PricewaterhouseCoopers

Study of the Economic Effects of Charging Actuarially Based Premium Rates for Pre-FIRM Structures

May 14, 1999
Final Report

FEMA

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1. Introduction

This report presents the results of a study on the economic effects of charging actuarially based premiums for pre-FIRM (Flood Insurance Rate Map) structures. The study was performed in response to Section 578 of the National Flood Insurance Reform Act of 1994, which required FEMA to "conduct a study of the economic effects that would result from increasing the premium rates for flood insurance coverage made available under the National Flood Insurance Program (NFIP) for pre-FIRM structures to the full actuarial risk based premium."

The effects covered in this study include:

- Which types of areas would experience a change in flood insurance rates
- The amount by which premiums would change
- The numbers and types of properties that would be affected
- The numbers and types of properties in which flood insurance coverage would be cancelled in response to higher insurance rates
- The effects of the change in rates on land values and property taxes
- Other effects of the change in rates on homeowners, the economy, and certain government disaster programs

The study does not include establishing the actuarially sound rates for flood insurance coverage; FEMA has provided the actuarial premium rates used in the study, and these rates are assumed to be actuarially sound.

Because this study was started in 1996, the changes in premiums are assumed to occur in 1998 for analysis purposes. The results would generally apply to premium changes that were initiated in 1999 or later years.

The NFIP program was intended to: (1) better indemnify property owners from flood losses; (2) reduce future flood-related losses through community floodplain management measures; and (3) reduce future disaster assistance costs through insurance and floodplain management. However, increases in flood insurance premiums could result in fewer flood insurance policies being purchased, undermining the original intent of the program. These concerns need to be balanced against the value of charging full actuarial risk based premiums when considering any NFIP policy changes.

1.1 Background of the National Flood Insurance Program

The National Flood Insurance Act of 1968, as amended, created the National Flood Insurance Program. The NFIP is a cooperative venture involving the federal government, state and local governments, and the private insurance industry. The federal government sets insurance rates, provides the necessary risk studies to communities, and establishes floodplain management criteria guiding construction in the floodplain. Communities must adopt and enforce minimum floodplain management standards for new and substantially improved structures. Flood insurance is only available in those communities that enact and enforce these measures. Private insurance companies, under an arrangement known as the Write Your Own program, sell and service federal flood insurance policies and retain part of the premium for their efforts.

The general principles upon which the NFIP was based are described in *Insurance and Other Programs for Financial Assistance to Flood Victims*, a report prepared by the Secretary of

Housing and Urban Development in 1966 for the U.S. Senate Committee on Banking and Currency. The report cited two considerations that justified providing a general taxpayer subsidy for the flood insurance program. One, premiums had to be reasonable for people to buy the insurance. Existing construction could be so poorly situated that full risk premiums would be unaffordable. With insurance provided at subsidized rates, floodplain residents could make a contribution toward pre-funding their recovery from a flood disaster. Second, flood insurance had to be linked to floodplain management. The availability of reasonably priced flood insurance would be the *quid pro quo* for communities to adopt measures to ensure future reductions in flood losses.

In establishing the flood insurance program, Congress considered ways to equitably distribute the burdens between those who would be protected by flood insurance and the public. Subsidized flood insurance for existing properties in flood risk areas became an important element of the flood insurance program for the following reasons:

- Occupants did not understand the risk when they built in these areas since flood hazard maps were generally not available.
- There were no effective public safeguards against the occupancy of this land.
- Capital was sunk in these properties in flood risk areas, and the investment could only be salvaged by continued use.
- Subsidized flood insurance may prove to be less costly to the federal government than disaster relief.
- Subsidized insurance for these structures could provide an incentive for communities to adopt and enforce floodplain management that would reduce future flood losses.

The 1966 Report argued against subsidies for new construction because it was believed that subsidized insurance for new construction in flood hazard areas would encourage development of these areas. Structures built after the flood hazard was identified are considered post-FIRM and pay actuarial rates. In addition, property owners who build or substantially improve structures after the federal government has identified the risk are charged full actuarial rates. If a structure is substantially damaged or otherwise substantially improved once the risk is identified, it too will be actuarially rated based on its risk of flooding.

Premium subsidies were an interim solution to longer-term adjustments in land use. Clearly, the intent was to get residences out of floodplains, not to encourage people to continue to live there. The subsidy would allow reasonable premiums in the face of progressively greater flood risk so occupants would be willing to pay the cost of their flood insurance. Premium subsidies were never intended to be compensation for the higher level of risk inherent in these properties.

The authors of the original study thought that the passage of time, natural forces, and more stringent building codes would gradually eliminate the subsidized structures over time. Currently, about 30 percent of the NFIP policies are subsidized. This compares with about 70 percent of the policies being subsidized in 1978. Though modern construction and renovation techniques have extended the useful lives of buildings, other factors have intervened to help reduce the number of properties eligible for subsidized rates. The decrease in pre-FIRM structures has been attributed to a number of factors. They include flood control projects that have removed property from the floodplain; the acquisition of flood damaged properties under Section 1362 of the 1968 Act; the Hazard Mitigation Grant Program authorized under the Robert T. Stafford Disaster Relief and Emergency Assistance Act of 1988, as amended, and other acquisition and retrofitting programs; the NFIP floodplain management regulations that require substantially improved or substantially damaged existing buildings to be elevated or otherwise protected; redevelopment; natural attrition; and severe floods.

