps provide planning services to the many municipalities across Chester County. Two County agencies, the Department of Emergency Services and the County Planning Commission, also provide important services. These County-level agencies are discussed further in section 4.4.3.7, in the section describing West Whiteland Township, also located in Chester County. The County includes 73 individual municipalities – one city (Coatesville), 15 boroughs, and 57 townships, some of them organized as early as the 1710s.
Chester County includes the site of William Penn’s plantation dating from the founding of the Commonwealth. In aggregate, the townships account for most of the population and by far most of the land area. As of 2015, the County’s population totals more than 500,000.

The Borough finds county-level guidance to be extremely helpful. The Authority provides Downingtown with valuable services including access to FEMA flood maps; the Authority also helps property owners identify which parts, if any, of their parcels lie within the 1% floodplain. FEMA offers a flood-mitigation grant program available to municipalities only if they participate in the Hazard Mitigation Plan by, at a minimum, adopting the Plan. This serves as a powerful incentive for participation. The Chester County Department of Emergency Services leads the preparation of the County Hazard Mitigation Plan. Downingtown reports that it has adopted and implements its portion of the Plan and finds it valuable for guidance on flood mitigation activities such as public outreach and information.

Integration of Commonwealth and Federal Programs

Downingtown’s participation in the NFIP has been crucial to improving its flood mitigation in the past decade. The Borough does not participate in CRS, but Borough personnel report “some pressure from citizens and some elected officials” to do so. That pressure almost certainly is motivated by the desire to reduce NFIP rates. Borough resources are stretched thin, and the Floodplain Manager/Code Enforcement Officer plans to investigate participation, learn about needed resources, and take the plan to Borough officials for resources to do so.

Downingtown participates in Chester County’s Hazard Mitigation Planning, a Commonwealth-directed requirement. The Borough also takes advantage of grant opportunities from the County and the Commonwealth, especially reporting the value of technical and institutional support from the County that might help with those grants. However, Borough personnel report those funds are insufficient – they address one or two problems at a time, which
can be improved by modest-scale infrastructure improvement, but the Borough faces multiple problems that may require larger-scale intervention.

**Fig. 7: Photos from Borough of Downingtown**

Upper picture: Lancaster Ave. crossing Brandywine Creek in Downingtown. Renovated historic stone structure at left houses Borough offices.

Lower: Abandoned older housing, Downingtown

Photos by L. Donald Duke.

4.4.3.5 City of Johnstown, Cambria County

*Geographic and Demographic Setting; Flood History and Impacts*

Johnstown was the site of not one, but two, of the most infamous, history-making flood events in the U.S., each of them leading to policy responses that fundamentally changed the way the nation regulated dam safety and flood mitigation. The first, known as “the Great Johnstown Flood,” in 1889 resulted from a collapse of the South Fork Dam, releasing artificial Lake Conemaugh to empty in a matter of hours, killing thousands. Subsequent federal legislation
required private and local-agency dams to meet design and construction standards and to be supervised by qualified engineers.

In 1936, Johnstown, like many riverside communities throughout Pennsylvania, was inundated by the “St. Patrick’s Day” flood. That event resulted from a large-scale, unseasonably warm-weather front dropping precipitation onto accumulated snow, with rainfall lasting sporadically from March 9 through March 22. Watersheds large and small across Pennsylvania received far more runoff than they could channel, overflowing banks and flooding thousands of communities. Along with extended flooding on the Mississippi River that year, the floods led Congress to adopt legislation directing the U.S. Army Corps of Engineers to seek out opportunities for structural flood-control projects nationwide, which are funded by Congress under periodic authorization bills. Until this occurred, the Corps was charged with construction to protect and promote navigation on the nation’s waterways; its new flood-control mission made it a major player in U.S. flood mitigation, a role in which it continues today.

Johnstown was one of few Pennsylvania riverside communities to largely escape damage from another statewide disaster, Agnes in 1972. The small Conemaugh watersheds did not receive extensive precipitation from that storm, and were too small to collect runoff in the multi-day increases experienced by larger Pennsylvania watersheds. Instead, Johnstown is susceptible to a different mode of flooding, which was powerfully demonstrated in a highly damaging flood in 1977. Intense localized rainfall in amounts never seen before (almost 12 inches in 10 hours) occurred in the upper Conemaugh watersheds, in a storm event that had been predicted to be so unusual that it was expected only once in 5,000 years. The storm produced runoff that overtopped several small dams, inundated Johnstown, and led to some 84 deaths in the region.

Despite its catastrophic history, statistics used for this report do not show Johnstown as receiving much flood damage: only $1.4 million in NFIP claims. This data encompass the years
1978-2015, just one year after the 1977 flood; few other damaging storms have occurred. Johnstown’s flooding does not include many of the relatively small, modest-damage flood events that are more frequent in locations like Muncy, Etna, Bedford Township, and other case studies. The events that do occur – on a much less frequent basis – are much more catastrophic.

Like many Pennsylvania municipalities, Johnstown was founded at the confluence of two natural waterbodies: Stony Creek from the south, and the Little Conemaugh River from the east, which join at Johnstown to form the Conemaugh River. These essentially act as mountain streams, because Johnstown is located high and near the origins of both, so they have flooding characteristics like local streams: they flood when there is extremely high precipitation or snowmelt in the basins, with sudden extreme runoff, allowing little advance time for forecasting. The city occupies a narrow floodplain surrounded by steep ridges of the Allegheny Plateau.

Johnstown was founded in the 1790s, incorporated as a borough in 1800, and found success in this location because it is one of few parts of Cambria County, or its region, accessible by river. Beginning in the 1860s, several major steel mills located here where barges on the Conemaugh allowed for import of iron and coke, and export of finished steel. Population grew as steelmaking industry boomed, reaching 20,000 by 1890, continuing to a maximum of over 65,000 in the 1940s. With the hollowing out of the steel industry, and the loss of steelmaking and many ancillary jobs, population declined by double-digit percentages to be less than 20,000 by 2015. The collapsed steel industry left a legacy of dense floodplain development, including mile-long masonry structures too large for repurposing (with some valuable exceptions where smaller companies occupy portions of a property), and too expensive to acquire and demolish: demolition of any one of these massive structures would exceed Johnstown’s annual budget.

Johnstown is the population center of a rural region. Its institutional and financial resources are typical of a small Pennsylvania community, with little opportunity for
infrastructure growth or improvement over the past 50 years or more, rather than the 21st century growth and infrastructure improvement of the Commonwealths’ larger and more prosperous urban centers. As with many Pennsylvania centers, most of the region’s population growth is outside the city, in townships with lower tax base, open spaces in which to build, and available lots outside the floodplain.

Institutions with Major Flood Mitigation Responsibilities

Floodplain management is the purview of the Department of Community and Economic Development. Floodplain management is crucial because the Special Flood Hazard Area (SFHA) encompasses the city’s entire central business district, and four of the city’s five historic districts. This is true even though a small portion of the city’s historic buildings are in the floodplain, about 20%, as reported by the Pennsylvania State Historic and Museum Commission. This is true ironically because so many structures in the floodplain were demolished during or after the floods of 1889, 1936, or 1977, leaving relatively few historic structures standing. Even so, a total of 698 structures are still in the SFHA – a more powerful statistic than the relatively small number of repetitive losses, only eight of which were claimed in the period 1978-2015.

The City’s zoning and code enforcement offices are important flood mitigation agencies because they implement the City’s Stormwater and Floodplain Management ordinances. Reports from City personnel suggest that flood building code enforcement and compliance efforts have increased and improved in recent years, partly in response to problems identified in site assessment visits from NFIP personnel. City inspections and floodplain code enforcement are now reported to be well-resourced and actively implemented.

Johnstown’s emergency management is active in flood risk management, similar to other case study communities. The City’s Fire Chief has important flood-mitigation duties, and the Fire Department is responsible for training, equipment, and public safety in event of a flood.
Current Main Flood Mitigation Strategies; Future Directions/Anticipated Challenges

Zoning and floodplain ordinances constitute Johnstown’s main flood mitigation strategy. This is, however, a troubled strategy for the community. DCED makes extensive efforts to lessen or reverse decades of decline in population and economic activity; overly rigorous design or implementation of floodplain ordinances could counter those efforts. The City has adopted a Floodplain Management Ordinance, in compliance with NFIP/FEMA requirements, but signals its readiness to work with potential developers to meet Ordinance requirements without prohibiting new construction in the SFHA.

The Floodplain Management Ordinance specifies zero freeboard – that is, the elevation of the lowest occupied floor must be at or above the 1%-flood elevation, not some margin of safety greater than that elevation as other municipalities requires. This replaces an older ordinance that specified 2.5 feet of freeboard, which was changed as it was seen as a brake on potential development. However, elevation is critical in Johnstown, so it is taken as a hard and fast rule, not one that can be relaxed if other flood-hardening steps are taken. This is because flooding in Johnstown is less frequent but higher floods with crests approaching the projected 1%-probability flood and longer inundation; this contrasts with other case study communities where their SFHA are subject to more frequent, low-elevation floods that cause only modest damage. The ground level of the SFHA is well below the projected 1% level, not mere inches as in some communities. Less-intensive hardening such as mobile barriers and water-resistant materials do not substantially reduce damage when the structure is inundated by several feet, for several days.

Another difference from other borough case studies is the advent of new development in Johnstown’s extensive SFHA, even though it was long ago considered to have been built out. The DCED notes two new structures in the SFHA in 2016, both in compliance with the Floodplain Ordinance. The City uses a special tax-reassessment tool to encourage development.
in a targeted 10-block region of the central business district, which of course also lies in the SFHA, as a means to make productive use of the vacated buildings and to upsize economic activity in others. The Floodplain Ordinance appears poised to have an effect on flood mitigation, unlike in many Pennsylvania historic boroughs where the SFHA is fully built out.

Building codes in Johnstown, as with all of the case studies and for most of Pennsylvania’s flood-susceptible communities, include a provision that any structure undergoing renovation with a cost exceeding 50% of the value of the structure requires a municipal permit and must also include flood hardening. The flood hardening generally requires elevating the property above the 1%-probability flood level. Although this is among the more costly measures, it is believed to be essential in Johnstown because of its mode of flooding. As with many of the studies, few structures are subject to renovations that would trigger the requirement in most years. Property owners are aware of the 50% trigger and are reported to plan their remodels to cost less than this threshold.

Another DCED tool is to encourage property owners in the SFHA to seek a certificate of elevation. If owners can demonstrate their lowest occupied floor is higher than the SFHA, they can reduce NFIP premiums substantially. Properties that include land lower than the 1%-probability flood are often automatically tagged as in the SFHA, but if the structure is at a higher elevation, it may be able to claim exemption, saving on premiums. The tool can also encourage property owners to make changes: if they can eliminate basement occupancy, raise utilities to above flood level, and demonstrate the entrance and first occupied floor are at high enough elevation, they can reduce premiums, while also reducing flood damage and claims to NFIP.

Riverbank and channel improvements are important to Johnstown. These are the province of the U.S. Army Corps of Engineers rather than local agencies. Structural measures by the Corps included dredging, channelization, and concrete sidewalls for the Conemaugh, Little
Conemaugh, and Stony Creek in a project begun in 1938 and completed in 1943 along some 9 to 10 miles of channels in the City. This was one of the Corps’ earliest structural interventions for flood mitigation. Channel improvement and sidewall armoring for erosion prevention were thought to be highly effective for flood mitigation in the 1930s, and are effective at preventing collapse of riverbanks and accompanying damage to infrastructure. These projects could be partially responsible for the near-absence of damage from smaller floods. The structures are not levees or floodwalls, features common to Corps projects in other locations from the 1940s and 1950s. These structures do not protect land uses to any level higher than the original stream banks; instead they are intended to facilitate flow and increase the channel’s capacity to move water. The Corps continues to own the structure and to periodically conduct dredging and stream-channel maintenance. This is also unusual because the Corps customarily turns over its structures to local entities to own and maintain. The Corps would like the City to accept the structure, but the City declines; this is further discussed below.

**County Programs: Integration and Support for Municipalities**

Johnstown is a community set apart from its neighbors in the kinds of natural hazards it faces; the City also reports little interaction with county agencies. Cambria County does not identify flood mitigation as a priority. The 2015 Cambria County Hazard Mitigation Plan states that “[t]here are only a small number of Repetitive Loss properties in several municipalities and the expense and effort needed to maintain CRS points, would outweigh the savings of participating in the program.” The County identifies only 16 repetitive loss structures, with 8 of those in Johnstown, so programs such as acquisition or hardening of those structures may not be a major priority. However, the presence of such an extensive floodplain and huge number of at-risk structures, which did not happen to file claims in the period 1978-2015, places the City at much greater risk than the NFIP figures might suggest.
Unlike many parts of Pennsylvania, Cambria County does not feature a major waterway lined by historic boroughs and townships located there for transportation: other than Johnstown, other communities in Cambria County either occupy the steep hillsides or achieve setbacks from the smaller streams they occupy; except for a small number of properties and structures, other communities are not particularly subject to flooding. The natural features (river transport, flat land for construction) that were in short supply in the region, and led to Johnstown’s growth as an industrial center, are now the source of hazards that are also not widespread in its region. Unlike so many other counties’ Hazard Mitigation Plans, the Cambria County plan devotes little attention to flooding, so Johnstown does not receive support from that source.

Integration of Commonwealth and Federal Programs

Johnstown strongly encourages its property owners to purchase flood insurance, and participates in NFIP. It is one of the communities that identified the powerful negative impact on development of the high costs of NFIP premiums for property owners in its extensive floodplain. The City is not a participant in CRS, but has expressed strong interest in exploring the possibility, as a means to reduce NFIP premiums for its property owners.

The City’s other concern about federal programs, ironically, is the streambank hardening project constructed by U.S. Army Corps of Engineers in the 1930s and 1940s. The walls do not permit the kind of ‘reconnect to the river’ projects that many Pennsylvania river towns enjoy, because it precludes habitat, open space, or modification of any kind, under Corps rules designed to protect the structure’s integrity. Most Corps projects since the 1930s specify local partnership, including turnover of the structure after completion to local agencies for maintenance and operations. The Johnstown structure, one of the Corps’ earliest flood protection projects, did not include that provision. City of Johnstown personnel mentioned they perceive the Corps would be receptive to turning over the Johnstown structures to local agencies, but the City is not interested.
because local ownership would not remove the obligation to meet Corps requirements – modifications to the structure would still be prohibited – while the City would be responsible for the cost of continuing maintenance.

Regardless of who owns it, Corps rules would still prohibit modifications that might weaken the structure. This structure provides only limited protection. In event of a major flood, which as shown in 1977 can still occur, the structure will prevent collapse of the bank-adjacent infrastructure into the river. Because it does not rise above the riverbank, it does not increase the floodplain elevation in a way that would reduce risk to the SFHA. Any modifications to the structure that might attain any of these goals are seen as prohibitively expensive for the community, and unlikely to receive federal funding in competition with many projects nationwide that might reach higher economic benefits. Any land use changes Johnstown could initiate to make major changes to the structure could be disruptive to the community, which would not be undertaken in the absence of some cooperative agreement with the Corps, which does not appear to be in the offing. The problem appears to be intractable.
Figure 19: Photos of City of Johnstown (Cambria County)

Conemaugh River bank stabilization wall and high-density residential land use at bank height, Johnstown, showing steep topography immediately outside of the floodplain. Photo by L. Donald Duke.

Industrial development in floodplain at Stony Creek just upstream of Conemaugh River, Johnstown. Photo by L. Donald Duke.
4.4.3.6 Bedford Township, Bedford County

Geographic and Demographic Setting; Flood History and Impacts

Bedford Township surrounds the Borough of Bedford. The township population is about 5,400, and the County population is just under 50,000 making it one of the Commonwealth’s smallest in population and most rural. Despite its sparse population, Bedford County had one of the greatest dollar values of 1978-2015 NFIP claims among Pennsylvania’s rural communities. The Township was responsible for just over one-third of all losses claimed in the County.

Early population growth made the Bedford area a regional center in the early 19th century, a prominent stop on the period’s roads as an intersection of routes to Pittsburgh and the growing interior industrial area from both the Baltimore-Washington area and the Philadelphia – Harrisburg route. Bedford Township was founded in 1768 to cater to travelers on the land route. The Bedford Springs Hotel catered to wealthy travelers on this route, became a resort destination in the early 19th century, and served as the “western White House” for President James Buchanan in the 1850s. It was built along Shobers Run and thus runs its own flooding risks. Mining and railroad connections doubled the population between 1870-1890; tourism sustained the County when those industrial activities began to decline. Bedford County’s population has been stable for recent decades, with only about 25% growth since 1900. But as in many areas, the population of boroughs and older centers has declined (only slightly in Bedford Borough) while the townships’ population and land-use development have increased. The Bedford Springs Hotel, now operated by Omni, continues to be the economic driver it has been since the 1840s, affording economic stability not found in many other rural Pennsylvania communities.

Because land uses in the County were defined so early in its history, including not only the Borough but the Township and surrounding areas, some portions of the developed land lies in the floodplain. The historic hotel itself is near the banks of a small tributary known as Shobers
Run. Many neighborhoods developed along highways, roads, and railroads, which in turn followed the most level routes available, which were the inter-ridge valleys that hold the floodplains of the Raystown Branch and its tributaries. Steady population growth in those neighborhoods through about the 1970s all predated floodplain management, so siting and design of properties and structures did not conform to modern flood-mitigation practices.