The Flood Disaster Protection Act of 1973 extended the NFIP's authority to grant premium subsidies as an additional incentive to encourage the purchase of flood insurance. The 1973 law also required the purchase of flood insurance as a condition of eligibility for direct federal and federally related financial assistance to acquire or construct improved real property in flood hazard areas. This linking of flood insurance to federal assistance was done because the voluntary purchase of flood insurance was not occurring as was originally hoped.

During the 1970s premiums were heavily subsidized. The availability of subsidized flood insurance and limitations on federal assistance for nonparticipating communities resulted in nearly all floodprone communities joining the program. The insurance policy count increased dramatically, reaching two million by 1979. States established floodplain management coordinators to provide technical assistance to communities in administering the NFIP at the local level. In 1981, with the flood program firmly established, FEMA began to initiate rating and coverage changes. The changes that took place through the mid-1980s made the program self-supporting for the historic average loss year and significantly reduced the subsidy. These changes were approved by the Congress and took into account the need to increase the number of flood insurance policies.

There is extreme variation in the flood risk among pre-FIRM buildings. Many structures flood during the 100-year flood, or lesser events, and others are surrounded by floodwaters or have floodwaters in contact with their foundations. As of 1997, there were 76,000 buildings that had two or more flood losses in any ten-year period since 1978. They have accounted for a disproportionate share of the program's total losses and have continued to qualify for subsidized rates because their damage did not exceed 50 percent of their value in a single loss. These repetitive loss buildings account for one-third of all losses paid.

The National Flood Insurance Reform Act of 1994 includes two provisions intended to mitigate losses to substantially damaged and repetitive loss buildings. The first is Increased Cost of Compliance insurance coverage that pays up to $15,000 of the cost of bringing a substantially damaged or repetitive loss building into compliance with a community’s floodplain management ordinances. The second is the Flood Mitigation Assistance Program that provides $20 million a year in funding to states and communities to support mitigation actions to protect insured buildings. These measures are intended to accelerate the process of reducing the subsidy on these properties. In addition, the Hazard Mitigation Grant Program provided by Section 404 of the recently expanded Stafford Act makes funds available to mitigate flood risks through acquisition, relocation or elevation of structures.

Congress' concern for the fiscal soundness of the program is reflected in the National Flood Insurance Reform Act of 1994. First, the legislation seeks to increase market penetration and spread the risk through the lender compliance requirements. Second, the legislation provides a way to mitigate the worst risks through mitigation insurance and the mitigation assistance program. Lastly, it recognizes the need to lower significantly and eventually eliminate the subsidy and allows rate increases of up to ten percent per year for any risk classification. The law also required this study of the economic effects of increasing subsidized rates.

1.2 Number of Structures Located in the Special Flood Hazard Area (SFHA)

There are 6.6 million structures located in Special Flood Hazard Areas identified by FEMA on Flood Insurance Rate Maps (FIRMs). These 6.6 million structures include 6.2 million residential structures, reflecting about 8 million housing units, and 0.4 million non-residential structures.

2.3 million of the SFHA structures were built after issuance of a community's initial FIRM. Generally, these structures were built in compliance with community floodplain management regulations and should sustain minimal damage during a 100-year flood.

4.3 million SFHA structures were built prior to the issuance of a community's FIRM and the adoption of floodplain management regulations. These pre-FIRM structures have varying degrees of risk.

– 2.3 million of the pre-FIRM structures have their lowest floors below the base flood elevation. These structures will flood during the 100-year flood, and many will flood during lesser events.

– 1.0 million of the pre-FIRM structures have their lowest floors at or above the base flood elevation but have their lowest adjacent grade below that elevation. During a 100-year flood, these structures will be surrounded by floodwaters or at least have floodwaters in contact with their foundations. The foundations of these structures may or may not be adequate to withstand flood forces such as high velocity floodwaters, wave impacts, or hydrostatic pressure.

– 1.0 million of the pre-FIRM structures have their lowest floors and lowest adjacent grades above the base flood elevation. Some of these structures have basements that could be subject to damage from hydrostatic pressure from groundwater (even though floodwaters do not touch the building during the 100-year flood). All of these are at risk from floods greater than the 100-year flood.

The 6.6 million include only those structures located in SFHAs designated by FEMA and are not the total universe of structures at risk. There are floods greater than the 100-year base flood used to designate SFHAs. These floods will damage structures outside of the SFHA. In addition, FEMA has generally designated floodplains only along major flooding sources such as rivers, streams, lakes, and tidal waters. Generally, streams with very small watersheds are not studied nor are areas subject to flooding from localized drainage problems or urban stormwater. These areas outside of the SFHA account for 23 percent of all NFIP claim dollars paid from 1978 to 1996.

Over time, natural deterioration, non-flood related removals, and various flood mitigation programs will significantly reduce the stock of pre-FIRM structures. Since flood mitigation programs are targeted at those structures at highest risk from flooding, a disproportionately large share of pre-FIRM attrition will occur for those structures below the Base Flood Elevation (BFE).

A section of this study focused on identifying the national count of total and pre-FIRM structures located in the SFHA projected out to 2022. These projections provide context in understanding the scope of subsidy elimination policies and the pace of attrition of pre-FIRM structures. The projections were based on models using various data sources from FEMA and the U.S. Department of Commerce Census Bureau. Because of data limitations in developing structure counts, approximately 1,700 NFIP communities in outlying U.S. territories and selected NFIP (mostly rural) communities with boundaries that did not correspond to any political, or Census defined boundaries were excluded from this study. The final study universe included 15,461 NFIP communities, referred to as the "NFIP study communities." Although precise estimation is difficult, it is believed that the 1,700 excluded communities account for less than two percent of the total number of SFHA structures nationally, and their exclusion does not have any significant impact on the analysis, results, or conclusions of this study.