Flooding in the region originates largely with the Raystown Branch of the Juniata River, which originates in the steep topography on the northwest quadrant of the county. The county is at the western edge of Pennsylvania’s Ridge and Valley province, where it has an overall pronounced tilt from northwest to southeast – its highest point at Blue Knob, on the eastern edge of the Allegheny Plateau, slopes downward through multiple ridges that contribute flow to tributaries following the valleys between ridges. (Another case study in this report, the City of Johnstown, is scarcely 50 miles to the northwest but occupies the Plateau region, experiences different flow conditions, and is drained by Conemaugh River westward into the Ohio River system.) The Raystown Branch is joined by multiple tributaries that drain similar steep topography, with several in or near Bedford Township including Dunning Creek from the north and Shobers Run from the south. The Raystown Branch then passes through a gap in the ridge to the east, turns back northward to follow a valley between ridges, and exits the county into Huntingdon County, eventually joining the Juniata River near Huntingdon, passes by Lewistown and enters the Susquehanna River at Duncannon, just upstream of Harrisburg. The Raystown Branch has always been too shallow and flows too irregular for transportation, so roads and later railroads were the transport mechanisms, thus guiding land uses accordingly. The Bedford Township region is quite near the headwaters of its streams, so flooding occurs as sudden flow increases from locally strong precipitation or snowmelt from rapid warming: a pattern of sudden, fast-moving, very high flow that can be quite damaging and difficult to predict.
The Township’s tourism supports robust seasonal outdoor enthusiasts, hunters, and fishing visitors, so its development includes clusters of second homes and “camps.” These cluster along the rivers and streams, and therefore occupy the floodplains. Those owners appear to be satisfied to risk flood damage in return for locating camps on the streambanks, and the relatively low property values – and propensity not to remodel, accepting rustic lodgings – mean there is little leverage available to cause them to alter structures for flood mitigation.

Institutions with Major Flood Mitigation Responsibilities

As with many townships, Bedford Township’s institutional and financial resources are sharply limited. A small number of personnel accomplish multiple missions. As of summer 2016, the Township’s secretary/treasurer is also its certified floodplain manager, assisted by one staff member plus a road-maintenance crew and overseen by a 3-member Board of Supervisors. Duties of municipal engineer, code enforcement, and solicitor are performed by contractors.

The code officer is identified as crucial to floodplain management. The Township is satisfied it has contracted with a highly effective, well-trained, and diligent code officer whose field inspections and code applications serve the Township well. Land development applications are reviewed by the floodplain manager for consistency with the Township’s floodplain management ordinance, then recommended for action by the Board of Supervisors. Bedford County staff provide important support and assistance, especially with map preparation and GIS analysis, as well as planning support including Hazard Mitigation Plan development. The Township participates in CRS and has a rating of 9 (earning a 5% discount for its citizens); the Township takes substantial guidance from recommendations under CRS.

Current Main Flood Mitigation Strategies; Future Directions/Anticipated Challenges

Providing information to the public is identified as a main tool of flood mitigation. A Flood Awareness Week is held once per year in the Township. This is considered especially
important for the temporary residents of hunting and fishing camps, which may have different occupants each year. Awareness Week is timed for late spring/early summer when occupancy is high and risk of flooding begins to rise. Letters are sent annually to property owners, lending institutions, insurance agencies, and real estate agencies informing them of flood risks, encouraging them to participate in insurance programs, and advising them where to get information about emergency response, which is a CRS-recommended activity that the Township has diligently implemented.

The floodplain management ordinance is implemented to strictly prohibit any new construction in the 1%-probability floodplain. The floodplain manager, who is also the Township secretary/treasurer, reviews all Land Development Applications, and so can easily identify any requests for floodplain development. Over the past decade or so, Township records show a total of only 19 requests from private entities to consider building any structures in the floodplain, and these are routinely declined. The Township has plentiful undeveloped land outside the floodplain, so in general encounters no difficulty in directing development there.

The existing land uses in the floodplains of Dunning Creek, Shobers Run, and the Raystown Branch include multiple vacation homes and camps and a residential development known as Friendship Village. The Township does not have plans to mitigate damage to existing structures, only to inform residents of the need for insurance and for vigilance for their own safety. They do not seek FEMA funding for acquisition in the floodplain because no local residents have shown interest; the Township does not promote the buy-out program or seek out repetitive-loss or severe-repetitive-loss property owners. Similarly, the Township has not encouraged any property owners to implement flood-hardening, or sought out properties that might benefit from it.
The Township would like to consider structural channel improvements, such as constructed wetlands along Shobers Run that could slow drainage from the Run into developed areas. This could be effective given the mode of flooding from those small drainages, which rises quickly after localized rainfalls. Estimates suggest that any rainfall of as much as 4 inches, not an uncommon storm, produces localized flooding in this area. Funding for this is uncertain, as projects like this are not included in FEMA’s Hazard Mitigation Assistance grants. It has been included in the County’s Hazard Mitigation Plan, making it eligible for PEMA funding, but that funding is in high demand by many communities with priority activities across the Commonwealth.

County Programs: Integration and Support for Municipalities

Bedford County’s Planning Commission is responsible for Hazard Mitigation Plan development and submittal. County personnel are well familiar with flooding issues of the county, including Bedford Borough, Everett Borough, and Bedford Township. The County stretches its modest resources by hiring a consulting firm to conduct this activity, and routinely applies for grand funding to prepare the document.

Bedford Township participates to a modest extent in Hazard Mitigation Plan development, but does offer some action items during each 5-year cycle. The Bedford Township Board of Supervisors adopted the most recent Plan put forward in 2012. Within Bedford County, 31 out of the 38 municipalities in the County adopted the 2012 Plan. Adoption by any fewer than 100% of municipalities is surprising given that failure to adopt means landowners are not eligible for any disaster relief funding that PEMA makes available in the event of a disaster.

The Hazard Mitigation Planning process has mixed results in Bedford County. For the upcoming 2017 planning process, the County held a kickoff meeting in June 2016 but reportedly had zero attendance by any of the county’s 38 municipalities. The County Planning Commission
is of the opinion that the Plans do not need to be revised on a 5-year cycle, noting that development activity is so minimal that few things change in the course of five years so new plans are not needed; the process of analysis, outreach, and preparation consumes three years of that five-year cycle. This suggests that Bedford County uses the Hazard Mitigation Plan as a reactive rather than a proactive instrument, documenting changes but not actively seeking opportunities to reduce existing hazards. The Plan does not appear to succeed in drawing formal involvement by the county’s municipalities, and is received by the municipalities as a guideline document with general principles for flood mitigation, rather than details of specific action items, and a necessary instrument to guard the availability of disaster-relief funds if needed.

Bedford County’s other contributions to Bedford Township, and its other municipalities, is substantial. The County reports that information about flooding is well disseminated: County personnel answer questions about development from the community, assisting the municipalities, which have ultimate decision authority, while providing information and guidance. Both realtors and individuals wishing to sell learn that “it is almost impossible” to sell property within the floodplain, as it is not developable and any remodeling would require costly flood-proofing. County GIS services prove invaluable, not only responding to municipalities that wish detailed maps of the SFHA, but also to individuals who would like help determining whether their properties are in the floodplain. In circumstances where part of a parcel is within the 1%-probability floodplain but some part of the parcel is not, the County advises landowners to appeal to lending entities and insurers to determine whether the structure itself lies in the floodplain – which would require NFIP insurance – or only some undeveloped corner of the property, which commonly triggers lenders to specify the insurance. In particular, County GIS services are much appreciated by municipalities, which then do not need to keep on staff personnel to create and analyze floodplain maps, a service the County can provide.
Integration of Commonwealth and Federal Programs

Bedford Township is one of the fewer than 30 municipalities in Pennsylvania that participates in the CRS program. The Township’s floodplain manager identifies this as an important service to reduce the NFIP premiums of the Township’s many policy holders, even while recognizing it as a burden on limited Township resources. The initial application process was a major barrier to overcome; the Township also identified the ongoing processes, record-keeping, and re-application for certification as particularly burdensome of Township time.

The Township reports benefits beyond the financial incentive from CRS. “CRS is a main driving force for us,” as flood mitigation activities implemented by the Township are drawn mainly from guidance and recommendations of the CRS program. Those activities that will gain CRS points are more easily supported by Township Supervisors, even though the Township has achieved only a level 9 for a 5% reduction, it is hoped to earn higher levels in the future.

To make the program more affordable and to implement further activities, the Township’s floodplain manager reports actively seeking out nearby communities that might benefit from participating in CRS to identify economies of scale: they would not be allowed to keep records in a central location, but three or four communities could pool funds to hire a single CRS coordinator to oversee activities for all four communities, while no one community might be able to afford the services of a specialist for only part time work.

Township officers report that CRS participation could easily add more activities (and gain higher levels) as such activities are identifiable and implementable, but Township personnel time will not allow it. The Township would like to form citizen committees to lead meetings, promote flood-proofing and disaster awareness, and complete paperwork to document those activities, but cannot find citizens willing to volunteer their time for those activities.
4.4.3.7 West Whiteland Township, Chester County

In contrast to Bedford Township, West Whiteland Township illustrates the kinds of tools available to more prosperous regions in Pennsylvania. This Township—near the Borough of Downingtown and also located in economically robust Chester County—also illustrates the stark differences between a borough and a township. The Township, like many in Pennsylvania, is geographically larger than the Borough (Downingtown encompasses only about 2 ¼ square miles, while West Whiteland encompasses nearly 13 square miles). As in many Pennsylvania boroughs, Downingtown’s land is densely developed, much of it with structures from previous decades or centuries, which may encumber them with decaying infrastructure; much of this development, following 19th century practices, lies in the floodplain. In contrast, West Whiteland Township has open space not yet fully developed, allowing it to respond to growing economic opportunities as a suburb of Philadelphia. In addition, plenty of the available acreage is outside the floodplains, so the Township can direct new development to those areas. Boroughs using that strategy would lose the new development to areas outside their borders. West Whiteland’s situation is typical of Pennsylvania townships influenced by nearby urban growth engines – it has a growing population that is larger than that of the Borough of Downingtown, and it has enjoyed a growing economic base as well. That is far different from the shrinking economic activity and population encountered by townships in more remote rural areas of Pennsylvania.

Geographic and Demographic Setting; Flood History and Impacts

West Whiteland Township occupies the same “Great Valley” as Downingtown, described above. The Township was settled based on the availability of waterpower from the East Branch of Brandywine Creek; it contains historic structures dating from the late 18th century.

Flooding issues in West Whiteland arise from Brandywine Creek and its small tributaries. Brandywine Creek flows from north to south, beginning in two roughly parallel branches (East
and West Branch). The two branches conjoin into a Brandywine’s main stem about two miles southeast of West Whiteland, from where it continues south through Delaware and joins the Christina River in Wilmington. After a short distance the Christina River then flows into the Delaware River. Total drainage area is roughly 300 square miles.

The East Branch of Brandywine Creek is fairly well contained in its steep channels through Chester the County’s rolling topography. That changes where it cuts across the “Great Valley,” a limestone depression that runs roughly east-west across the County that was formed by geologic forces, not by creeks. Where East Branch Brandywine Creek intersects the Great Valley, it finds wide, flat areas where floodwaters tend to spread, forming much wider floodplains than other parts of the stream channel. Valley Creek, which flows from the east, follows the Great Valley and enters the East Branch of the Brandywine, and shares this propensity to overflow its banks in high rainfall conditions. Local flooding is exacerbated in this swath of flat land, which also formed attractive open space for early settlements.

Historic boroughs, townships, and population centers stretch along the Great Valley and its floodplain from Philadelphia to Lancaster. In Chester County, population centers reach from Berwyn through Malvern, Downingtown, and Coatesville. The Township is quite old, with some Revolutionary War-era structures, including some along the waterways for access to mill power during the 18th century. One mill was used by George Washington. Other historic development lined the 18th century’s major arterials, most atop higher lands above Great Valley and out of the floodplain. Most population growth, and accompanying land use, occurred since about 1950, and followed the highways rather than the watercourses, so much of it is not subject to flooding.

Like the Borough of Downingtown, West Whiteland Township is also in Chester County, yet is strikingly different in its flood problems and mitigation strategies. West Whiteland Township is much larger and has a growing population (nearly 20,000). This provides a robust
tax base and better financial resources to personnel focused on planning and floodplain management. The Township is nearly 10 times the size of Downingtown, at about 13 square miles; even with four times the population, the Township is much less built-out. New development permits can readily be directed to areas outside the 1% floodplain. While it contains some historic structures, it does not have a concentrated historic urban core, and especially not one centered on watercourses as in Downingtown, so flood damage is dispersed.

**Institutions with Major Flood Mitigation Responsibilities**

The Township’s Director of Planning is also its Zoning Officer, so the Planning Department and zoning processes are structured to work together on flood management activities. That kind of procedural response, and focus on avoiding flooding problems for new development, characterizes this Township’s response.

Both Downingtown and West Whiteland Township benefit from the technical and planning support of various county-level agencies, including the Chester County Planning Commission, the Chester County Department of Emergency Services, and the Chester County Water Resources Authority. The Chester County Water Resources Authority is unique in Pennsylvania and gives technical and planning support for water resources management and protection, and provides flood control to the municipalities of the Brandywine Creek watershed. Resources available from county-level agencies (described below) include planning support, information support including GIS and mapping, and financial support through grants for specific projects. In addition, the technical assistance provided by the Chester County Water Resources Authority, and technical assistance and grants from the Planning Commission, are invaluable to municipalities. The Commission provides those grants for a wide range of planning, zoning, and ordinance initiatives, and can be used by municipalities to undertake thoughtful flood mitigation land uses. As with all Pennsylvania counties, municipalities are
required to adopt the County’s Hazard Mitigation Plan in order to be eligible for FEMA or PEMA disaster relief funding. The Hazard Mitigation Planning process is overseen by the Chester County Department of Emergency Services. This creates a strong incentive for active participation in the Hazard Mitigation Plan process.

Current Main Flood Mitigation Strategies; Future Directions/Anticipated Challenges

The Township’s Floodplain Management Ordinance and Stormwater Management Ordinance, implemented in compliance with requirements of NFIP and FEMA, form its main strategies. These strategies are essentially proactive, designed to avoid losses from future events. Township personnel find these are sufficient for most of their problems.

Flooding problems stem from the relatively small number of existing structures in the SFHA that pre-date NFIP requirements. Township personnel note that these structures are of sufficiently high value that owners are prepared to pay the premiums in exchange for occupying the financially valuable locations. This sharply contrasts with older boroughs in economically contracting areas. The Township reports little if any pressure to mitigate those problems, or to keep NFIP premiums at more affordable costs. Total NFIP claims in the Township from the period 1978-2015 were less than $1 million. Mitigation of existing problems is addressed incrementally through relatively small capital-improvement projects such as storm sewer capacity improvements, overflow responses, and drainage improvements. These are supported by grants as-needed from the County Water Resources Authority.

The Township finds no need to specialize its Floodplain Management Ordinance, reporting they implement what was essentially “handed to us by FEMA.” Under its Floodplain Management Ordinance, the Township has marked out the floodways of its two small creeks and the Special Flood Hazard Areas (SFHAs) next to the waterways. The Ordinance is implemented to limit “to essentially zero” any requests to build in the floodplain, denying permits to all new
structures, equipment, or land uses of any kind in the SFHAs that might interfere with flow
during high-flow events. Open space zoned for development remains plentiful in the Township,
even with the growth of the past 20 years, so the planning agency finds it can comfortably direct
growth to areas outside the floodplain without inhibiting any economic activity.

In most cases, the Township uses the permit process to lead developers to modify their
proposed structures by identifying elevation and grading that will keep their lowest occupied
story higher than the 1%-probability floodplain. The Planning Commission assists landowners by
working with those who own parcels intersected by the SFHAs to identify acceptable land uses.
Few parcels within the SFHA lie completely in the floodplain, so the Township’s usual approach
is to guide any construction plans so the buildings in any given parcel are constructed entirely
outside the SFHA. Township input is to provide maps of the SFHA to developers, and require
that plans for development make note of the floodplain and demonstrate to the Township they
will avoid the floodplain. Making that a pre-requisite for receiving a building permit gives the
Township the authority and implementation mechanisms needed to fully mitigate potential flood
damage on any new structures or developments within the Township. Township officials report
that this method has little or no impact on the Township’s economy, as no structures have been
proposed that could not adapt to meet the requirement.

A recent example is a major headquarters building for a regional branch of the Boy
Scouts of America, where most of the parcel lay in the floodplain. The area within the floodplain
will be used for hiking and picnic facilities, affording access to natural systems including the
stream ecosystem; the building itself needed careful attention to tailor its footprint to achieve the
desired square footage without impinging on the floodplain. The geometric challenge was met,
and the organization successfully achieved a Township building permit; as of August 2016, the
building was on the drawing board and construction planned.
A second example is the recently-constructed building housing the Township. The building is sited on a parcel that backs up against the floodplain, and so might have presented a challenge to any private business trying to develop it. The Township converted the parcel into a model of flood-mitigation design by locating its structure at a high elevation: street level is well above the water-way, so the building rises from that elevation rather than following the ground to the streambank. Much of the Township’s parking occupies lower elevations; a parking lot incurs much less damage and is readily evacuated. Garages, parking for municipal vehicles, access roads, and other support spaces are beneath the main buildings, also evacuated during a flood.