Figure 1.1 shows the national total of SFHA residential and commercial structures for the NFIP study communities for total SFHA and pre-FIRM SFHA properties projected from 1997 to 2022. Over the 25 year projection period, the number of total SFHA structures is projected to increase from about 6.6 million in 1997 to about 8.7 million in 1998, an annual average increase of about 1.1 percent. Over this period, the number of pre-FIRM properties is projected to decline from about 4.3 million in 1997 to about 3.2 million in 2022, an annual average percentage decline of about 1.1 percent. Pre-FIRM structures as a share of all properties are estimated to decline from 64 percent to 37 percent over the 1997 to 2022 period. Based on detailed pre-FIRM attrition estimates developed for this study, about 1.14 million pre-FIRM structures are projected to be removed from the stock of structures over the 1997 to 2022 period. Of this total, about 730,000 are projected to be non-flood related removals (such as demolition as the result of normal deterioration), about 300,000 are projected to be removed as the result of structural mitigation (such as drainage improvements or the construction of levees and reservoirs), and about 110,000 are projected to be removed as a result of various non-structural flood mitigation programs.

1.3 Overview of the Study Approach

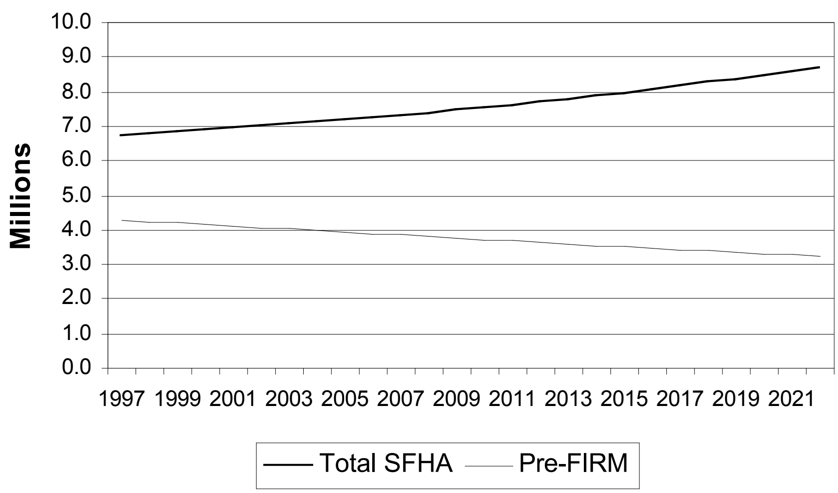
The study approach divides into the following steps:

Develop a Sample of Communities – Since there are over 19,000 NFIP communities, the first step in the study was to select a sample of communities representative of the nation's NFIP communities. Detailed analysis of the sample communities could then be extrapolated and generalized to the national universe of NFIP communities. The sample selection was based on replicating the range of flood risk and economic and demographic characteristics observed in the universe of NFIP study communities. Fifty (50) sample communities were selected.

Develop a Sample of Structures – Within each of these 50 sample communities, a sample of pre-FIRM structures was selected for detailed elevation analysis. These samples were designed to reasonably represent the distribution of risks and structure types for the universe of structures in each community.

Figure 1.1

Total SFHA and Pre-FIRM SFHA Properties, All NFIP Study Communities, 1997-2022



Develop Structure Elevation Data – Structure elevation data are necessary to estimate the actuarial premiums for the sampled structures. A team of surveyors collected elevation data for a representative sample of structures in 23 of the 50 sample NFIP communities. The survey data included: estimates of lowest floor elevations, lowest adjacent grades, structure "footprint" areas, and replacement values. The surveyors used state-of-the-art Global Positioning Satellite receivers to develop lowest floor and lowest adjacent grade elevations accurate within ±5 centimeters and a computerized Geographic Information System to record the attributes of each structure.

Calculate Premiums – The subsidized and actuarial premiums were calculated for each of the sampled pre-FIRM structures, under seven premium change scenarios. These scenarios were designed to represent a range of policy changes to ensure a reasonable understanding of the economic effects of charging actuarially based premiums. Detailed premium rate assumptions provided by FEMA along with the data from the elevation certificate and replacement value information collected for each structure were used to calculate the subsidized and actuarial premiums.

Estimate the Number of Structures Potentially Affected – The number of pre- and post-FIRM structures were estimated in each sample community in order to approximate the population of *potential* participants in the flood insurance program. Taking into account the attrition of pre-FIRM structures as well as the growth in post-FIRM structures, the Property Simulation Model (PSM) was developed to estimate the number of potentially participating structures and project the numbers of structures in each sample community over the 1997 to 2022 study period.

Estimate the Effects on the Purchase of Flood Insurance – A transition to actuarial rates affects the number of purchases of flood insurance, because individuals are sensitive to price changes and will adjust their purchase behavior accordingly. The change in purchases of flood insurance reflects the structures in each community that have altered their flood insurance coverage in response to the premium change. The Insurance Demand Model (IDM) was developed to estimate flood insurance purchases for each sample community and the U.S. over the 1997 to 2022 study period under each premium change scenario.

Estimate the Effects on Property Values and Property Taxes – Information on premium changes, changes in program participation and the number of structures potentially affected were used to estimate the effects of charging actuarial premiums on property values and property taxes. The Property Valuation Model (PVM) was developed to estimate the extent to which premium changes are capitalized into the value of the affected structures over the 1997 to 2022 study period for each sample community. The model also estimates the resulting changes in property tax revenues for each sample community.

Extrapolate to All NFIP Study Communities – A methodology was developed to extrapolate the effects estimated for each of the 50 sample communities to the universe of study communities participating in the National Flood Insurance Program. A series of weights were developed, based on the characteristics of the community sample and the estimated numbers of pre-FIRM and post-FIRM structures in each community and in the program as a whole.

Develop Case Studies – Case studies were developed to focus on the economic impacts related to changes in flood insurance premiums and the subsequent changes in property values and property tax revenues. The scope of economic impacts included employment, income, and business viability. A case study framework was constructed and utilized to examine the broad range of impacts in property values.

Estimate Impacts on Disaster Assistance Programs – Charging actuarially based premiums is likely to affect other government disaster assistance programs. Certain government programs at FEMA and the Small Business Administration were reviewed to understand how they might be affected by changes in flood insurance purchases. Reductions in flood purchases translates into an increase in the numbers of uninsured properties and can possibly result in increased requests for disaster assistance.

The report provides more information on each of these steps and presents the results of the study. The appendices to this report provide more details on the Premium Calculator, the Insurance Demand Model, the Property Simulation Model, the Property Valuation Model, and the Extrapolation to the Universe of NFIP communities.

1.4 Major Assumptions for Study Approach

This study required the collection, development, and analysis of large amounts of data to analyze complex policy issues. As with any such study, certain key assumptions were made. Five of the most important assumptions are presented below:

Actuarial rates selected for pre-FIRM properties reasonably reflect the risk currently and over the next 25 years – Rates were provided by FEMA for estimating the actuarial premiums for pre-FIRM structures. These included rates computed specifically for this study using the NFIP's current actuarial rate methodology and rates culled from existing rate tables in the NFIP agents' manual and underwriting guidelines used to rate post-FIRM buildings below the BFE. Although simplified, the selected actuarial rates are assumed to be accurate enough to reasonably assess the economic effects of the premium changes.

Current flood risk delineations reasonably portray the flood risk over the next 25 years – The current BFE and flood risk zones depicted on NFIP Flood Insurance Rate Maps are assumed to remain accurate over the next 25 years. Projections of future delineations, based on either actual risk changes due to future floodplain conditions or advances in flood study technology, were not incorporated into this analysis.

Actuarial premiums for pre-FIRM structures will be based on elevation certificates – It is assumed that all pre-FIRM structures without elevation certificates would obtain elevation certificates so that actuarial premiums can be calculated. The cost of obtaining these elevation certificates is not included in this study.

No significant changes in flood-related policies – It is assumed that there are no significant changes in federal and state government policies with respect to disaster assistance, flood mitigation, and related programs over the next 25 years.

Price elasticities – The price elasticities used in the study are based on data cited in a General Accounting Office (GAO) study. The changes in participation rates in the NFIP under premium subsidy elimination are driven by the price elasticity assumptions. Despite various efforts to obtain robust and detailed price elasticities, only the GAO study was identified, and this source did not fully address price elasticities under the conditions of large premium changes. Since this assumption is critical to estimating the demand for flood insurance under potential changes in the premium subsidy, new research in estimating the price elasticity for flood insurance is recommended but was beyond the scope of this study.

2. The Sample of Communities

This section describes the methodology used to select the samples of communities and structures. This section is structured as follows:

- Requirements for Sampling describes the sample requirements and the rationale underlying the sampling methodology.
- Gathering Economic and Risk Characteristics describes the data sources and rules used to classify communities.
- Imputing Missing Data describes two procedures used to impute missing data while maintaining the multivariate distribution of community characteristics.
- Selecting the Sample describes the sampling process used to satisfy the often conflicting requirements.

2.1 Requirements for Sampling

A wide range of requirements were specified for the sampled communities. These were broadly grouped into three categories:

- The sampled communities must be representative of the total population of communities.
- Estimates resulting from the sampled communities should be precise.
- Communities should be chosen to facilitate the process used to collect elevation data.

These requirements often conflicted with each other. For example, a random, representative sample would have resulted in a sample composed almost entirely of small communities, and would not have produced precise estimates. In addition, communities where the collection of elevation data is easier are not representative of the overall population of communities. As a result, judgment was used to balance the conflicting requirements against each other in order to select a practical sample.

Sound statistical procedures were used at each stage of the sampling process. These included hot deck imputation, logistic regression, clustering, stratification, and systematic sampling. However, because of the conflicting requirements, the results of the strict statistical procedures were subject to review and modifications in order to select a representative sample.

The sample of 50 communities contained two groups. Site visits were conducted for the first group, consisting of 23 communities, where elevation data were obtained for a targeted sample of 7,900 structures. The second group, consisting of 27 communities, were not surveyed, and thus, no elevation data were obtained. The economic impact on each of these 50 communities was analyzed, and then the community level results were extrapolated to the U.S. level. The requirements for the sample of 50 communities are discussed in detail below.

Requirement 1 - Sampled communities must be representative of the total population of communities.