In compliance with NFIP requirements, the Township conducts public information activities, reportedly sending letters with information on flood risks to approximately 200 property owners in a typical year. FEMA completed a redrawing of its maps of floodplains in this region in about 2011, and apparently that redrawing reduced the number of properties found in the 1% floodplain, the converse of a problem faced by many communities. Changes to stream flows, improved storm drainage, channel improvements, and other changes led to smaller projected 1%-high flows. Township personnel also credit their floodplain management ordinance for this result, as it requires runoff reductions for all development, not only in the SFHA. The ordinance specifies that total storm runoff, and the maximum ‘peak’ flow projected from any storm, after construction be equal to or less than the conditions before the structure was built. Thus, the NFIP requirements have declined on some property owners because the actual mapped floodplain has decreased, even with the sharp increase in rates per structure in the floodplain.

County Programs: Integration and Support for Municipalities

Chester County agencies are a model of integration across multiple jurisdictions to address common problems using aggregate resources. County agencies encourage communities to select and implement suitable flood mitigation actions. Three agencies work closely in their
flood control missions: the Chester County Water Resources Authority, the Chester County Department of Emergency Services, and the Chester County Planning Commission.

The Chester County Water Resources Authority is a municipal authority established by the County of Chester. The Authority includes flood mitigation as just one of its missions, but its high priority is readily transmitted to all municipalities. The Authority operates flood mitigation infrastructure on the County’s Brandywine Creek watershed. Five dams constructed beginning in the 1970s primarily provide flood control and recreation; two of them also supplement the region’s water supply. These were constructed through what was then known as the U.S. Department of Agriculture’s Soil Conservation Service Small Watersheds Program (Public Law 566). That Program had a mission of “upstream” erosion and runoff control using multiple locally-owned small dams, as compared to the Corps of Engineers’ “downstream” approach of large dams and protective walls and levees. This USDA program has provided important flood control for Chester County, as it has for a number of other Pennsylvania counties. Of the five USDA-provided dams, the Authority now owns, operates, and maintains four, using funds from multiple sources including federal and Commonwealth grants; private funding partners; and Chester County general funds. Four of the five dams are upstream of Downingtown and West Whiteland Township in the East Branch of Brandywine Creek watershed. The fifth, Hibernia Dam and Chambers Lake Reservoir, is upstream of Coatesville. Marsh Creek Dam and Reservoir, located in the upper East Branch Brandywine Creek watershed, was built by the Authority and is now owned and operated by the Commonwealth as Marsh Creek State Park.

The Chester County Water Resources Authority also supplies technical assistance to the County’s municipalities, such as guidance on floodplain management, guidance on stormwater management, scientific studies of streamflow conditions that can lead to flooding, and others. It provides GIS mapping and on-line tools, as well as an on-line repository for FEMA maps,
facilitating the availability to municipalities in the County. FEMA completed revisions of Chester County’s floodplain maps in 2017. These are the maps reported by West Whiteland Township for use by zoning agencies to identify at-risk areas. They also allow for municipalities to be able to discern exact locations of the edges of their SFHAs so that developers may use those parts of their parcels outside the floodplain. The Authority assisted County municipalities in revising their floodplain ordinances to be consistent with current FEMA requirements. The Authority coordinated with FEMA and Commonwealth agencies PEMA and DCED, and encouraged municipalities to adopt the most appropriate restrictions for their circumstances, not just the minimum required for NFIP participation.

The Chester County Department of Emergency Services is considered to be well funded, well equipped, and staffed with well trained personnel. As with many Pennsylvania municipalities, the County-level Emergency Management Agency holds a lead role, coordinating its activities with municipalities in roles such as forecasting, public involvement/preparation, and response planning. Municipalities maintain their own emergency agencies and equipment, but the County also keeps equipment in place at strategic locations throughout the county, and maintains personnel who are trained, drilled, and prepared for disaster response.

The Department of Emergency Services also takes the lead in implementing the Commonwealth’s County Hazard Mitigation Plan. During the Plan’s 5-year renewal cycle, all municipalities are contacted, informed of meetings, and encouraged to participate. Municipalities are asked to identify their priority actions; including a proposed action in the Plan improves its likelihood of receiving grant funding. When the plan is completed, municipalities are encouraged to adopt it via their Borough council, City council, or Township Supervisors to maintain their eligibility for FEMA funding. As a result of the extensive outreach and communication efforts
from the Department of Emergency Services to the municipalities, the Plan routinely attains near-total participation from the County’s 73 municipalities.

The Chester County Planning Commission offers support to municipalities in floodplain management and protection, planning, zoning, and ordinances. It provides grant funding and technical assistance for comprehensive plans, open space planning, and zoning and ordinance development, all of which can directly incorporate flood mitigation components. The Commission encourages municipalities to integrate flood mitigation, flood resilience, and stormwater reduction, along with other planning objectives in all their zoning and ordinances. The Commission is in the process of updating the County’s Comprehensive Plan to address the significant growth pressures being faced by Chester County, and will consider the potential impact of growth on future flooding and stormwater runoff. The Commission also provides extensive GIS and online mapping tools to assist municipalities in their planning efforts. The Commission uses its extensive network of social media and periodic meetings to keep municipalities well-informed of available tools and techniques that may assist municipalities in strengthening their plans and ordinances. To provide municipalities with information, updates, and opportunities for collaboration, to support their preparation of recent FEMA ordinances and for preparation, adoption, and implementation of their floodplain ordinances, the Commission conducts periodic informational forums for personnel of its municipalities, where they highlight innovative activities and programs by some agencies that may be of interest to others.

Integration of Commonwealth and Federal Programs

Federal and Commonwealth programs are integral to flood mitigation throughout Chester County; such programs are made more effective by the way in which they are promoted by, and incorporated into, County-level programs. County incentives and support ensure that NFIP requirements for floodplain management ordinances, stormwater ordinances, public outreach,
and others are used effectively by essentially all municipalities. The County Hazard Mitigation Plan effort is seen to be among the more effective in Pennsylvania, largely due to the County agencies’ active involvement and oversight. The actions taken in developing and implementing the Plan is essentially sufficient to address the flood-mitigation needs of the Township, which consist largely of personnel, information, and regulatory support. For communities short on funds to undertake acquisition, neighborhood rehabilitation, or reconstruction of aging stormwater infrastructure, the Hazard Mitigation Plan process is a useful beginning, but needs to be supplemented by robust funding from Commonwealth and federal sources, which can prove too little to meet the communities’ needs.

Regarding Federal programs, West Whiteland Township does not participate in the CRS program, and does not report any interest by residents or Township officials to do so. Interviewees reported an attitude by some residents and elected officials that participation is not warranted because the administrative costs to implement the program will benefit only a small portion of the Township’s property owners. The County-led Hazard Mitigation Plan (a Commonwealth-level program), and the well-resourced and technically-capable County agencies, provide some of the same guidance and information that communities in other counties find from CRS participation.
4.4.3.8 Smithfield Township, Monroe County

Geographic and Demographic Setting; Flood History and Impacts

Smithfield Township is in Monroe County and is part of the Delaware River Basin. The western part of Monroe County lies at the eastern edge of the Pocono Plateau, encompassing the ski resorts and recreational area of the Poconos. The land drops off rapidly toward the east, where the Delaware River forms the eastern boundary. Steep hillsides are drained by multiple smaller creeks, the largest being Brodhead Creek from the northwest and McMichael Creek from the southwest, both joining the Delaware at or near the adjacent boroughs of Stroudsburg and East Stroudsburg. Smithfield Township lies along the Delaware River, just to the east of East Stroudsburg, with rolling hills and portions of the Delaware floodplain.
Smithfield Township experiences two modes of flooding. Several smaller streams and the downstream portion of Brodhead Creek, are subject to sudden peak runoff from local intense storms draining the steep eastern flanks of the plateau. Those floods are difficult to anticipate, difficult to estimate the magnitude of peak flow, and can produce damaging high-velocity flooding in steep channels. Boroughs in this region are protected by sizable earthen dikes built by the U.S. Army Corps of Engineers, lining Brodhead Creek between Stroudsburg and East Stroudsburg. The County’s other, smaller municipalities have little or no such protection.

The second mode of flooding is from the Delaware River. This originates as regional high rainfall or snowmelt across all or parts of the much larger Delaware River basin. Areas that flood include the Delaware floodplain itself, plus portions of Brodhead Creek where high river flows cause the creek to back up and spill into its own floodplain. These are typically better predicted with rainfall/runoff and hydrological forecast models, but typically convey much more water than the hillside creek flooding, and can inundate broad swaths of floodplain for longer periods. The most severe floods occur when the two modes coincide: when heavy local rainfall causes flooding on the creeks at the same time as the Delaware rises from regional rainfall to the north. That limits the creeks’ ability to drain, so they back up and overflow their banks just upstream of their mouths.

The Delaware River experienced major flooding in 1903, and again with Hurricane Diane in 1955, causing about 75 deaths. In 1972, Tropical Storm Agnes had prolonged rain and produced the dual-mode kind of flooding in Monroe County, as creeks overflowed with runoff from the Pocono Plateau and met the overflowing Delaware River, with long-term inundation throughout the region. The Township, and much of the region, experienced area-wide flooding on the creeks from storms in 2006, and from Hurricane Irene and Tropical Storm Lee in 2011.
On the Delaware itself, no sizable population centers are directly on the river between Port Jervis, New York and Easton, Pennsylvania; however, there are a relatively dense string of townships on both the Pennsylvania and New Jersey side. The pattern is similar downstream of Easton until the Trenton metropolitan area, and upstream all the way to the headwaters in New York State. Because of these smaller municipalities, the river’s flooding receives less attention, but the small populations in multiple scattered townships and very small boroughs in aggregate experience substantial losses. Smithfield Township accrued some $8 million in damage from 1978 to 2015, which accounts for three-fourths of all NFIP claims in Monroe County.

The region was settled long ago. Smithfield Township was founded in 1742, and features some older historic buildings, though most of its growth has been in the past few decades. The County, and by extension many of its municipalities, is relatively prosperous, benefitting from the Pocono ski resorts that draw visitors from the New York, Philadelphia, and New Jersey metropolitan areas. The County’s ‘downhill’ communities provide lodging and tourism-related services, plus related activities; for example, the annual Pocono 500 NASCAR race draws tens of thousands of visitors. A university at East Stroudsburg also provides an economic base. The County’s boroughs have stable, rather than declining, population and economies; as is typical throughout Pennsylvania, much of the residential growth is in the townships surrounding the older historic boroughs. Smithfield Township benefits from these factors.

_Institutions with Major Flood Mitigation Responsibilities_

The three-person Township Board of Supervisors leads flood mitigation efforts. The Township has its own Zoning Officer, not a contractor as in some small communities. The Zoning Officer reports to the Supervisors and implements the Floodplain Ordinance and Stormwater Ordinance among other duties. Building code enforcement is contracted to an outside firm, so the Township’s Code Officer is an employee of that firm, not of the Township.
Under this structure, there is no agency or institution directly charged with flood mitigation as its main function. The Board of Supervisors handles all decisions, including floodplain management, emergency response and public safety, and planning and zoning, including work on the County Hazard Mitigation Plan. As of the summer of 2016, the Township’s website listed a total of nine Township employees, three of whom are elected Supervisors, and many of whom perform multiple duties. The Township works closely with Monroe County personnel, where flood mitigation efforts are led by the Emergency Management office. Within the past few years, the Board of Supervisors led an effort to revise the floodplain management plan, with substantial support from County Emergency Management, and driven by PEMA notifications that improved ordinances would be necessary for continued NFIP compliance. The Floodplain Management Plan revision, and the solicitation and response to public comments leading to adoption by the Board of Supervisors, is reported to have consumed many of the resources of the Township for several years. The interviewed staff cited that effort as evidence of the burden placed on Pennsylvania’s smaller rural communities by relatively routine changes, even those necessitated by Commonwealth changes with obvious benefits to the community, and even though the Floodplain Management Plan was created using clear and extensive information provided by PEMA.

**Current Main Flood Mitigation Strategies; Future Directions/Anticipated Challenges**

The primary tool of Smithfield Township for flood mitigation is its ordinances: floodplain management and stormwater management are two separate ordinances.

The Floodplain Ordinance specifies requirements for new development in the floodplain. As with many Pennsylvania townships, land available for development is plentiful outside the floodplain, so the Township directs development there when possible; but would like to encourage economic growth, so does not prohibit building in the floodplain. The primary
requirement is to elevate structures so the first floor is higher than the 1% floodplain; any level of the building below that elevation is not occupied and must be open or vented with flood vents.

The Stormwater Ordinance is seen as an important tool to reduce localized flooding from small creeks, which continue to be a source of damage. All new development in the Township is subject to rules including minimizing impervious surfaces, specified setbacks from creeks, and buffer zones around creeks and waterbodies, including in areas not identified as floodplains. Such regulations are aimed at reducing the kind of flash flooding and storm drain overflows that can occur in the Township’s steep topography. The Township is situated such that adjacent municipalities are ‘uphill:’ Smithfield Township occupies the low ground, at the confluences of two creeks with the Delaware River. Township personnel project that stormwater controls of this type, if constructed in upstream portions of the creeks, would be even more beneficial to Smithfield Township than actions within the Township itself: upstream municipalities’ overflows run across Smithfield Township. This is a key observation for many of Pennsylvania’s hillside rural communities: they lack a mechanism to design, fund, and operate improvements on the scale of small, multiple-township watersheds that could benefit downstream parts of the watershed. Under township rule, upstream townships have no incentive to fund and implement any activities for which they do not experience the negative effects, even though they might be the lowest-cost and most-effective measures to prevent flooding in downstream townships.

Because parts of the Township were developed long ago—decades, or centuries, prior to floodplain management concerns – it includes several built areas in the floodplains. One neighborhood built directly on the Delaware River has had long-established occupancy, including both primary residences and secondary vacation homes; this area accounts for a large portion of the Township’s flood damage. Many of these properties are identified as severe repetitive loss; some have accepted FEMA funds for flood-proofing such as elevation of existing
structures. Other owners decline to do this, and no owners have indicated any willingness to sell properties under the SRL acquisition process; the Township firmly declines to bring any pressure to bear on any but willing sellers. A few other areas experience flooding of existing properties; roads laid out a century or more ago include some that follow creeks’ floodplains; businesses followed the roads; so commercial and residential structures are found in that area that are not up to standards that would be required if they were new construction.

Smithfield Township, and reportedly most municipalities in Monroe County, is not presently seeking to acquire at-risk properties in the floodplains. In interviews, both Township and County personnel noted that residents in this area are fiercely protective of their amenities and their communities, and resist selling properties even when risks are high and financial resources are available. Institutional “red tape” and slow, cumbersome procedures play a part in this reluctance. One anecdote described a property owner with a repetitive-loss structure who was willing to sell, achieved support of County and municipal entities, including willingness to accept management of the parcel indefinitely, spent a period of years acquiring documentation including fair-value pricing, and proceeded through the NFIP acquisition process, only to be turned down when FEMA analysts offered a price lower than the owner was willing to accept. Personnel now observe the structure has been abandoned, and expect to acquire the parcel under eminent domain at some point. In the end, the outcome is similar – the property will be owned by the municipality – but it does not achieve payment to the owner. It has also precluded any opportunity for that business to productively operate at another location. Such experiences reportedly have dissuaded other property owners from attempting to make the sale. Other owners simply decline to leave their locations regardless the number of times flooded, or the financial losses, they experience.
Figure 8: Photo of Smithfield Township (Monroe County)

Example of elevated structure: residence in Smithfield Township where first occupied floor sits atop strongly built concrete block garage with flow-through vents. Structure sits alongside Marshalls Creek, just upstream of confluence with Brodhead Creek, in turn just upstream of confluence with Delaware River – flooding on the small creek is exacerbated when the creek backs up from high flows on the larger waterbodies. Photo by L. Donald Duke.

**County Programs: Integration and Support for Municipalities**

Monroe County has made good use of the Commonwealth’s Hazard Mitigation Planning process. The County’s Emergency Management Agency (EMA) and Planning Agency work closely together and actively reach out to the county’s municipalities. Each five-year cycle features multiple meetings of personnel invited from all municipalities; Smithfield Township personnel find great satisfaction in their role as one of the municipalities on a Steering Committee that participates actively in the planning process. County personnel report that every municipality sent at least one representative to at least one meeting in the previous cycle, leading to the 2016-adopted Plan. PEMA’s guidelines for the Hazard Mitigation Plans includes a list of conceptual objectives and a list of concrete action items, intended as goals for which the County will strive during the five years of their Plan. The Monroe County EMA asks all municipalities to submit “four or five” action items they will commit to working toward; EMA staff estimate that about 50% of the action items included in the 2011 plan had been implemented by the time the 2016 plan was prepared. Judging from Smithfield Township, the municipalities feel connected to the planning process, seek out useful actions, and commit resources to attaining
those actions. County agencies’ leadership has been effective in enabling progress in the municipalities. This model is particularly effective for Pennsylvania’s many townships, where resources and skills may be limited and effective actions may extend beyond local borders.

The Monroe County EMA reported the 2011 cycle had “100% participation” by municipalities, meaning that every municipality had attendance to at least one meeting and contributed at least one action item to the Plan. The 2011 Plan had a total of about 40 action items, distributed among the County’s 13 municipalities, of which an estimated 50% were implemented or completed by the end of the plan cycle in 2016. The EMA articulates a goal that a similar number will be included, and a similar percentage completed, in future cycles.

The Smithfield Township Board of Supervisors enthusiastically attributes several advantages to the County’s activities, including but not limited to the Commonwealth’s Hazard Mitigation Plan process. County activities, including the Plan, give support for Township ordinances – it helps persuade voters, and in turn persuades Supervisors, of the continuing importance of adopting and implementing the specific actions identified in the Plan, keeping flood mitigation in the forefront of planning rather than allowing it to seem as if problems are in the past. The County provides direct support with community outreach, both in the form of publicity conducted by the County Emergency Management Agencies, and providing to the Township a wide range of printed and digital materials that the Township can distribute to its residents. The County is credited with ensuring that Smithfield Township, and other municipalities, are proactive. The Hazard Mitigation Plan is used to integrate municipalities into the process by identifying specific actions. Including those actions in the Plan holds municipalities accountable before the public to implement those actions, or at a minimum to actively seek funding from external sources for implementation. The County’s process for its Mitigation Plan cycle requires municipalities to be proactive; interviews with Township
personnel suggest they feel empowered and involved in the planning process, an important driver to identify and implement actions.

The County also provides some services, notably a GIS and mapping service available to its municipalities. Monroe County EMA keeps digitized maps of floodplains, structures in the floodplains, and critical structures such as Township facilities and first-responder locations. Municipalities may receive printouts or digital resources of these maps on request.

Integration of Commonwealth and Federal Programs

Monroe County is an example of a well-functioning County Hazard Mitigation Planning process. The success of this Commonwealth program is in large part attributable to the efforts of a County agency, in this case, the Emergency Management Agency.

As of summer 2016, no Monroe County municipalities participate in CRS. Smithfield Township personnel were very interested in learning of the program, in particular because of its advantages in reducing NFIP premiums for local residents and businesses. EMA personnel intend to promote CRS participation as one of its actions in the 2016 Hazard Mitigation Planning cycle. They recognized that the County could not actively participate, but could encourage its municipalities and offer certain services (recordkeeping, public information and outreach, and serving as a conduit for information from FEMA to CRS participants, among others). The County was one among several agencies contacted for this study that expressed a desire that CRS reconsider its definition of “community” for CRS participation, which would allow Pennsylvania and other states with borough-township structures to use County agencies to facilitate, or take the lead on CRS participation, gaining the advantages of CRS for many more communities than now participate in Pennsylvania. Alternately, sub-county collaborations or regional groups might be another way to achieve these goals. Six townships in the western part of Monroe County already collaborate to provide emergency services, on zoning activities, and so on; this collaboration
would be a ready-made, multi-municipality, sub-county organization that could effectively implement CRS where the individual townships could not provide resources to do so.

An institutional feature of this waterbody is the fact of large water-supply reservoirs near the headwaters, located in a separate state. The two are Cannonsville Reservoir and Pepacton Reservoir. Together the two reservoirs supply much of the drinking water for New York City – in most years, on the order of 30% to 60% of the City’s supply. Operation of the reservoirs by New York state and city officials give priority to supplying water for the 30-million resident megalopolis, and less emphasis to flood control for the small communities downstream (or for the somewhat more distant metropolitan areas of Trenton, Philadelphia, Camden, and vicinity).

Agencies in New York make decisions about the operation of those reservoirs, guided by needs for drinking water supply to New York City. Pennsylvania citizens, similar to those in New Jersey, are concerned that operation of those reservoirs may not be optimal to reduce flood impacts downstream, and could even exacerbate those impacts if reservoirs are held in a near-full condition when a major storm happens to generate large amounts of runoff in the upstream reaches of the Delaware. The Delaware River Basin Commission, an interstate commission, has the primary purpose of ensuring that each member state receives the amount of water it is allocated under the Delaware River Compact, and a range of other authorities such as conservation and efficiency of water use; prioritization of users during drought; water use pricing; and, to some extent, dam operations, primarily to provide adequate in-stream flows during drought. But it is not authorized to regulate discharge in ways that might minimize flooding. On some river systems the U.S. Army Corps of Engineers owns and operates dams for that purpose. But the dams owned and operated by New York City are operated for the purpose of providing water supply to the City, and are not subject to Basin Commission authority – or to any other authority that might wish to use the facilities for flood control.
It is not clear that operation of these reservoirs actually impacts Delaware River flooding, and this project did not uncover a study that has evaluated this possibility. But the cross-state nature of the origin and impacts means that any dialogue on the topic is routinely declined. That does create at least the impression that not everything is done that could be done. Integrated planning on a basin-wide, multi-state scale would be an important goodwill gesture, and could demonstrate that all available avenues are implemented to reduce flood impacts.

4.4.4 Use of PEMA’s Hazard Mitigation Planning Process

Hazard Mitigation Plans have emerged as an important driver for flood mitigation by municipalities across the Commonwealth. Counties develop these plans under the premise that local-level planning incorporates local preferences, goals, and needs better than Commonwealth-level planning. The Commonwealth has a powerful tool to require plan completion: counties that do not submit are not eligible for PEMA-administered disaster-recovery funding. That feature drives counties to essentially 100% compliance. PEMA issues guidelines for features required for each county’s plan, and mandates that plans be revised every five years and adopted by each county’s commission, otherwise counties lose eligibility for that funding.

However, some plans are much more successful in some counties than others at generating effective mitigation actions by communities, judging from observations of the eight case studies and their six counties. As discussed above, counties vary tremendously in the extent to which they involve their municipalities in the Plan development and the extent to which the Counties hold municipalities responsible for accomplishing actions stated as priorities in the Plan. Several of the cases are examples of excellent planning and accountability.

In Monroe County, the County Emergency Management Department conducts an open planning process on a continuous basis. During each five-year planning period, the County convenes meetings of representatives from all of its municipalities to select hazard mitigation
actions for its Plan. Representatives from Smithfield Township stated that the County makes clear it expects each municipality to put forth a number of proposed priority actions; the convened group helps select the actions that comprise its Plan, and the County then expects reports from each municipality on how they have progressed toward implementing each of the selected actions, prior to the next five-year planning cycle. County staff report that each of the municipalities had supplied staff to these meetings at least once during the planning cycle and that all municipalities had formally adopted the Plan by their Borough or Township Council.

At least two other counties in the case studies also had very effective Hazard Mitigation Plan processes: Chester County and Lycoming County similarly produce plans that actively involve their municipalities. Chester County Department of Emergency Services has been designated the County’s lead agency for the Hazard Mitigation Plan; it actively integrates municipalities into the Plan preparation and implementation. Lycoming County Planning and Community Development also serves a similar role. Both Chester and Lycoming Counties use their Hazard Mitigation Planning process to integrate municipalities in developing and selecting county-wide priorities, and directs available funding from PEMA and FEMA toward the priorities identified in the Plan. Several counties in the case studies (Monroe County, Bedford County, and others) reported that they have applied for and received Pre-Disaster Mitigation grant funding from FEMA to conduct its Hazard Mitigation Plan process.

On the other hand, several of the case study municipalities reported that their Hazard Mitigation Plan had little or no impact on their flood mitigation efforts. In some counties, the county agency designated for Plan preparation conducted their work with little consultation with municipalities. In several of these, a consultant was hired to complete the Plan. This proved successful in Monroe County, where the consultant worked closely with County and municipal agencies, but less so in other counties appeared to be detached from the municipalities. Those
counties meet PEMA’s requirement for a completed plan, and the County Commissions adopt the plans as required, but the Plan exists as an exercise on paper that does not seek out municipalities’ needs or drive municipalities to action. The experience of Luzerne County in adopting its revised Hazard Mitigation Plan in 2015 illustrates both the ways in which some counties may overlook the value of extensive planning involving local communities, and the importance to the community of retaining eligibility for disaster-relief funding. Local news described Luzerne County Council’s activities to adopt a plan on short notice, because the need to adopt had been overlooked during a change in staffing at the County (Wellock, 2015). Publicity emphasized how the County would have lost eligibility for FEMA disaster relief funding should a disaster have occurred after the County had failed to comply with the requirement to adopt a Plan. Compliance by adopting a written Plan is sufficient to retain that eligibility, but the degree of progress toward flood mitigation achieved by some counties is much greater than mere compliance if they include five years of active collaboration and accountable commitments among the county’s municipalities.

In many ways, the Hazard Mitigation Plan process fills many of the same roles as that of the federal CRS program. It offers guidelines and suggestions about potentially effective flood mitigation measures that communities may adopt. It also provides collaborative opportunities for communities to share resources when there might be savings by implementing on a larger scale than a single township or borough. Finally, it prompts each municipality to actively develop and implement measures that might otherwise slide into a lower priority. It has the added important feature that it promotes, rather than prohibits, county-level planning, allowing counties to develop actions on a slightly broader geographic scale and to prioritize activities across the county. It also serves as a legitimizing institution for flood mitigation, helping elected municipal leaders accept the importance of flood mitigation – and its costs – for their communities. Not
least, it centralizes many of the required data management and public-information activities within a county agency where they can attain economies of scale, removing those activities from the need to be funded from severely limited general funds of Pennsylvania’s smallest rural communities.

However, it fails to attain several other advantages of the CRS program. Most prominently, CRS participation is tied to reduction in NFIP premiums for policy-holders within each participating municipality, a feature that would powerfully soften the impact of rate increases under the Biggert-Waters Act. Also important for CRS participation is access to the full range of FEMA’s information materials that local communities can adapt for their own use, and access to the many informational resources about effectiveness of various approaches to flood mitigation. Those features are reported to be very useful by CRS communities.

This project acquired and analyzed the most recent Hazard Mitigation Plans adopted by the six counties in which case studies were located. Actions listed in each county’s Plan relevant to flood mitigation are grouped into categories to identify actions most widely listed by counties. That analysis provides an understanding of the kinds of actions currently underway and that are high priority actions in Pennsylvania’s counties at present, i.e. have not already been implemented to the extent counties find they should be, but are among the highest priority to reduce flood damage and threats to safety. These are summarized in Table 22 below.

The table does not allow strict comparison because counties selected and described their actions differently; their phrasing and choices of how to group actions are different from one another. But some observations are possible. First, it is clear how different the counties’ priorities and selected actions are from one another; within the major groups created, some counties had multiple actions and others had none. That is consistent with the intent of the Hazard Mitigation Plans, allowing flexibility as counties choose what is important for them.
Actions to improve public outreach, or to provide information about potential hazards to the public, are widely seen as important to improve. All six counties identified this as important, albeit with differing number of specific actions. All counties give high priority to emergency preparedness, and all counties found one or more ways in which they would like to continue to improve those procedures. All also had ways in which they would like to improve data management, though as a rule these were identified as only needing one or two kinds of actions.

Table 22: Types of Flood Mitigation Activities Identified in Six Selected PA County Hazard Mitigation Plans, 2011-2015: Number of Activities Reported by Each County

<table>
<thead>
<tr>
<th>Category</th>
<th>Allegheny</th>
<th>Bedford</th>
<th>Cambria</th>
<th>Chester</th>
<th>Lycoming</th>
<th>Monroe</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Communication and Public Information</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public information / outreach</td>
<td>3</td>
<td>2</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>Communicate flood priorities to local agencies</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Facilitate cooperation among local agencies</td>
<td>1</td>
<td>--</td>
<td>--</td>
<td>1</td>
<td>6</td>
<td>--</td>
</tr>
<tr>
<td>Promote collaboration with state and federal agencies</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>2</td>
<td>--</td>
<td>1</td>
</tr>
<tr>
<td>Provide technical support to community and/or agencies</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>2</td>
</tr>
<tr>
<td><strong>Infrastructure</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Authorize, fund, or build new structures</td>
<td>1</td>
<td>--</td>
<td>3</td>
<td>1</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>Identify and develop new structural projects</td>
<td>--</td>
<td>--</td>
<td>1</td>
<td>--</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Expand operations and maintenance or identify new funding</td>
<td>1</td>
<td>--</td>
<td>2</td>
<td>2</td>
<td>--</td>
<td>2</td>
</tr>
<tr>
<td>Acquire properties in flood zone: RL, SRL, other</td>
<td>--</td>
<td>--</td>
<td>1</td>
<td>--</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Other mitigation on private property</td>
<td>--</td>
<td>3</td>
<td>3</td>
<td>--</td>
<td>2</td>
<td>--</td>
</tr>
<tr>
<td><strong>Comprehensive Plans, Ordinances, Codes, Etc.</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Review or improve plans, ordinances, codes</td>
<td>1</td>
<td>--</td>
<td>4</td>
<td>1</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Limit development in flood-prone areas</td>
<td>1</td>
<td>2</td>
<td>--</td>
<td>--</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Improve stormwater and drainage systems</td>
<td>--</td>
<td>1</td>
<td>1</td>
<td>--</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><strong>Emergency Preparedness</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acquire new equipment</td>
<td>--</td>
<td>1</td>
<td>2</td>
<td>--</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Improve procedures</td>
<td>--</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Protect critical facilities</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td><strong>Data Management</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Improve data management/analysis, including data on vulnerable structures, Geographic Information Systems, others</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td><strong>Natural Systems</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Protect natural systems and/or acquire land for open space</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>--</td>
<td>4</td>
<td>--</td>
</tr>
<tr>
<td><strong>Other Actions</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enhance/ improve training</td>
<td>--</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Encourage flood insurance by constituents and/or CRS participation by municipalities</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>--</td>
<td>2</td>
<td>--</td>
</tr>
<tr>
<td>Protect historically significant structures</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>1</td>
<td>--</td>
</tr>
<tr>
<td>Protect public assets vulnerable to flood damage</td>
<td>1</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>
Several counties identified needs for infrastructure improvements. Those might include repairing or improving drainage systems, flow control structures, and similar features; a few identified floodwalls or similar barriers. All plans showed the importance of ordinances and codes for flood mitigation, and identified a variety of ways in which to continue to improve either design or implementation of ordinances, codes, or code-enforcement procedures. All counties also stated issues of improving collaboration and coordination among institutions, reflecting the importance of functioning within the complex interrelationship among many Federal, State, and local institutions.

4.4.5 Case Study Municipalities’ Use of FEMA’s Community Rating System

As discussed in Section 3.4 (Methodology of Case Studies), interviews specific to FEMA’s Community Rating System were conducted to better identify more information about how this program is working and/or perceived in Pennsylvania. Ten respondents participated in the survey: one from each of the eight municipalities appearing as case studies in this report, and two from different counties in which the eight case studies are located. Of those municipalities, three currently participate in the CRS program, two with a level 8 classification and one at a level 9; five currently do not participate in the CRS program. Results are presented in Table 23 below, and summarized briefly in a discussion following the Table.

Table 23: Survey Results: Advantages, Problems, Limitations with CRS program and other Key Flood Mitigation Issues in Case Study Municipalities.