The sample of 50 communities was chosen to be small enough to control cost and scope, yet large enough to be representative across seven economic and risk characteristics identified by FEMA:

Economic characteristics
- percent of community land area in the flood plain
- percent of community structures that are pre-FIRM
- urban/rural
- population growth rate between 1990 and 1995
- per capita income

Risk characteristics
- source of flooding (inland or coastal)
- depth of flooding

Data for each characteristic were gathered and combined into a single database. Missing data were imputed using a hot deck methodology and logistic regression. The distribution of the characteristics for the total population was analyzed and set as the target for the sample of communities.

Requirement 2 - Estimates resulting from the sampled communities should be precise.

Extrapolating the results of the analysis for the 50 communities to the nation implies that the results from the surveyed structures will be extrapolated to the nation as well. Therefore, the selection of the community sample must contain a structure sample representative of the universe of SFHA structures at the national level. The sample selection process revealed that most NFIP communities are small with few structures and have few flood insurance policies; yet a few communities contain a high number of structures and flood insurance policies. A simple random sample of communities would therefore have likely resulted in selecting all small communities with few structures and policies, which would have yielded imprecise results. This type of sampling was avoided by first stratifying the population of communities by the number of pre-FIRM policies in the SFHA in each community. Samples were then chosen from each strata, resulting in a cross-section of small, medium, and large communities.

Requirement 3 - Communities should be chosen to facilitate obtaining elevation data on the structures.

Elevation data needed to be obtained for 23 of the 50 sample communities. The 23 communities were chosen from the sample of 50 to maximize diversity across characteristics. To facilitate the collection of the elevation data for these 23 communities, several communities with established survey control points were chosen to be included in the sample of 23 communities. (In 1995, FEMA conducted a No-Certification (no-Cert) project in which survey control points were established in each of 61 communities, making it easier and less costly to return to them for future surveying.) With FEMA's agreement, nine control communities were included in the sample of 23 communities chosen for the process of collecting elevation data. (These nine control communities included Santa Cruz City, California, Ft. Lauderdale City, Florida, New Smyrna Beach City, Florida, St. Petersburg Beach City, Florida, Carteret County, North Carolina, Edenton Town, North Carolina, Myrtle Beach City, South Carolina, Garland City, Texas, and League City, Texas.) In addition to these communities, Louisville/Jefferson County was also included because the data required to develop elevation certificates were already available for 1,300 pre-FIRM structures, although 62 of these were later determined to be duplicates.

During the selection of the sample communities, an initial sample of 23 elevation certificate communities was selected and analyzed to determine the number of control communities chosen. Control communities were added and removed to bring the number of control communities to nine while still meeting Requirements 1 and 2.

In addition, the sampled communities had to be geographically dispersed around the nation. After selecting an initial sample of communities, the geographic distribution was reviewed, and substitute communities were chosen to meet the geographic requirement.

2.2 Gathering Economic and Risk Characteristics

The first step in the process was to identify the NFIP communities to be included in the study sample. Certain communities were excluded from the sample selection process because they either did not fit the criteria for the universe population or they lacked certain risk or economic data necessary for sorting the data.

First, the NFIP Community Information System (CIS) data, which includes 19,355 communities in the flood program were considered. Of these 19,355 communities, some were excluded for one or more of the following reasons:

Participant in the Emergency Program - These communities are in the initial phase of participation in the NFIP, where only limited amounts of coverage are available. Eventually, these communities will participate in the regular NFIP program.
No SFHA Designated - These communities do not have FIRMs because it was determined that there are no SFHAs with the community. (Policies outside the SFHA are not affected by changes to the subsidy.)
Rescinded - These communities' FIRMs were rescinded by FEMA.
No Census Data - These communities have not been assigned data from the Bureau of the Census because of inconsistencies between FEMA community boundaries and Census county definitions. A further explanation of these exclusions is included below.

Communities Excluded Due to Lack of Census Data

The NFIP defines a community as the governing body that has land use authority over a geographical area. An NFIP community is usually a county, city, or town, but can be a special district or other local government. The boundaries of these communities do not always coincide with those used for collecting Census data. The communities excluded from the study universe due to a lack of consistent or complete Census data were one of three types of communities: (1) NFIP communities which are outlying territories, (2) NFIP communities which are Census Designated Places, or (3) NFIP communities with no Census designations.

Outlying Territories

Although the NFIP Policy-in-Force data indicate flood insurance policies in four NFIP communities designated as outlying areas— the Commonwealth of Puerto Rico, the Commonwealth of the Virgin Islands, the Territory of Guam, and American Samoa— it was agreed to exclude outlying areas from the study universe for cost considerations early in the study. During the development of the selection criteria for communities to be surveyed, it was recognized that it would have been prohibitively expensive to send a survey team out of the U.S. to survey structures in these areas. Had outlying territories been included in the study universe, these non-U.S. NFIP communities would have been candidates for surveying.

Census Designated Places

Of the 1,391 NFIP communities excluded from the universe for geographic reasons, a majority of these communities are identified as Census Designated Places (CDPs) in the 1990 decennial Census. CDPs, which are unincorporated areas designated by Census for data presentation purposes, are not composed of lower geographic units such as Census Tracts or Block groups, but may cross city or even county boundaries. Because the Census Tiger files did not allow the identification of the location of CDPs within a state, it was not possible to overlay the digitized Q3 data with the Census Block Group data to estimate the number of structures in NFIP communities identified as CDPs.

Geographically, most of the CDPs identified in the 1,391 excluded NFIP communities occurred in New England and New Jersey, where many unincorporated townships are located. Maine alone had 531 of the 1,391 excluded communities. Except in New Jersey, most of the CDPs identified in the list of excluded communities were found to occur in sparsely populated, rural areas.