<table>
<thead>
<tr>
<th>Questions or frequently-stated issues</th>
<th>Respond “yes”</th>
<th>Respond “no”</th>
<th>Does not apply or no response</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>General information or knowledge of CRS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are you aware of CRS?</td>
<td>10</td>
<td>0</td>
<td>0</td>
<td>One learned from FEMA at a conference.</td>
</tr>
<tr>
<td>Case study municipalities that participate in CRS *</td>
<td>3</td>
<td>5</td>
<td>0</td>
<td>Of the eight case studies, three are CRS participants; 2 of 3 CRS participants responded to this survey.</td>
</tr>
<tr>
<td>Do you participate in a CRS users’ group? *</td>
<td>0</td>
<td>3</td>
<td>5</td>
<td>Two are working to create a users’ group in their area – may cross county lines</td>
</tr>
<tr>
<td>Advantages to CRS participation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Discount on flood insurance</td>
<td>5</td>
<td>0</td>
<td>5</td>
<td>Most considered this very important – one stated “It's our duty to our residents.”</td>
</tr>
<tr>
<td>----------------------------</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>------------------------------------------------------------------</td>
</tr>
<tr>
<td>Guidance from CRS: public information materials; outreach program examples; suggested mitigation actions</td>
<td>2</td>
<td>0</td>
<td>8</td>
<td>All responding CRS participants found guidance to be a powerful advantage.</td>
</tr>
<tr>
<td>CRS procedures, reporting, compliance</td>
<td>4</td>
<td>0</td>
<td>6</td>
<td>Several stated CRS procedures and recognition helps demonstrate value to elected leaders. One stated the maintenance schedule specified by CRS was very helpful to promote local agencies’ continuing maintenance.</td>
</tr>
<tr>
<td>Funding access</td>
<td>1</td>
<td>0</td>
<td>9</td>
<td>One respondent received grant application assistance with CRS guidance</td>
</tr>
</tbody>
</table>

**Barriers to CRS participation**

<table>
<thead>
<tr>
<th>Lack of support from upper levels of municipal government</th>
<th>7</th>
<th>1</th>
<th>2</th>
<th>One participant was told by City Council too few residents would benefit to make participation viable. Several commented they did not have authority to join CRS but would need authorization from above, and either they chose not to seek or were denied authority to participate.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administrative paperwork burdensome (initial application or continuing): required staff time is beyond agency’s resources</td>
<td>9</td>
<td>0</td>
<td>1</td>
<td>Initial paperwork was reported by all respondents burdensome. Several responded that participating would require at least one full-time staff position</td>
</tr>
<tr>
<td>Permitting is outsourced to others (County, private entity, other municipality)</td>
<td>2</td>
<td>0</td>
<td>6</td>
<td>Several small-budget municipalities do not have in-house permitting staff, so enforcement procedures, access to information may not be under their control.</td>
</tr>
<tr>
<td>Lack of assistance from Commonwealth agencies / staff</td>
<td>9</td>
<td>1</td>
<td>0</td>
<td>Respondents had little or no knowledge of available assistance or guidance. Only one contacted the PA-designated CRS coordinator with questions.</td>
</tr>
<tr>
<td>Prohibition on regional/County-level membership on behalf of cities, boroughs, townships</td>
<td>6</td>
<td>1</td>
<td>3</td>
<td>CRS is a federal program structured to work directly with municipalities – no role for County or regional agencies as currently designed. PA’s small communities are unable to achieve economies of scale though some activities would benefit (info. management, publicity, inspections, others).</td>
</tr>
<tr>
<td>Barriers to pooling resources</td>
<td>5</td>
<td>2</td>
<td>3</td>
<td>CRS membership is restricted to individual municipalities. Users groups promote information sharing but not collaboration. Many respondents routinely do this for other municipal activities (police, schools, code enforcement, etc.).</td>
</tr>
</tbody>
</table>

**Other barriers to effective flood mitigation (increasing CRS level or other beneficial actions)**

<table>
<thead>
<tr>
<th>Institutional barriers when actions require approval or oversight by PA or US agencies: FEMA, USEPA, PA DEP, USA Corps of Engineers, PEMA, other</th>
<th>8</th>
<th>0</th>
<th>2</th>
<th>Several mentioned complex procedures for acquiring properties in floodplain – consent or initiative of homeowner; negotiation over price (federal limits vs. market value); funding (though small) from municipality; documentation to PEMA and FEMA. Several gave examples of acquisitions begun but failed. One commented federal agency information “obstructionist and lengthy.”</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perception that flood mitigation is not supported by all residents because benefits accrue only to properties in floodplains</td>
<td>7</td>
<td>1</td>
<td>2</td>
<td>Elected and staff personnel expressed concern that general funds and of personnel shared by all residents should not be extensively used is not appropriate because not all residents are directly damaged by flood events</td>
</tr>
<tr>
<td>Question</td>
<td>Responses</td>
<td>Total</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-------------------------------------------------------------------------</td>
<td>-----------</td>
<td>-------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is adequate funding available for your flood mitigation?</td>
<td>8</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you have adequate information about potential funding programs?</td>
<td>0</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you have access to grants from funding entities?</td>
<td>1</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are restrictive floodplain regulations a problem to your community?</td>
<td>2</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is floodplain management conducted at the appropriate scope – local, county, regional, other?</td>
<td>0</td>
<td>4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Most respondents are not aware of the many PA, federal, and private programs available for funding flood mitigation. Multiple PA programs offer technical assistance for flood mitigation – none was mentioned by respondents.

Respondents found application process extremely time consuming and grants difficult to win. “Too overwhelmed with everyday responsibilities” to do necessary paperwork for applications.

Two respondents reported floodplain restrictions “lacking or non-existent” – “Hurts economic development.” Four respondents reported very strict limitations, one commenting “absolutely no development in the floodplain.”

Several respondents stated planning should be at regional or watershed scope. Cooperation and coordination in a regional plan would reduce non-compliance “Needs to be managed regionally!,” “No one looks at the big picture.”

These municipalities stated three key challenges for using the CRS program: insufficient or lack of funding, information, or institutional support. These barriers dissuade them from CRS participation and inhibit effective flood mitigation in their communities. All of the respondents reported lack of sufficient staff for initial paperwork including but not limited to tracking permits, records, regulations, and elevation certificates. Several of the non-participating communities expressed the level of funding needed as a full time staff position. Several commenters noted that the participating communities have stalled at an introductory level (Level 8 or Level 9) and attributed this to staffing, finding that more staff time is needed to increase programs beyond their basic status that would gain points for higher CRS levels. One participant enthusiastically brought the idea of participating in the CRS program to its council after viewing a CRS webinar, but the council declined on the grounds that it would require a full time staff...
Lack of support from “above” (i.e., elected officials or administrative staff with higher ranks in the local agencies) was reported by seven municipalities. Several of the seven found elected officials or higher-level staff to hold a position that funding required for the program would not benefit “enough” of the perception by some decision-makers that spending on flood mitigation is a benefit accruing only to properties in floodplains, not to residents whose own properties are not damaged by flooding, and therefore general revenues raised from all residents equally should be used sparingly for flood mitigation.

To a surprising degree, respondents expressed that they did not receive as much support as they would like from County and Commonwealth agencies. All respondents stated problems in this area whether it was access to grants, knowledge of funding programs or knowledge and support of the CRS program. Several of the municipalities felt the County activities were fragmented such that individual municipalities are not integrated into County plans. One respondent stated: "The small municipalities do not have the capacity to manage the program.”

That respondent recommends a regional approach to consolidate resources and information, an approach that is not supported by the current structure whereby FEMA interacts only with individual municipalities. Only one respondent reported contact with a state coordinator regarding CRS information. There are several funding opportunities at the state and federal level, however, none of the respondents were familiar with them or stated grant applications are burdensome and very competitive unless they have had a recent disaster.

The last area of questioning dealt with benefits of the program. All felt they had a duty to protect their citizens and help offset the cost of flood insurance, but most were not adequately knowledgeable of the other benefits offered by the program such as guidance materials, maintenance schedules, and free webinars.
CRS users groups were identified by some respondents as potentially useful. CRS user groups are regional groups of floodplain managers that meet usually once a month to share information, communicate ideas and brainstorm efficient ways to maneuver the complicated paperwork involved with the CRS program. CRS offers monthly webinars and newsletters on various topics that are free and would make a good meeting time for user groups to gather and discuss information from the webinar. All municipalities contacted for this part of the report expressed interest in participating in a user group. Two are currently investigating or beginning a process to organize such a group, and several County agencies have noted the advisability of such a group, but others had no knowledge of such groups or the advantages they may bring.

Many respondents suggested they would benefit from integrating flood-mitigation activities across municipalities, at the scale of counties, regions, or watersheds. That kind of coordination would assist the flow of information by the sharing of ideas for funding opportunities, flood mitigation actions that are effective in the participants’ own region, and activities found to gain points toward CRS scores. A CRS coordinator at the scale of multiple municipalities – aggregating municipalities by counties, cross-county regions, or watershed-based entities uninhibited by political boundaries – would be valuable to provide guidance on paperwork and facilitate information-sharing among member municipalities.

A CRS agency at the county level, or stand-alone institution facilitating CRS in a multi-county region, could achieve important financial economies of scale for actions such as record-keeping, completing paperwork for application and annual verification, and public-information campaigns. That kind of entity would undoubtedly increase CRS membership by Pennsylvania municipalities. Many floodplain managers interviewed for this report expressed being overwhelmed with the myriad duties they already perform on a day to day basis; the paperwork associated with the CRS program is overly burdensome. Coordination on a regional or watershed
scale can take the pressure off individuals, by leaving behind the 'to each his own' mentality by coming together sharing ideas and strategies much the way CRS user groups perform.

FEMA rules currently require that CRS-compliant records and flood-descriptive data be maintained at the level of each municipality, a rule that prohibits actions by agencies of any other political unit, but does not prohibit an entity such as ‘coordinator’ who could assist with information and guidance. That kind of information and institutional support could be provided by Commonwealth-funded personnel, who might work at the scale of multi-county regions or of the entire Commonwealth. Some parts of the U.S. have seen some state-level or regional-level efforts in this regard. For example, the Florida Emergency Management Agency funds a program known as the Florida CRS Initiative (floridadisaster.org). Florida State-employed CRS specialists visit communities to assist in identifying actions that can reduce potential flood damage and increase CRS credit points to increase the premium reductions for residents. The specialists also visit nonparticipating communities to encourage and assist with CRS enrollment. Similar support by Commonwealth staff could facilitate and greatly increase CRS membership by municipalities, and increase the extent municipalities’ flood-mitigation activities within CRS.

4.4.6 Use of Buyout Programs

While buyout programs referenced above give options to homeowners and property owners hit by flooding impacts, there are multiple concerns with the programs. First, because property owners have the option to rebuild with flood mitigation measures, the buyout programs can be looked at as encouraging property owners to remain in the floodplain, in at-risk zones. Additionally, when the government successfully buys out homeowners, those properties are no longer taxed, resulting in a loss of revenue. Lastly, the buyout programs are extremely slow. For example, under HUD’s buyout and recovery program, money remains to be allocated for damage and loss due to Tropical Storm Lee and Hurricane Irene, about five years ago.
The Lincoln Institute of Land Policy recently released a collaborative report assessing the impact of buyout programs and how they can be improved to better address the shortfalls.\textsuperscript{73} The report stresses the need to address long-term flooding adaptations, not simply fixing short-term problems. One recommendation suggests standardizing a buyout program on both national and state levels. Another recommendation provides methods for alternative sources of funding, possibly driven by funding models, and could include such ideas as land trusts and preservation taxes. Finally, the report puts forth the importance of incentivizing property owners to mitigate flooding and flood damage and to aid the recovery process as best as possible.

4.4.7 Key Points and Lessons from the Case Studies

Flood mitigation policy in Pennsylvania’s rural communities varies tremendously from one community to another. Flood protection approaches are highly dependent on decisions and conditions particular to the municipalities, even though federal and Commonwealth programs and guidance are exactly the same for each community. These case studies attempt to capture some of that variability due to the diversity of culture and geography, stream type and flood hazard type, and institutional or organizational approaches used by the municipalities. Some conclusions about strategies and techniques found effective by the case study communities, and factors that promote or inhibit those strategies, are summarized here.

The NFIP is not only a financial-compensation program for flood damage but also an incentive for communities to implement flood mitigation measures. The NFIP, designed to compensate property owners for losses and to have property owners pay for the value of this compensation, has evolved to include a set of guidelines and recommendations for basic flood mitigation measures that communities must implement for property owners in their jurisdictions.

to be eligible to purchase NFIP policies. Because those policies are so valuable, it has become almost unthinkable for communities not to allow them; accordingly, all communities studied conform to the NFIP’s basic requirements (including not only the eight case studies but also all other municipalities mentioned during the study). One feature is requiring communities to adopt a floodplain management ordinance, which has been a demonstrably important tool to the case study communities in this report. This federal program thus incorporates a programmatic, preventive component along with its reactive, financial-compensation purpose, and drives essentially all Pennsylvania municipalities to implement at least a minimum set of flood mitigation actions.

NFIP’s Community Rating System, a potentially valuable program, is severely underutilized in Pennsylvania as compared to other states. The CRS includes detailed lists of measures that municipalities may implement that are considered to go “above and beyond” the basic actions required for participation in NFIP. The underutilization appears to be partly by choice, partly because of specifics of the CRS design along with the Pennsylvania governance system, and partly because of alternatives available to Pennsylvania. Case study municipalities were selected to include some of the Commonwealth’s few CRS participants; participating and non-participating communities alike found CRS application, recordkeeping, compliance, and reporting to be financially burdensome for the small resources available to smaller municipalities typical of Pennsylvania’s rural communities. They choose to avoid those burdens. Placing the burdens at the level of municipalities, which is CRS strategy and is effective in states with large municipalities, causes problems in Pennsylvania because the township-and-borough governance structure ensures the state comprises thousands of small, low-tax-base municipalities, rather than the large “unincorporated county” structure common to many western and southern U.S. states. CRS staunchly refuses to allow agencies outside the municipality (e.g., at the county level) to
conduct activities and keep records on behalf of the small municipalities, thus the CRS burden falls to the smallest unit of government, which in Pennsylvania is very small indeed and often has limited financial resources. The presence of Pennsylvania’s County Hazard Mitigation Plan process appears to afford many of the same advantages as CRS, in those counties that actively and effectively implement it; but in counties that choose to implement in a modest way, reducing tax expenditures for their citizens, those efforts do not measure up to CRS standards. Further, an enormous driving factor for CRS is FEMA’s rule that reduces NFIP premiums for communities that participate in CRS – a potentially very valuable feature when Biggert-Waters Act effects are due to sharply increase the cost of those premiums. In short, some Pennsylvania municipalities achieve flood mitigation under Hazard Mitigation Plans comparable to what they would achieve under CRS, but a) those plans are not equally well implemented in all counties and b) those plans do not achieve the intensely valued effect of reducing NFIP premiums for residents.

PEMA’s County Hazard Mitigation Plan program is a valuable tool prompting communities to improve their flood mitigation strategies and techniques. Hazard Mitigation Plans have emerged as an important driver for flood mitigation by municipalities across the Commonwealth, using County agencies to lead municipalities and promulgating commonwealth-wide requirements via PEMA to elevate the minimum level of activity every county undertakes. The Plans are updated every five years, ensuring that counties and communities keep flood mitigation (and mitigation for other hazards) at the forefront of their planning and attention. However, the Plans are much more successful in some counties than others at generating effective mitigation actions by communities, because the counties very tremendously in the extent to which they involve their municipalities in the Plan development and the extent to which the Counties hold municipalities responsible for accomplishing actions stated as priorities in the Plan. Several of the case study communities are examples of excellent planning and
accountability and excellent impetus by county agencies. Other case study communities report little or no interaction with these plans, and little or no support for their flood mitigation efforts through this program. Shoring up the County Hazard Mitigation Program is one mechanism by which the Commonwealth could increase flood protection for many of its residents.

Floodplain management ordinances are in place in essentially all Pennsylvania municipalities where flooding may be experienced, and are a widely used tool in the case study municipalities. Land use and zoning ordinances are strictly the province of local, not state, government in the U.S., but PEMA has a powerful leverage in directing municipalities to take certain actions, in that PEMA has stated it will not approve disaster-response funding for municipalities that do not adopt a floodplain ordinance or for counties that do not adopt a Hazard Mitigation Plan. All case study locations were well aware of their floodplain ordinances, and review of those ordinances showed them to be strikingly similar – a testimony to PEMA’s power, as all conformed closely to the minimum requirements in PEMA’s suggested guidance. Yet, while the wording was very similar, ordinance implementation was sufficiently flexible to accommodate the different preferences of different municipalities.

Case study communities followed one of two courses. Most municipalities that experience any growth – which are primarily municipalities with substantial undeveloped land in their jurisdictions, almost all of which are townships – use the ordinances to prohibit all construction in the floodplain, guiding growth to areas outside the floodplain. Communities which are fully developed, including essentially all boroughs and cities evaluated here – whose boundaries established long ago are tightly constrictive of modern land uses – use their ordinances while allowing – even encouraging – construction in the floodplain, to gain economic development. They still use the ordinance to require restrictions such as design requirements and building materials that would minimize or eliminate potential damage in event of flooding.
Acquisition of structures in the floodplain, largely driven by FEMA funds, can be useful but is a double-edged tool with substantial negative implications, and is not funded at a level to be of more than limited use in Pennsylvania communities. FEMA programs of two kinds periodically make funds available: “pre-disaster mitigation” funds, with occasional funding from federal sources; and disaster-recovery funds, typically authorized by Congress in the period following a major disaster event. Both are administered by PEMA on behalf of FEMA, which means the Commonwealth has responsibility to choose which applicants receive funding – among potentially many municipalities and property owners. These acquisition programs require active participation by the municipalities in which the acquired land is located: a willing seller needs to work through the community to apply, and the sale is approved only if the municipality agrees to accept ownership of the land including indefinite maintenance and verification that no structures or other flow-obstructing items (trees, ballpark backstops, certain kinds of picnic pavilions, and many more). The requirement of municipalities’ participation gives the communities some control over the choice of properties, but that control is limited.

Among the case studies, it is clear that municipalities use this process only when “willing sellers” are interested – none of the communities wish to be seen in any way as coercing businesses or homeowners to sell properties where they would like to remain; but many of the municipalities are prepared to work with owners who have interest in leaving the floodplain, which incrementally reduces damage in the event that neighborhood should flood. Further, some municipalities (Jersey Shore, Johnstown, Downingtown) specifically eschew acquisition and demolition of structures unless they have been abandoned, on the grounds that they do not support any loss of productive land use or tax revenue. If the municipality declines to accept and maintain the property, no acquisition is possible under this program. Finally, participating municipalities note a tendency toward increasing burden to them in paperwork, application,
negotiation with landowners, and approval of final details – several described years-long efforts that failed to be consummated. They are discouraged from entering the process in return for limited gains, since funding limits the number of properties that can be removed from flood hazard through this technique. Lycoming County, which actively employs this technique, notes it has successfully supported its municipalities to acquire some 200 properties – a small proportion in a county with population of some 115,000. Muncy has acquired approximately 10 properties, with another 5 in process – still a small proportion in a borough of about 3,000 persons, of which some 40% lies in the floodplain. If Muncy were to alleviate its entire flood problem in this way, at the current rate of progress, it estimates the solution would be complete in perhaps 200 years. That solution would of course also destroy the cultural and historic fabric of the community.

This program is most effective when used surgically and focused on specific areas, where the entirety of a small, often-flooded neighborhood can be converted to open space; is of modest use when a few owners choose to sell in an afflicted neighborhood where many additional properties remain (and remain subject to future damage); and is judged to be of no use – is declined or avoided by some municipalities – where neighborhoods of many properties, equally subject to flood damage, would be damaged instead by the hollowing-out of scattered vacant properties, reducing the tax rolls and possibly triggering an irreversible decline of treasured cultural and historic neighborhoods.

Existing programs have limited capability of coordination across jurisdictions. In a theme that recurs repeatedly through these case studies, the geographically small size of each municipal jurisdiction has hampered certain improvements that the flood managers would find useful: Modifications to the creek bed could include acquisition of open space near the channel, with potential modifications as holding basins, that could capture the peak of localized short-duration high-0runoff events; but the floodplain in the borough has been developed, with historical land
uses that would be substantial economic and cultural losses; while remaining undeveloped open space – including pasture land that could continue as pasture with easements for infrequent flooding where needed – is not within the Borough’s jurisdiction, and the adjacent townships where such land is found do not experience costly flooding and so have no incentive to implement those land use changes. The responsibility for actions and decisions for floodplain management occur at such a local level, and have no incentives for cross-jurisdiction coordination – even to the point of prohibitively strong barriers to such coordination- that there is no mechanism to implement certain kinds of improvements that require consideration across larger land areas. Examples include: a) Muncy Creek channel improvements where potential spreading zones are outside the Borough b) Etna where storm drain improvements upstream of the jurisdiction could powerfully reduce the amount of runoff from local storms that flows across the borough, exacerbating backup of floodwaters in local creeks, and overflow of overloaded storm drain systems in the borough c) inhibiting acquisition of properties in floodplain, where businesses and homeowners would move to nearest undeveloped area – which is outside the very limited jurisdiction of the boroughs, generally fully built out, and commonly within an adjacent township; d) planning for avoiding development in a region’s most at-risk floodplain, and encouraging development in geographically desirable location, while sharing revenues from development channeled to those areas from all parts of the region.

Boroughs and Townships exhibit tremendous institutionally-, geographically-, and demographically-driven differences in the opportunities, limitations, and suitability of various flood mitigation strategies. The difference begins with the style of governance, where Townships exhibit a lighter touch: lower taxes, somewhat reduced services, and limited time, effort, and resources from Township personnel, who as a rule have fewer staff person-hours per capita resident, and even more so per square mile of area served. But Boroughs differ from Townships...
profoundly in demographic, historical, and geographic factors as well. Problems faced by third-class cities are in many cases indistinguishable from those of the Boroughs – in many cases those cities are similar in cultural, historical, and demographic factors with Boroughs. A key difference among all three kinds of governance structures is the divide between areas with growing population and economic activity and areas that are contracting: in growing areas, floodplain management can direct growth to areas outside the floodplain.

The sharp distinction here is that many Boroughs, their boundaries laid out for 18th or 19th century land uses, are very tightly constricted – little if any acreage is available for new construction, inside or outside the floodplain – so if they direct construction to be outside the floodplain, nearly always that construction exits the jurisdiction and the borough loses the potential economic growth and tax base. They are understandably reluctant to prohibit that construction, or to acquire land in the floodplain, or require costly renovations, because they almost certainly lose the business or homeowner to a surrounding jurisdiction.

Townships, on the other hand, routinely are laid out to be much larger in acreage; routinely were not the site of intensive development in previous centuries; and so typically have undeveloped land available, including outside the floodplain, where they can direct development without losing it to another municipality. They happily accommodate any businesses or homes that are turned away, or even mildly discouraged, in the congested boroughs and cities.

Among boroughs and small cities, the tendency for would-be developers to look elsewhere if flood restrictions are burdensome is resisted only in boroughs and cities with a strong reputation or desirability – such as a local university, a desirable historic district, or a nearby large city to which residents would commute. Notably, in many areas of growing and contracting economies alike, the growth in both population and in economic activity within the past few decades has tended to cluster in the areas outside established historical population.
centers, while long-established population centers decline. That trend, visible throughout the US, in Pennsylvania is manifested as yet another difference between Boroughs/Cities and Townships, because the long-established population centers are almost entirely found in Boroughs and Cities while the growth of suburban areas is almost entirely found in Townships. There are exceptions, with remarkable urban growth of Pennsylvania’s megacities of Philadelphia and Pittsburgh and some prospering medium-sized cities across the Commonwealth, but largely the urban/rural divide is also a divide between economic contraction and economic growth. In the case studies, the boroughs of Downingtown and Etna are contracting economically, while Townships such as West Whiteland, Bedford, and Smithfield are growing – West Whiteland rapidly and with financial resources substantially greater than the other cases examined in this report. Downingtown and West Whiteland Township exhibit sharply different trajectories even though both are in the growing and prosperous Chester County within the orbit of Philadelphia’s growth engine. The kinds of flood-mitigation actions available to Pennsylvania’s small municipalities depend powerfully upon the financial resources and institutions upon which they can draw, and those in turn depend strongly upon the economic climate where the community finds itself.

5.0 CONCLUSIONS AND POLICY RECOMMENDATIONS

The National Flood Insurance Program (NFIP) is both a benefit and a challenge for flood mitigation and local communities in Pennsylvania. The NFIP is unquestionably a benefit for residents and businesses in mitigating the extensive flood damage seen every year in Pennsylvania. Yet the structure of the NFIP produces challenges and problems for homeowners, renters, business owners, and other residents in many ways: how they can bear the insurance rate premiums to achieve the coverage and security provided by the NFIP? How do requirements or mandates under the NFIP limit or change choices they may make with their property? How do they navigate the informational and procedural complexity of the NFIP and the network of
insurers, local agency concerns, Commonwealth rules, and NFIP procedures that can make the difference for a given property owner’s successful coverage or costly mistakes? How does the Commonwealth help mitigate flood damage, reduce risk, and recover from floods?

Because the NFIP expires in September 2017, there may be an opportunity to help refine the NFIP in a way that works better for Pennsylvania’s communities, many of which have significant structures in the floodplain that pre-date the NFIP, some by a century or more. As noted above, at least one Pennsylvania citizen noted that they had figured out how to deal with flooding, but not flood insurance. This is a very real issue for individuals and communities alike, as well as the Commonwealth interested in preserving its sense of history while creating economic opportunities and ensuring vitality of local communities. Based on the information herein, this report includes several policy recommendations at the federal, state, and local levels.

5.1 Reauthorization of the NFIP offers an opportunity to examine critical issues.

The number of households carrying NFIP policies is declining against a backdrop of sharp and highly-publicized NFIP rate increases, even as their own properties remain at risk of flood damage and as occurrence of flooding has never been higher. This is increasing the potential financial impact to individuals, communities, and the U.S. Treasury. Addressing the NFIP’s budgetary shortfall by paring back subsidies (to inhibit placing new structures inside floodplains), while compassionately assisting communities where homes – and cultural history – long pre-date the NFIP, is a challenge that must be addressed. The adjustment costs outlined in Section 4.3 are significant, as is the risk of flood damage.

The search for an effective new NFIP structure is a search for a balanced approach that addresses the economic impact on primary homes and businesses while addressing the NFIP’s insolvency. Providing insurance rate relief for structures that implement flood damage mitigation measures, with innovative ways to offer rate reductions, may be one mechanism to help
incentivize flood damage mitigation, which reduces both misery of the property owners and financial impact to the Treasury.

Adjustments in the NFIP are being debated in Congress, and should be considered. There may also be finite adjustments that make a significant difference in Pennsylvania. For example, the Community Rating System program could be revised to allow for regional or cooperative groups’ participation in the CRS program. This could enhance the number of communities using CRS and gaining the benefits of damage reduction and rate relief. This change at the federal level, de-emphasizing its insistence on dealing only directly with municipal agencies, would be particularly valuable to Pennsylvania owing to the Commonwealth’s system of many small municipalities. FEMA should also complete the affordability study mandated under HFIAA 2014 as soon as possible to better determine the actual impact of rate increases more broadly.

5.2 The Federal Emergency Management Agency (FEMA) should improve its collection and sharing of flood data and information

Understanding the impacts of flooding and increased flood insurance rates is made more difficult because a) data are not systematically collected for that purpose by FEMA, and b) FEMA does not actively promote accessibility of data it does collect. For example, data is on subsidized rates or what constitutes an actuarial rate is not available. Although the number of policies and overall value is available, the need to better link with geographic and demographic data would be important to more fully determine the potential impacts of NFIP rate increases, especially related to particular rural, low-income, or ethnic groups. The limited information arises partly from the need to protect privacy of individuals and confidentiality of business data, but partly because neither FEMA nor others make it a point to collect, or to make available, information that would be useful to assess their effectiveness. Analyses like this one would be greatly improved by improved data.
5.3 Federal, State, and Local partnerships and collaboration should continue and be enhanced.

Continued and enhanced coordination between federal, state and local partners can greatly improve flood risk mitigation by sharing information about multiple agencies’ programs, and identifying ways in which programs and projects can include flood mitigation among their multiple objectives. For example, the U.S. Army Corps of Engineers is partnering with the Commonwealth on important flood risk and mitigation studies, as is the Susquehanna River Basin Commission. A particularly helpful cooperative effort is the Silver Jackets, a partnership of federal, state and local agencies led by the Corps of Engineers and replicated in many parts of the U.S., designed to share information about resources, techniques, and emerging information, and identify ways to more fully implement mitigation activities. However, there is a need for more outreach at the municipal and local level. Municipal-level agencies across the Commonwealth benefit from guidance, outreach, and funding programs led by the Pennsylvania Emergency Management Agency (PEMA), and take advantage of funding programs such as through the Department of Community and Economic Development (DCED) to develop multi-objective local programs that include flood mitigation among the outcomes that benefit their communities. However, more coordination, outreach (and funding) is needed.

5.4 FEMA’s Flood Insurance Rate Map (FIRM) process should improve its ability to consider on-the-ground conditions

Remapping flood zones periodically is crucial so that these decision-guiding maps can incorporate changes in land uses and hydrology. As always, the mapping process also encounters many choices. There are numerous challenges, such as how to incorporate protective levees that are not up to current standards; how to demarcate zones with a precise probabilistic line when the edges of the zones are subject to many local perturbations; and how to interpret data from historical flood events while addressing changing conditions in the number and intensity of
storms that can be expected in the future. FIRMs need to use both aerial techniques and ground techniques to acquire information about the floodplains, structures located in the floodplains, and complexities of elevation and flow patterns, especially at the borders between Special Flood Hazard Areas and areas designated as lower in risk. Additionally, FEMA should continue to finalize updated maps in areas not yet finished; this includes three Pennsylvania counties to date. In particular, FEMA should be fully transparent in the decisions it makes about these many highly imprecise analyses, and should enhance its procedures for accepting information from communities about land uses, protective structures, and localized flows. Innovative approaches might allow FEMA to alert communities of a pending change. For example, if FEMA determines that a local levee is unreliable or not certified and cannot be included in the updated map, there needs to be a conversation with the community to allow for action to improve the levee prior to making a rate-impacting final decision about mapping the flood zone.

5.5 Congress and the States should explore innovative market designs to address flood risk reduction

The Federal Government should seek ways to promote the creation of flood insurance markets using innovative market designs that resolve the fundamental problems that have made private insurance markets infeasible and necessitated the creation of the NFIP. This may include insurance for moderate to low flood risk properties, flood insurance beyond $250,000, all-hazards insurance, and/or multi-year flood insurance (Affordability of National Flood Insurance Program Premiums: Report 1). There may also be ways to rethink the system. For example, could universal flood coverage be created by removing the flood exclusion from normal homeowner or rental insurance? This would increase the number of American homeowners who have insurance that covers flood losses from approximately 5.5 million to 69 million. (French, 2014). It should be noted that a goal of the NFIP is to increase participation in flood insurance;
However, the rate increases have in part resulted in drops in coverage, not expansion. How to create opportunities to expand participation in flood insurance is critical.

5.6 Federal or Commonwealth agencies should create and adopt standardized lender guidelines for flood insurers

Federal law specifies that property owners must hold flood insurance to acquire a mortgage on properties in a FIRM-designated high-risk flood zone, but not on properties in moderate to low-risk flood zones. However, persons acquiring a property in those lower-risk zones may need to hold flood insurance coverage to secure a mortgage, because many lenders require flood insurance for any property in a community with known history of flooding.

Because lenders have the prerogative to require a buyer or a property owner to hold flood insurance, there can be powerful inequities between property owners based on varying decision processes by lenders. In the past, such arbitrary decisions have led to housing market crises in some areas (Holt, 2009), and have the potential to intentionally or unintentionally discriminate against certain categories of would-be homeowners. Clear, uniform and binding guidelines for lenders would eliminate this inequity, and would allow the Commonwealth to make a considered decision about the extent of the covered community. For example, requiring homeowners in low-to moderate-probability flood zones to also buy flood insurance may increase the risk pool, which is a decision that should be made for all lenders and all borrowers rather than on an ad hoc basis by individual lenders. Doing so at the Commonwealth level would allow rates to be adjusted to varying probability of flooding in high, moderate, and low-probability zones.

74 https://www.floodsmart.gov/floodsmart/pages/about/when_insurance_is_required.jsp.
5.7 **Pennsylvania should consider creating a comprehensive flood and stormwater mitigation plan for the Commonwealth as a whole.**

This analysis supports a recommendation by the Pennsylvania Association of Floodplain Managers (PAFPM) calling for a statewide strategic approach for both flooding and stormwater policies. The two problems are similar in nature; however, many Pennsylvania municipalities have separate programs or regulations. If the two are not considered together, policies that improve one problem may exacerbate the other. Managing both sets of questions together may help provide innovative and creative solutions that would not be financially attractive for either problem on its own. Working in tandem with updates to the Pennsylvania State Water Plan may be a way to start to view water as a unified system. Significantly increasing financial, staffing, and training support to meet statewide needs and provide for county-level coordination and local implementation, including effective Community Rating System (CRS) and Hazard Mitigation Plan actions, is a critically identified need. Development of a Center of Excellence like that proposed in the Borough of Muncy may be one way to achieve this statewide coordination of flooding and stormwater.

5.8 **Pennsylvania can help address rate increases by better supporting CRS implementation and developing overarching templates or guidelines**

Implementation of the CRS program in Pennsylvania is very limited. Very few eligible communities participate: about 28 communities, out of a total of nearly 2,500 eligible communities. Most participating Pennsylvania communities have achieved only the lowest levels (Class 9 or 10), which afford relatively small rate reductions of 5% or 10%. Examples show that it is possible to achieve higher levels: Harrisburg is an example of a Class 6 CRS community, which provides a 20% reduction in rates for its NFIP policy holders. Better support and/or regional coordinators to help accomplish the CRS requirements may help improve implementation of this program.
The Commonwealth should identify ways to increase community participation in CRS to provide financial relief to Pennsylvania’s businesses and homeowners through reduced NFIP premiums. The Commonwealth could work with FEMA to allow recordkeeping and outreach activities to be conducted by county or regional agencies, removing the burden of that activity from Pennsylvania’s many small communities; this, however, may take a change in legislation. Failing that, the Commonwealth could create or encourage multi-community collaborative groups to help meet the local community needs, including potentially hiring contractors. These collaborative entities could conduct all outreach within communities, and keep records within the communities, while attaining economies of scale by replicating those services for multiple municipalities. The goal is to gain CRS credit for many flood mitigation activities currently implemented, or easily added, by small municipalities, gaining not only the flood protection of those measures but also CRS recognition and reduction of NFIP premiums. This is the one existing program that has the opportunity to reduce those premiums, and the proper institutional infrastructure could gain advantages for Pennsylvania’s communities and individuals.

The creation of an overarching “template” for localities to follow in drafting various flood mitigation plans and activities could lead to better organization and implementation across Pennsylvania. Flood protection approaches are highly dependent on decisions and conditions particular to the municipalities, even though federal and Commonwealth programs and guidance are the same in each community.

5.9 Pennsylvania should help communities and individuals by providing easily-accessed information, State-level support personnel, and expanded funding for outreach and communication.

There is a need to improve accessibility of data sharing and communication systems, so that information can be productively used by members of the public, by researchers and analysts who can assess effectiveness of various programs, and by municipal staff who would like to use
the information to improve their own efforts. Improvements may include updating the “flood mapper” program and raising awareness of flood risk and mitigation options, and more accessible web sites, including those of many Commonwealth and municipal agencies that could much more effectively promote informational exchange.

As the Commonwealth moves forward, access to integrated information is critical. The Commonwealth can be helpful in a) aggregating information, and b) sharing it in more accessible ways. The Pennsylvania Association of Floodplain Managers recommended gathering information statewide about flood insurance and property data from counties and other agencies; analyzing the impact of insurance rate changes within county boundaries, with state support and funding, and then consolidating these county studies for a statewide picture. (PAFPM, 2014). In addition, PASDA has made much of the information available from this project on its site. Given the challenge of accessing county-information (Section 3.2), purchasing access to detailed data from CoreLogic75 (a commercial database that in part includes property transactions and linkages to flood-related information) may provide a more direct route to this information.