NFIP Communities with No Census Designations

About fifty of the 1,391 NFIP communities excluded from the universe are identified with special designations such as “Municipal Utility District,” “Water Improvement District” or “Drainage District.” These specially designated areas do not correspond to any geographic entity identified by the Census Bureau. In the list of excluded NFIP communities, these specially designated areas occurred mostly in Texas but were found in states throughout the country. Because no geographic entity identified by Census corresponds to these specially designated areas, the Census Tiger files could not indicate where in a state these communities were located. It was therefore not possible to develop estimates of the number of structures in these specially designated areas.

The application of these exclusions resulted in reducing the 19,355 communities to 15,461 study communities. Table 2.1 shows the breakdown of NFIP communities excluded from the pool of potential sample communities.

As evidenced by Table 2.1, there were more than 2,000 communities with SFHAs that were not included in the study. Many of these communities have little or no floodplain development, but some have large numbers of SFHA buildings. While precise estimation is difficult, these communities have a number of flood insurance policies but likely account for no more than two

Table 2.1
Breakdown of Communities Excluded from Sample Selection

Type of Community	Number of Communities
Total in Flood Program	**19,355**
Communities Eliminated from Sample Universe*	
Participation In the Emergency Program	359
No SFHA Designated	1,822
Rescinded	23
No Census Data	1,690
Total Included in Study	**15,461**

* Communities could be excluded for more than one reason

percent of all SFHA structures, and the exclusion of these buildings does not significantly affect the study results. The Emergency Program communities will eventually join the Regular Program and will then be subject to any rate changes for pre-FIRM buildings.

Sampling was limited to participating mapped communities. Participating mapped communities were identified based on the FIRM status code in the CIS and included communities with FIRM status codes of:

2 - Original
3 - Revised
6 - All zones 'A' or 'C'
7 - All zones 'A' or 'C', letter conversion

Data for the five economic and two risk characteristics were compiled for each NFIP study community. The primary sources for data were the CIS, the Policy-in-Force database, Q3 Flood Data, the U.S. Bureau of the Census, and Claritas.

Because some data sources contained records for geographic areas smaller than the communities, sub-community level data had to be aggregated to the NFIP community level. For example, Census data was obtained at the block group level. The block groups had to be aggregated to the county subdivision level, and then each subdivision had to be matched to an NFIP community. For each data source, the goal of the aggregation process was to create a one-to-one match to NFIP communities with no overlap across communities. In some cases this could not be avoided, and a block group had to be assigned to two NFIP communities.

Following are detailed descriptions of the 7 economic and risk characteristics used to stratify communities for sampling.

Percent of community land area in the floodplain

Each community was classified as having either a Low or a High percent of land area in the floodplain.

Floodplain data was available for 7,912 Q3 communities. The Q3 Flood Data are developed by digitally capturing certain key features from the current FIRMs. These features are converted into area features, such as floodplain boundaries, flood insurance zones, and political boundaries. The most current FIRM panels are generally used in the Q3 Flood Data production. In addition, Letters of Map Change, including Letters of Map Amendment and Letters of Map Revision, are incorporated into the Q3 Flood Data if they can be mapped at the publication scale of the paper FIRM. Nationally, at the time the estimates were made, the Q3 data covered about 75 percent of the total number of SFHA structures and flood insurance policies.

The percent of community land area in the floodplain is the ratio of the total land area in the floodplain to the total land area in the community. The median of the percent of community land area in the floodplain was calculated at 10.12 percent, where half of the communities are above the median and half are below. If a Q3 community had a percentage less than or equal to the median, it was classified as Low; if the percentage was higher than the median, it was classified as High. For the 7,549 non-Q3 communities, a logistic regression was used to impute the missing data.

Percent of total structures that are pre-FIRM

Each community was classified as having either a Low or a High percent of total structures that are pre-FIRM.

First, the distribution of the age of structures was estimated using data from the Bureau of the Census's STF3A file. This file contains both the number of structures and the percent of structures built during 10-year time intervals for each block group. In each block group, the number of structures was multiplied by the percent built during each time interval, yielding the number of structures built during each time period. Each block group was assigned to an NFIP community, and then the data were aggregated from the block group level to the NFIP community level.

The effective date of the FIRM for each NFIP study community was obtained from the CIS database. This date was compared to the time period distribution obtained from the Census files to determine the number and percent of pre-FIRM structures in each community.

The median of the percent of pre-FIRM structures computed across communities was 90.5 percent. Communities with a percent of pre-FIRM structures less than or equal to 90.5 percent were classified as Low; communities with a percentage higher than 90.5 percent were classified as High.

Urban/Rural

Each community was classified as either Urban or Rural.

The Biennial Report data in the CIS database provide a population estimate for each NFIP community. NFIP study communities that are cities or townships with a population greater than or equal to 5,000 were classified as urban. All other cities or townships were classified as rural. NFIP study communities that are parishes, boroughs, towns, villages, or counties with a population greater than or equal to 10,000 were classified as urban. All other parishes, boroughs, towns, villages, or counties were classified as rural.

Population growth rate between 1990 and 1995

Each community was classified as having either a Low or High rate of population growth.

The data source for this characteristic was Claritas TrendMap 1995 software. This software contained Census population data for 1990 and population estimates for 1995 at the Census tract level. After matching each Census tract to an NFIP community, the 1990 and 1995 community population was computed. The growth rate was calculated using the formula:

$$\text{Population growth rate} = \frac{1995\ \text{population} - 1990\ \text{population}}{1990\ \text{population}}$$

The median population growth rate computed across all NFIP study communities was 3.6 percent. If a community had a growth rate less than or equal to 3.6 percent, it was classified as Low; if the growth rate was above 3.6 percent, it was classified as High.

Per capita income

Each community was classified as either Low, Medium, or High per capita income.

The data source for this file was the Claritas TrendMap 1995 database. This database contained aggregate income and population for each Census tract. These Census tracts were matched to the NFIP communities, and the total community income and population were computed. For each community, per capita income was calculated by dividing total income by total population. The communities were sorted by per capita income and divided into three equal groups. Communities in the lower third of per capita income were classified as Low, those in the middle third were classified as Medium, and those in the top third were classified as High.

Table 2.2
Community Per Capita Income

Community Per Capita Income	Classification
Less than $10,270	Low
From $10,270 to $12,600	Medium
Greater than $12,600	High

Source of flooding

Each community was classified as having either Inland or Coastal source of flooding.

The CIS data and the Q3 database were used to determine the source of flooding. The following rules were used to define the source of flooding for each community:

1. If the inland_coastal field in the CIS data was 'C', the community was classified as Coastal.

2. If the inland_coastal field in the CIS data was blank, the level of regulation field in the CIS data was used:

   - 'E' or 'DE' was classified as Coastal.
   - 'A', 'B', 'C', or 'D' alone was classified as Inland.

3. If the inland_coastal field in the CIS data was blank and the level of regulation field in the CIS data was blank, geographic information system (GIS) data were used to classify the community.

4. If the inland_coastal field in the CIS data was 'I' and the level of regulation field was 'A', 'B', 'C', or 'D', the community was classified as Inland.

5. If the inland_coastal field in the CIS data was 'I' and the level of regulation field was 'D' or 'DE', the coast_code field in the Q3 database was used to see if the community was an inland community. If the coast_code field indicated that the community was an inland community (coast_code=0), the community was classified as Inland. If the coast_code field indicated that the community may not be an inland community (coast_code=1) or was blank, GIS data were used to classify the community.

6. If the inland_coastal field in the CIS data was 'I' and the level of regulation field was blank, the community was classified as Inland.

Depth of flooding

Each community was classified as having either Shallow, Medium, or Deep flooding. For each of the communities in the map data file in the CIS database, a map panel was selected based on the following rules:

1. The most recent map panel was used if it contained one or more of the following: numbered A, numbered V, AO, or AH flood hazard ratings.

2. If the most recent map panel included only an AE or VE flood hazard rating, then the next most recent map panel, having numbered A, numbered V, AO, or AH flood hazard ratings, was chosen to provide more detailed flood hazard ratings.

3. If the community had no map panels that included numbered A, numbered V, AO, or AH flood hazard ratings, then the most recent map panel with an AE or VE flood hazard rating was selected.

Next, the depth of flooding classifications were assigned to each flood hazard rating, as shown in Table 2.3. Note that flood hazard ratings from A01 to A19 and V01 to V19 represent half foot increments between the 10-year and 100-year flood elevations beginning at zero. Flood hazard ratings from A20 to A30 and V20 to V30 represent one foot increments between the 10-year and 100-year flood elevations beginning at 10 feet.

Table 2.3
Depth of Flooding Classifications

Classification	**Average Difference Between 10- and 100-Year Floods**	**Flood Hazard Ratings**
Shallow	Under 3 feet	A01-A05, AO, and AH
Medium	Above 3 feet and under 6 feet	A06-A11, AE, A
Deep	6 feet and above	A12-A30, V01-V30, V, VE

Next, all shallow ratings in the community were assigned a 1; a 2 was assigned to all medium ratings in a community; and a 3 was assigned to all deep ratings in the community.

Finally, the depth of flooding for each community was calculated based on a weighted average of the classifications across the ratings in the community. For example, if a sample community had two flood hazard ratings that corresponded to the shallow classification (assigned a value of 1) and one flood hazard rating that corresponded to the medium classification (assigned a value of 2), the depth of flooding for that community would be (2 x 1)+(1 x 2)=0.75. If the weighted average of the ratings was less than 1.5, the community was classified as Shallow. If the average was greater than or equal to 1.5 and less than 2.5, the community was classified as Medium. If the average was greater than or equal to 2.5, the community was classified as Deep.

2.3 Imputing Missing Data

Data for each of the economic characteristics were not available for every community, resulting in missing values for some of the characteristics. The amount of available and missing data for the communities is summarized in Table 2.4. Note that there were no imputed values for the two risk characteristics. Extensive procedures were developed to utilize alternative data sources for these characteristics, thus reducing the number of communities with missing values.

Table 2.4
Imputed Values for Study Characteristics

Characteristic	Number of Communities	
	With Imputed Values	With Missing Values After Imputation
Percent of community land area in the flood plain	7,549	0
Percent of community structures that were pre-FIRM	5,897	19
Urban/Rural	108	19
Population growth between 1990 and 1995	1,401	19
Per capita income	1,401	19
Source of flooding	0	56
Depth of flooding	0	407

Two methodologies were employed to impute missing data. A logistic regression was used to estimate the percent of community land area in the flood plain for non-Q3 communities. A logistic regression was used because of the high number of missing values for this characteristic and because auxiliary data were available. For the other four characteristics, a hot deck imputation procedure was used. The following provides information on the hot deck imputation procedure, followed by information on the logistic regression imputation.