Finally, more detailed information on flood related issues and contacts is needed. While DCED’s website does not state its NFIP responsibilities,76 the agency’s webpages on flooding are some of the more helpful and easy-to-navigate webpages among the Commonwealth’s various agencies.77 Other sites could be more robust, including access to key flood related contacts. At the municipal level, websites can also be quite helpful; see, for example, the Borough of Etna’s site.78

75 CoreLogic’s flood related information: http://www.corelogic.com/landing-pages/flood-services.aspx
76 http://dced.pa.gov.
78 See e.g. http://etnaborough.org/flood-information.html.
5.10 The Commonwealth should develop differentiated procedures, requirements, and guidance for different kinds of communities.

There are stark differences in the needs, capabilities, and conditions of different kinds of communities: urban versus rural; city versus borough versus township; high-frequency, low-impact flooding versus seldom-occurring, catastrophic-impact flooding; and others. The Commonwealth should seek to develop a flood-mitigation program that differentiates the needs of the wide variety of its communities.

In aggregate, townships experience nearly twice as many flood events and nearly twice the financial damage of boroughs and cities combined. They also have very different governance structures and financial resources from other local governments. Commonwealth programs will best serve those communities if they make available more technical expertise, more funding or cost-sharing opportunities, and more opportunities for collaboration.

Historic boroughs often have 200-year-old land uses and very small geographic boundaries. In many cases, they also have declining population and employment so face a need to conserve their tax base while protecting their citizens from flooding. They need financial resources and flexibility in regulatory requirements to implement innovative, sustainable, effective protective measures for existing structures in the face of the federal preference to remove structures from the floodplain. Widespread removal of properties is a strategy that would mean the end of many of Pennsylvania’s historic river towns with their deep cultural roots.

Different flood impacts also necessitate different responses. For example, communities that experience rare, but catastrophic events such as Johnstown need access to emergency assistance while thinking about wide-spread land-use decisions and slowly-accruing, high-ceiling financial resources. In contrast, communities that experience frequent low-intensity events such
as Muncy need programs that provide low-cost, low-payout insurance for properties that receive minor damage on a repeated basis.

The many variations in Pennsylvania’s communities argue against a one-size-fits-all program of insurance, guidance, and response. The Commonwealth should actively develop programs specifically tailored to those distinct needs. All programs should permit and promote collaboration across jurisdictional boundaries, at the county and the multi-county scale, to allow for adaptation to each region’s needs. Further development of regional development districts may be one mechanism; there may also be others to help address local needs.

5.11 The Commonwealth’s Hazard Mitigation Plan is an effective blueprint that needs additional support and implementation.

The Hazard Mitigation Plan process may be an effective blueprint for the kind of county-scale collaboration recommended above. Its feasibility is well demonstrated. Some case study communities have made highly effective use of that process to drive continuing improvement in flood mitigation activities. The Hazard Mitigation Plan process helps drive vigorous flood mitigation where counties require their communities to participate by developing proposed actions and holding them accountable for completing those actions within the five-year Plan reauthorization cycle. In contrast, other counties have made limited use of the Hazard Mitigation Plan, creating a paper-only plan that has little input from municipalities and little influence on incentivizing municipalities to implement effective flood mitigation.

Commonwealth-level financial and technical support should be provided to counties to help attain the maximum value from this program. Other approaches can also succeed: effective county-level implementation is accomplished through other resources. For example, Chester and Lycoming Counties supplement their Hazard Mitigation planning with other flood management activities. The Commonwealth should allow and encourage those alternate approaches.
5.12 State level funding, expertise, and incentives should be increased, and can be used to direct funds to areas of greatest needs.

Overall, adequate funding, staffing, training and institutional support are key elements to develop a statewide strategy. These should be increased to a level where municipalities can obtain the kinds of knowledge, technical support, and financial resources they need to conduct effective mitigation. Flood impact mitigation is at present a task whose financial burden falls in large part upon the municipalities of the Commonwealth. However, all Commonwealth citizens suffer from flooding impacts, either directly or indirectly. There is a role for Commonwealth resources, both technical and financial, to provide municipalities support they are currently lacking to solve this pressing problem.

Counties differ enormously in the extent to which they suffer flood damage. Further, as the case studies show, some locations within counties are much more hard-hit historically, and subject to much more potential damage in future, than other locations. At a smaller scale, most municipalities include areas subject to damage and others less so. County and municipal jurisdictions express reluctance to devote too large a proportion of their time and effort to specific areas, implying that taxpayers outside the flood zone resist spending their taxes on others. This may be short-sighted: the economic vitality of a business district or a neighborhood benefits all, not only those who live or work there.

Grants should be made available based on need for program development, planning, and mitigation measure implementation. It is crucial that a program of that kind be uncomplicated and not burdensome for the communities applying for grants: the community’s burden of proof to show they need the funds should be held to a minimum, and the grant process should be accompanied by Commonwealth-level experts and assistance to support the process.
Technical expertise should be provided to communities to assist in administering, implementing, and documenting their flood mitigation efforts. Almost uniformly, the case study municipalities had assembled an impressive understanding of their flooding problems and the capability to design programs to reduce risks. They do not need help with this, but instead to allow them to act on their deep understanding of local problems and preferences. But many of them do not have resources or expertise to acquire funding, to continuously interact with the many affected members of their communities, and to sustain the planning and coordination needed for this complex problem. Commonwealth staffing or financial support for staffing will allow them to act on their identified needs.

Commonwealth leadership should help establish county-level or regional-level agencies that could perform tasks for municipalities, attaining economies of scale and promoting collaborative approaches. These entities could take responsibility for identifying, seeking funding for, implementing, and maintaining some of the many potentially-effective flood mitigation measures that cross boundaries of smaller jurisdictions such as basin-scale drainage designs, regional decisions about optimal locations for development, and regional-scale decisions about neighborhoods needing assistance.

5.13 The Commonwealth should consider developing a Center of Excellence to address these issues.

Development of a Commonwealth “Center of Excellence” focused on these issues may be a way to leverage additional funding and resources. Jeffrey Allen, DCED, has been pursuing this idea with partners to build such a center in the Borough of Muncy. Based on Centers of Excellence in other areas, this may be a way to coordinate work, leverage grant funding, provide training and resources, and connect with other entities working on flood related work. In addition, the U.S. Army Corps of Engineers has developed a proposal, “Chesapeake Bay and
5.14 Both the Commonwealth and local governments need to address potential impacts to the local tax base.

Local communities may be severely adversely affected as the tax base exits flood zones. To mitigate the loss— and in extreme cases prevent community dissolution— local tax authorities may be able to make their non-flood zone areas more attractive by stimulating new construction in non-flood zone areas through tax breaks and rezoning. This is more of a challenge in boroughs than in townships, the latter which tend to have more open space. Local government may have to adjust to lower population and economic growth in flood zones. Growth in non-flood zone areas should be prioritized.

Updating property value assessments to reflect true market values as prices decline in response to higher premiums will prevent flood zone housing owners from facing inflated property tax rates due to tax bills being based on legacy property values. Doing so will prevent an over-correction of flood zone housing supply, buoy housing prices during a difficult transition period, and prevent excess loss in long-term tax revenue from excessive flight. However, updated lower assessed housing values will reduce short-term tax revenue. How to address these very real effects could be an opportunity for a larger conversation between the Commonwealth and local governments.

5.15 Local government support of flood mitigation efforts can help address individual concerns.

Local governments can accomplish a win-win by participating in NFIP flood mitigation activities that both lower flood damage and lower premiums such as the CRS program. Doing so addresses the root of the problem by lowering user costs in a way that is reflects the true costs of
floodplain occupancy. This timely action will help stabilize housing prices, supply and tax revenue, while achieving economic efficient and socially optimality.

Local government can work with homeowners on how to lower premiums by reducing their flood damage exposure and appealing to FEMA for appropriately lower premiums. Local and state governments may opportunistically convert flood zone housing parcels to natural areas, such as recreational and wetland areas, through property purchases and easements.

5.16 Information about flood insurance premiums must be more easily accessed

Homeowners need to be able to access up to date information about flood premiums. Currently, prospective homeowners are not fully informed about the full costs of flood damage (or equivalently, flood insurance costs). Indeed, in some cases, people cannot fully inform themselves even if they diligently seek the information. To prevent this from happening, prospective buyers should be made aware of (1) these costs prior to purchase, (2) the nature of typical flood damage (e.g. groundwater seepage as opposed to houses being swept away by rivers), and (3) the kinds of damage that are, and are not, covered by insurance policies they are considering, which can be very complex and can vary among policies.

Updating the Commonwealth’s “flood mapper” program may provide some of this information; however, information on this program is out of date. Working with realtors, lenders, title companies, and insurers to fully understand the impacts of both flooding and flood insurance may also be important to ensure that current and prospective property owners are fully informed.

5.17 Resiliency and Sustainability should be promoted at all levels of governance

Closely related to accessible information, resiliency and sustainability need to be promoted from all levels of governance, including municipalities, authorities, and utilities. The Rockefeller Foundation defines resilience as “the capacity of individuals, communities and systems to survive, adapt, and grow in the face of stress and shocks, and even transform when
conditions require it. Building resilience is about making people, communities and systems better prepared to withstand catastrophic events—both natural and manmade—and able to bounce back more quickly and emerge stronger from these shocks and stresses.”79 Penn State’s Sustainability Institute defines sustainability as “the simultaneous pursuit of human health and happiness, environmental quality and economic well-being for current and future generations.”80 Taken together, these ideas suggest that finding ways to address the economic well-being of local communities affected by flooding, addressing ecological needs, and meeting the needs of the people currently being affected are all critical goals. Furthermore, promoting resiliency and sustainability addresses not only flooding but also other impacts such as soil losses, water supply, climate change, and in general preparing individuals and communities for both the near and longer term as the risk of flooding is high, and increasing.

5.18 The Commonwealth should continue to explore expanding insurance options

The Commonwealth can work to increase coverage through the NFIP/private insurance markets, but care is needed to figure out how to more fully integrate private insurance into the market. As it stands currently, private insurance may be more affordable, but may not provide access to federal disaster relief funding and acts as a “lapse” in NFIP coverage. In other words, if a property owner switches from NFIP backed-flood insurance to private insurance, then wishes to switch back, their rates would jump to full actuarial rates. In addition, some lenders may not recognize private insurance. How to create a fully functional private insurance market is an area beyond the scope of this report, and may be a subject for further study.

79 Rockefeller Foundation: https://www.rockefellerfoundation.org/our-work/topics/resilience/
80 Penn State Sustainability Institute: http://sustainability.psu.edu/sustainability-institute
5.19 Counties can continue to play a key role in coordinating mitigation and providing critical information necessary to address increase flood insurance premiums

By participating to the fullest extent in the NFIP, the CRS program, Hazard Mitigation Plans, and other federal and Commonwealth programs, counties can help local municipalities meet requirements and implement flood mitigation. Sharing county level data with state, federal, local entities, including property assessment data, will be critical in identifying impacts of changing flood insurance rates. Working with local communities to address the impacts to their local tax base will also be important going forward. Finally, considering land use planning options to reduce high-value land uses in floodplains will also help decrease future risk.

5.20 Individuals should be encouraged to mitigate risk and purchase flood insurance

The risk of flood impacts is potentially severe for many individuals. Finding ways to mitigate risk will continue to be important, including by raising utilities out of harms’ way, elevating homes, or finding other mitigation measures to alleviate risk. At the same time, ensuring adequate insurance coverage is critical to help mitigate risk. Because of current federal rules that treat switching to private insurance as a lapse in NFIP coverage, care should be taken by individuals in evaluating their risk and coverage. However, private insurance may offer a way to access supplemental insurance for those looking to decrease their risk.
6.0 References


Cambria County Hazard Mitigation Plan Draft (2016). Retrieved from https://docs.google.com/viewer?a=v&pid=sites&srcid=ZGVmYXVsdGRvbWFpbnxjYW1icmlhY291bnR5aGlwfGd4OjY1MWVmNjM1NTk1MTczYQ.


Flood plain management criteria for flood-prone areas. 44 C.F.R. 60.3.


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7.0 APPENDICES

7.1 List of data resources gathered for this report
7.2 FEMA Data for Subsidized Properties (2012)
7.3 Case study selection memo
7.4 Case study questionnaire
**Appendix 7.1 List of data resources gathered for this report**

<table>
<thead>
<tr>
<th>Data</th>
<th>Source/Location</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>National Flood Hazard Layer NFHL (current)</td>
<td>PASDA</td>
<td>To provide baseline on current flood boundaries.</td>
</tr>
<tr>
<td>Flood Insurance Rate Maps—DFIRMS/FIRM (historic multiple years)</td>
<td>FEMA</td>
<td>To provide for analysis of change over time.</td>
</tr>
<tr>
<td>Light Detection and Ranging (LIDAR)</td>
<td>PASDA, Counties</td>
<td>To examine potential vulnerable areas.</td>
</tr>
<tr>
<td>Additional Elevation Data</td>
<td>PASDA</td>
<td>To examine potential vulnerable areas.</td>
</tr>
<tr>
<td>Aerial Photography (current as available and historic—digital to 1993)</td>
<td>PASDA, Counties</td>
<td>To identify structures, environmental attributes.</td>
</tr>
<tr>
<td>Aerial Photography of Flood events (historic)</td>
<td>PEMA, FEMA, Counties</td>
<td>To address data gap issues and provide foundation for vulnerability analysis.</td>
</tr>
<tr>
<td>Municipal Boundaries</td>
<td>PASDA</td>
<td>Base data for geospatial analysis.</td>
</tr>
<tr>
<td>Census Boundaries, Tracts, Block Groups, Blocks</td>
<td>PASDA, Census Bureau</td>
<td>To support for community level analysis.</td>
</tr>
<tr>
<td>Meteorological data (historic)</td>
<td>NOAA/National Weather Service</td>
<td>To provide for analysis of flood events.</td>
</tr>
<tr>
<td>Building footprints/structures (where available—these will likely only be available for current years—past 5-10)</td>
<td>Counties</td>
<td>To assess structures vulnerable to floods.</td>
</tr>
<tr>
<td>Land Use/Land Cover (current &amp; historic)</td>
<td>PASDA, Counties</td>
<td>To assess change in land use, impervious surface over time.</td>
</tr>
<tr>
<td>Parcels (where available)</td>
<td>Counties</td>
<td></td>
</tr>
<tr>
<td>Zoning (where available)</td>
<td>Counties, Municipalities</td>
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</tr>
<tr>
<td>Property sale data/assessment</td>
<td>Counties</td>
<td>To assess the change in housing values due to floodplain mapping and flood insurance rates</td>
</tr>
<tr>
<td>Flood claim/damages data</td>
<td>FEMA/PEMA</td>
<td>To assess how flood damages change housing values and occupancy</td>
</tr>
<tr>
<td>Mortgage data</td>
<td>Counties</td>
<td>To assess how many people in flood plains are required to buy flood insurance</td>
</tr>
<tr>
<td>Flood insurance policies</td>
<td>FEMA/PEMA and/or counties</td>
<td>To assess how many people in flood plains actually have flood insurance policies</td>
</tr>
</tbody>
</table>
Appendix 7.2 FEMA Data on Subsidized Properties for Pennsylvania (2012)

<table>
<thead>
<tr>
<th>State</th>
<th>Phase Out Immediately (25% annual increases until true-risk rate)*</th>
<th>Change of Ownership or other 100205(g) trigger</th>
<th>No Phase Out at This Time (Pending Full Implementation of BW-12 or 100205(g) trigger)</th>
<th>Total Affected by 100205</th>
<th>Not Affected by 100205</th>
<th>Grand Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>PENNSYLVANIA</td>
<td>3,798</td>
<td>4,934</td>
<td>613</td>
<td>21,423</td>
<td>399</td>
<td>34,477</td>
</tr>
<tr>
<td></td>
<td>157,268</td>
<td>82,932</td>
<td>12,651</td>
<td>578,312</td>
<td>34,477</td>
<td>61,941</td>
</tr>
<tr>
<td>Grand Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>75,693</td>
</tr>
</tbody>
</table>

* H.R. 5740 non-principal residences will be phased out beginning January 1, 2013. All others will begin being phased out October 1, 2013. Also, note that there is overlap between the categories. For example, some SRLs are also non-principal residences. However, for this exhibit each policy has been placed into only one category.

** Non-Residential count includes some structures that are not businesses, such as churches, government buildings, garages etc.
Goal 4.1 of the Project was to identify community-level impacts, costs, and strategies for between 6 and 8 selected case-study communities in Pennsylvania. Case study communities are intended to be selected to capture, to the extent possible with such a small sample, the diversity of Pennsylvania’s rural communities subject to flood concerns, and the diversity of ways in which the communities have responded. The following table, presented in the Proposal, listed the kind of factors that could be used to select case studies.

<table>
<thead>
<tr>
<th>Potential selection factors from original proposal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Government structure</td>
</tr>
<tr>
<td>Size of the community</td>
</tr>
<tr>
<td>Socioeconomic factors</td>
</tr>
<tr>
<td>Land use</td>
</tr>
<tr>
<td>Geographic region</td>
</tr>
<tr>
<td>Vulnerability to flooding</td>
</tr>
<tr>
<td>Participation in voluntary Federal or Commonwealth programs</td>
</tr>
<tr>
<td>Availability of information</td>
</tr>
<tr>
<td>Other factors to be suggested by the Center for Rural Pennsylvania staff</td>
</tr>
</tbody>
</table>
As the first deliverable, the Project team proposed the following potential selection factors. These factors modify the above list, developing factors that can use available data to capture diversity among the communities and to focus the case studies, to the extent possible, on communities with rural characteristics and/or underserved demographic characteristics. Table A summarizes the factors. Table B uses available data to divide Pennsylvania counties, cities, boroughs, and townships into categories for each of the potential factors. The data used for the analysis are presented in four Attachments. Prepared by: FGCU team, April 28, 2016

**Table A. Selection Factors shown in italics in left-hand column. Factors numbered 1 through 5 in left-hand column are described and tabulated in Table 2.**

<table>
<thead>
<tr>
<th>Selection Factor</th>
<th>Categories</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Government structure</strong></td>
<td>City, Borough, or Township – stated on table, not itemized as a separate category</td>
<td>Diversity of institutional approaches</td>
</tr>
<tr>
<td><strong>Geographic region</strong></td>
<td>Distribute across Pennsylvania: three major river basins (Ohio, Susquehanna, Delaware); and various tributaries. These will be used to ensure that some case studies are selected from each of the three major river basins.</td>
<td>Diversity of geography</td>
</tr>
</tbody>
</table>

1. **Socioeconomic factors**
   These will be used to identify those potential candidate communities with relatively high proportions of underserved populations (by ethnicity) and with relatively high proportions of population in low-income categories, and to include examples of each within the case studies, if other factors can be satisfied while so doing.
   a) Ethnic composition of population by county  
   b) Household income by county
   a) List counties with minority population greater than PA average (22 counties); identify those where minority population greater than 1 standard deviation above the mean (8 of those 22 counties)  
   b) List those where >20% of population is “low income” (<$20,000/yr): 27 counties

2. **Population density by county**
   These will be used to direct focus primarily to low-density and rural-land use counties, and give less favorability to high-density or mostly-urban communities, except where needed to include some cases with desired geographic distribution and/or examples of a range of flood management strategies.
   List those with <250 persons / sq mile; note those with <100

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*Flood Mitigation for Pennsylvania’s Rural Communities*
Table A, concluded. Selection Factors tabulated below in Table 2

<table>
<thead>
<tr>
<th>Selection Factor</th>
<th>Categories</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>3. Land use: rural vs “developed”</td>
<td>Counties with low percentage as “developed:” PA median is about 10% developed, 35 counties have less; PA 25th percentile is about 6% developed, 15 counties have less.</td>
<td>Focus on rural counties</td>
</tr>
</tbody>
</table>

Same note as above: These will be used to direct focus primarily to low-density and rural-land use counties, and give less favorability to high-density or mostly-urban communities, except where needed to include some cases with desired geographic distribution and/or examples of a range of flood management strategies.

4. Vulnerability to flooding

These will be used to give high priority among case studies to areas with higher vulnerability to flooding, via one or both of the identified factors.

   a) Number of NFIP Insurance Policies
   b) Number of Repetitive Loss properties

   a) List those among 22 greatest communities in PA
   b) List those among 24 greatest communities in PA

Focus on regions with greatest flood impacts

5. Participation in voluntary Federal or Commonwealth programs

These will be used to give high priority among case studies to communities that participate in one or both of the programs identified here, or other programs that might be later identified.

   a) Participation in Community Rating System of NFIP
   b) Participation in PEMA’s County Hazard Mitigation Plan

   a) 28 CRS communities in PA
   b) 14 counties developed HMPs with PEMA facilitation since 2010

Serve communities with history of participation; and take advantage of increased availability of information in those communities

Availability of information

Existing and revised floodplain demarcation, economic information, flood mitigation, planning information. Not shown on Table 2 – to be discovered during preliminary case study data acquisition.

Study those where information is available

These will be used to narrow down candidate case studies – those where information is limited or unavailable, or staff have limited availability, will be given lower priority and potentially replaced by those with higher availability of information, while satisfying the other criteria on this list.
1A. Socioeconomic factors part A:
Ethnic composition of population by county: See Attachment 1

Notations

Listed: Counties with % population “minority” greater than PA average (22 counties)

* Counties among those 22 with % population “minority” greater than 1 standard deviation above the mean (8 counties)

1B. Socioeconomic factors part B:
Household income by county: See Attachment 1

>20% of households with low income (<$20,000/year): 27 counties
2. Population density by county: See Attachment 1

**Notations**
* <100 persons/sq mi
<250 persons/sq mi: 44 counties – Greatest focus – all are listed here
200 – 600 persons/sq mi: 18 counties
>600 persons/sq mi: 8 counties

<table>
<thead>
<tr>
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<th>West Branch</th>
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<tbody>
<tr>
<td>Pike (105)</td>
<td>Centre (139)</td>
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<tr>
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<td>Clinton (44)*</td>
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<td></td>
<td>Lycoming (95)*</td>
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<td></td>
<td>Union (82)*</td>
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<tr>
<td>Carbon (171)</td>
<td>Northumberland (206)</td>
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<table>
<thead>
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<td>Centre (139)</td>
</tr>
<tr>
<td>Bradford (55)*</td>
<td>Montour (140)</td>
</tr>
<tr>
<td>Potter (16)*</td>
<td>Wyoming (71)*</td>
</tr>
<tr>
<td>McKean (44)*</td>
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<tr>
<td>Susquehanna (53)*</td>
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<tr>
<td>Warren (47)*</td>
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<table>
<thead>
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<th>Northern Tier</th>
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<tbody>
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<td>Tioga (37)*</td>
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<td>Montour (140)</td>
<td>Bradford (55)*</td>
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<td>Potter (16)*</td>
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<td>Warren (47)*</td>
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<td>Snyder (121)</td>
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<tr>
<td></td>
<td>Wyoming (71)*</td>
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<td>Butler (233)</td>
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<td>Clarion (67)*</td>
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<tr>
<td></td>
<td>Crawford (88)*</td>
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<tr>
<td></td>
<td>Mercer (173)</td>
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<td></td>
<td>Venango (82)*</td>
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<th>Schuylkill River</th>
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<td>Schuylkill (190)</td>
</tr>
<tr>
<td>Juniata (63)*</td>
<td></td>
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<tr>
<td>Bedford (49)*</td>
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<td>Huntingdon (52)*</td>
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<th>Central / plateau counties</th>
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<td>Blair (242)</td>
<td>Juniata (63)*</td>
</tr>
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<td>Cameron (13)*</td>
<td>Bedford (49)*</td>
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<td>Clearfield (71) *</td>
<td>Huntingdon (52)*</td>
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<tr>
<td>Elk (39) *</td>
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<tr>
<td>Forest (18) *</td>
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<td>Franklin (194)</td>
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<td>Fulton (34) *</td>
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<td>Jefferson (69) *</td>
<td></td>
</tr>
<tr>
<td>Sullivan (14) *</td>
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<tr>
<td>Somerset (72) *</td>
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</table>
3. Land use: Proportion of county land use in “developed” categories: See Attachment 2.

Notations
Listed: PA median is about 10% developed, 35 counties have less.

* PA 25th percentile is about 6% developed, 15 counties have less.

<table>
<thead>
<tr>
<th>Northern Tier</th>
<th>West Branch</th>
<th>Central / plateau counties</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pike</td>
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<td>Armstrong</td>
</tr>
<tr>
<td>Wayne*</td>
<td>Centre</td>
<td>Clarion</td>
</tr>
<tr>
<td>Tioga*</td>
<td>Lycoming*</td>
<td>Crawford</td>
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<td>Clinton*</td>
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<td>Potter*</td>
<td>Montour</td>
<td>Indiana</td>
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<tr>
<td>McKean*</td>
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</tr>
<tr>
<td>Susquehanna*</td>
<td>Wyoming*</td>
<td></td>
</tr>
<tr>
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<td>Crawford</td>
</tr>
<tr>
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<td>Wyoming*</td>
<td>Greene</td>
</tr>
<tr>
<td>Bedford</td>
<td></td>
<td>Indiana</td>
</tr>
<tr>
<td>Juniata</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Huntingdon*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bedford</td>
<td></td>
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</tr>
<tr>
<td>Juniata</td>
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<tr>
<td>Huntingdon*</td>
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<tr>
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<td>Armstrong</td>
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<td>Crawford</td>
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<tr>
<td>Greene</td>
<td>Armstrong</td>
<td></td>
</tr>
<tr>
<td>Indiana</td>
<td>Armstrong</td>
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</table>
### 4A. Vulnerability to flooding, part A:
Number of NFIP Insurance Policies: See Attachment 3

With number of policies as of May 2012

(22 greatest-number communities are listed – all with >290 policies)

<table>
<thead>
<tr>
<th>Community</th>
<th>Number of Policies</th>
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<tbody>
<tr>
<td>Philadelphia</td>
<td>3979</td>
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<tr>
<td>Bucks County:</td>
<td></td>
</tr>
<tr>
<td>Bristol Twp</td>
<td>714</td>
</tr>
<tr>
<td>Falls Twp</td>
<td>398</td>
</tr>
<tr>
<td>Lower Makefield</td>
<td>Twp 390</td>
</tr>
<tr>
<td>Yardley</td>
<td>281</td>
</tr>
<tr>
<td>Montgomery County:</td>
<td>729</td>
</tr>
<tr>
<td>Lower Merion Twp</td>
<td>434</td>
</tr>
<tr>
<td>Delaware County:</td>
<td>tribs.</td>
</tr>
<tr>
<td>Upper Darby Twp</td>
<td>321</td>
</tr>
<tr>
<td>West Branch</td>
<td></td>
</tr>
<tr>
<td>Jersey Shore</td>
<td>487</td>
</tr>
<tr>
<td>Milton</td>
<td>409</td>
</tr>
<tr>
<td>Lewisburg</td>
<td>339</td>
</tr>
<tr>
<td>Susquehanna Twp</td>
<td>303</td>
</tr>
<tr>
<td>North Branch</td>
<td></td>
</tr>
<tr>
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<td>2691</td>
</tr>
<tr>
<td>West Pittston</td>
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</tr>
<tr>
<td>Wilkes Barre</td>
<td>1923</td>
</tr>
<tr>
<td>Forty Fort</td>
<td>815</td>
</tr>
<tr>
<td>Bloomsburg</td>
<td>487</td>
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<tr>
<td>Main stem / south</td>
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</tr>
<tr>
<td>Sunbury</td>
<td>320</td>
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<tr>
<td>Lewistown</td>
<td>298</td>
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<tr>
<td>Harrisburg</td>
<td>1234</td>
</tr>
<tr>
<td>West Branch</td>
<td></td>
</tr>
<tr>
<td>Lycoming</td>
<td>549</td>
</tr>
<tr>
<td>Northumberland</td>
<td></td>
</tr>
<tr>
<td>Union</td>
<td>138</td>
</tr>
<tr>
<td>North Branch</td>
<td></td>
</tr>
<tr>
<td>Luzerne</td>
<td>491</td>
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<tr>
<td>Columbia</td>
<td>400</td>
</tr>
<tr>
<td>Wyoming</td>
<td>189</td>
</tr>
<tr>
<td>Lackawanna</td>
<td>147</td>
</tr>
<tr>
<td>Main stem</td>
<td></td>
</tr>
<tr>
<td>Bedford</td>
<td>130</td>
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<tr>
<td>Dauphin</td>
<td>755</td>
</tr>
<tr>
<td>Cumberland</td>
<td>157</td>
</tr>
<tr>
<td>Snyder</td>
<td>157</td>
</tr>
<tr>
<td>Lancaster</td>
<td>149</td>
</tr>
<tr>
<td>York</td>
<td>119</td>
</tr>
<tr>
<td>Perry</td>
<td>100</td>
</tr>
</tbody>
</table>

### 4B. Vulnerability to flooding, part B:
Number of Repetitive Loss (RL) properties per PEMA: See Attachment 4

(24 greatest-number counties are listed – all with >100 RL properties)

<table>
<thead>
<tr>
<th>County</th>
<th>Number of RL Properties</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bucks</td>
<td>846</td>
</tr>
<tr>
<td>Montgomery</td>
<td>628</td>
</tr>
<tr>
<td>Delaware</td>
<td>285</td>
</tr>
<tr>
<td>Northampton</td>
<td>262</td>
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<tr>
<td>Chester</td>
<td>164</td>
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<tr>
<td>Lehigh</td>
<td>111</td>
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<tr>
<td>Philadelphia</td>
<td>111</td>
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<tr>
<td>West Branch</td>
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</tr>
<tr>
<td>Lycoming</td>
<td>549</td>
</tr>
<tr>
<td>Northumberland</td>
<td></td>
</tr>
<tr>
<td>Union</td>
<td>138</td>
</tr>
<tr>
<td>North Branch</td>
<td></td>
</tr>
<tr>
<td>Luzerne</td>
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<tr>
<td>Columbia</td>
<td>400</td>
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<tr>
<td>Wyoming</td>
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</tr>
<tr>
<td>Lackawanna</td>
<td>147</td>
</tr>
<tr>
<td>Main stem</td>
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<tr>
<td>Bedford</td>
<td>130</td>
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<td>755</td>
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<tr>
<td>Cumberland</td>
<td>157</td>
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<tr>
<td>Snyder</td>
<td>157</td>
</tr>
<tr>
<td>Lancaster</td>
<td>149</td>
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<tr>
<td>York</td>
<td>119</td>
</tr>
<tr>
<td>Perry</td>
<td>100</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>County</th>
<th>Number of RL Properties</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allegheny</td>
<td>351</td>
</tr>
<tr>
<td>Blair</td>
<td>112</td>
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<tr>
<td>Westmoreland</td>
<td>110</td>
</tr>
</tbody>
</table>
5A. Participation in voluntary federal or Commonwealth programs part A: NFIP’s Community Rating System: See Attachment 5

28 communities in PA participate

* Eleven communities among the top 50 for number of flood insurance policies

# CRS level 6 or 7

---

**West Branch**
- Jersey Shore Borough*
- Lewisburg Borough*
- Milton Borough*
- Loyalsock Twp
- Northumberland Borough

**North Branch**
- Scranton*
- Wilkes-Barre*
- Kingston*
- Bloomsburg town*
- Danville Borough
- Point Twp
- Upper Augusta Twp

**Main stem**
- Sunbury*
- Selinsgrove Borough*
- Penn Twp (Snyder Co)*
- Hanover Twp*
- Harrisburg*
- Herndon Borough
- Monroe Twp (Snyder Co)

**Juniata River**
- Lewistown Borough*
- Granville Twp

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Flood Mitigation for Pennsylvania’s Rural Communities 235
5B. Participation in voluntary federal or Commonwealth programs part B: County Hazard Mitigation Plans

14 counties updated under 2009 PEMA facilitation
(with date of most recent update)

Per County web sites

References

Attachment 1: Data Pennsylvania demographics by county
Tables created for this project using data from Center for Rural PA demographic data:
http://www.ruralpa2.org/municipalities.cfm
http://www.ruralpa2.org/county_profiles.cfm

Attachment 2: Pennsylvania county land use: percent of land in “developed” categories.
Tables created using data from NLCD land cover data: http://www.mrlc.gov/nlcd11_leg.php

Attachment 3: Community CRS Participation Ranked by Flood Insurance Policy Count

Attachment 4: Data on flood events and on Repetitive Loss (RL) properties, by county for Pennsylvania
Tables created for this project using data from Pennsylvania 2013 Standard State All Hazard Mitigation Plan

Attachment 5: Community Rating System

Attachment 6: NFIP Payments to PA Municipalities since 1978
Appendix 7.4 Interview Questionnaire

Questionnaire for CRS Study: Top Form

Municipality Information

Contact's name:__________________________________________________________

Contact's title:__________________________________________________________

The Floodplain Manager/CRS Coordinator Phone

Number:______________________________________________________________

Town Name:_____________________________________________________________

Municipality Code # ______________________________________________________________________________________
Municipality Code # ________________________________

1. CRS Class ____  Were you the one who started the application?

2. What are your other responsibilities?

3. Are you a Certified Floodplain Manager? Do you have one on staff?

4. What sort of barriers do you or have you faced implementing CRS?

5. (NP) What incentives interest you in the program:
   a) Reduced insurance rates
   b) Guidance for mitigation
   c) Funding for projects

6. (P) What advantages do you find in your community's participation?
   a) Gain discounts on flood ins. for residents and businesses
   b) Access to guidance materials and informational outreach materials
   c) Use CRS participation as guiding force to help community agencies and decision makers recognize the importance of flood mitigation activities
   d) Something else you like

7. What led your community to choose your specific mitigation activities? Did CRS facilitate them?

8. Are you familiar with CRS user groups?

9. What types of funding are available for your mitigation measures?

10. Do you receive assistance from state or county agencies? Any others?

11. What CRS activities do you feel are most proactive in mitigating future floods damage in your town?

12. If you had the power to do so, in what ways would you change the CRS program to be more useful to communities like yours? Suggestions?

13. What are your current goals for flood mitigation?

14. What have we not discussed that you feel is important?
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