Hot decking

An imputation method called hot decking was used to assign values for missing data for four characteristics:

Percent of community structures that are pre-FIRM
Urban/Rural
Population growth between 1990 and 1995
Per capita income

There are many methods that can be used to impute missing data. One simple method is to compute the average across all known values and then assign this average to each missing observation. The problem with this method is that the distribution of the values is skewed toward the average. Another method, called cold decking, uses auxiliary data sources such as previous studies to assign values to the missing observations. Hot decking is the method frequently used for imputation because it uses real data to estimate the missing data, and it maintains the distribution of the values.

As a simple example of hot decking, suppose a community has low per capita income but the population growth rate is unknown. In that case, all communities with low per capita income and known population growth rate are grouped together, and one of them is randomly selected. The population growth rate for the randomly selected community is then assigned to the community with the missing growth rate. The hot decking methodology used for this study was more complicated than this simple example, however. In this study, there are four characteristics that must be imputed, and it is important to represent the correlation between the characteristics in the imputation. If this correlation is not maintained, the multivariate distribution of the imputed values would not agree with that of the known values.

The first step in the imputation process was to cluster communities together. Communities were assigned to a cluster if they had similar values of the characteristics. In addition to the four characteristics to impute and the source and depth of flooding characteristics, an additional variable based on the Donnelly data for the percent land area in the floodplain was also used in the clustering. Clustering was performed using the numeric values of the characteristic, not the classification (e.g. Low, Medium, High). The distance of each community to a central point in each cluster was computed, and the community was assigned to the closest cluster. To keep the number of clusters manageable, each cluster had to contain at least 25 communities. This eliminated clusters with only one or very few data points, which would not be useful for imputing. Thirty-eight communities could not be assigned to a cluster because they had missing values for all six characteristics and the Donnelly flood data. Otherwise, each community was assigned to a cluster.

Many combinations of the maximum number of clusters allowed and the minimum number of communities in a cluster were tested. The final clustering was chosen because it balanced the need to have a manageable, but not too small, number of clusters. As a result, 39 clusters were formed. The largest cluster contained 5,378 communities. Most of the clusters were relatively small, with 28 clusters containing between 25 and 200 communities each.

The second step in the imputation process was to select known values that would be assigned to missing data. The following process was employed in turn for each of the four characteristics. The clusters were separated from each other, and within each cluster, the communities with a missing value for the characteristic were separated from the communities with a known value. From the communities with a known value, up to 200 observations were chosen at random. Thus, for each cluster, there were up to 200 values that could be used for assignment of missing values. Of course, there would be less than 200 values if there were fewer than 200 communities in a cluster.

In the final step, for each community with a missing value, one of the 200 selected known values from the same cluster was randomly assigned to it. The end result was that similar communities were used to replace the missing data, and the multivariate distribution of the characteristics was preserved.

Logistic Regression

A logistic regression was developed to impute missing values for the percent area in the floodplain for 7,549 non-Q3 communities. Logistic regression is frequently used in situations where the goal is to estimate the probability that an event occurs. In this case, the probability can be viewed as the percent of land in the floodplain. A logistic regression is similar to an ordinary regression – the dependent variable was a function of the percent of land area in the floodplain for the community, and the independent variables were:

Population growth
Number of families in the SFHA
Per-capita income
Percentage of pre-FIRM structures
Depth of flooding
Percent of community land area in the floodplain based on Donnelly data in the CIS

The logistic regression was applied to the data, and the non-Q3 communities were classified in the following steps:

Parameters of the logistic regression were estimated using known data from the Q3 communities.
Percent of land area in each of the non-Q3 communities was estimated based on the parameters.
Each non-Q3 community was classified as having a Low or High percent of land area in the floodplain.

The next step was to decide a cut-off point to apply to the logistic estimates so that a community could be classified as a having a Low or High percent of land area in the floodplain. The logistic estimates for the Q3 communities were used to identify this cut-off point. In assigning the classification of High or Low for the non-Q3 communities, the cut-off point was chosen to minimize misclassification of the Q3 communities. In this process, most Q3 communities with a logit estimate above the cut-off point were classified as Low, and most Q3 communities with a logit estimate below the cut-off point were classified as High. Not all Q3 communities with a logit estimate above cut-of were classified as Low since the logit is based on a regression and is subject to error.

2.4 Selecting the Sample

The selection of the sample of 50 communities was divided into two groups: the 23 communities with elevation certificates formed one group, and the remaining 27 communities formed the other group. The sample of communities is a stratified, systematic sample with modifications to address the conflicting sampling requirements.

Stratification - The 15,461 NFIP study communities were stratified according to the number of pre-FIRM policies in SFHAs. The purpose of sampling was to ensure adequate representation of small, medium, and large communities. The division points between the strata were determined using the Dalenius-Hodges method, a statistical procedure used to stratify populations. The Dalenius-Hodges method identifies the *optimal division points between strata*. The Neyman allocation was employed to determine the appropriate number of communities that should be selected from each strata. The number of communities to pick in a strata was computed using Neyman allocation, which is a statistical procedure used to determine the *number of sample communities that should be chosen from each strata*. Neyman allocation is an optimal method because it minimizes the variance of the estimate arising from a stratified sample. These two statistical techniques were used because they produce the most precise estimates, fulfilling Requirement 2. However, a strict application of Neyman allocation to determine the number of communities in each sample would have resulted in a sample of almost entirely large communities, violating Requirement 1. Based on an analysis of the sampling requirements and judgment, more small and medium size communities were selected. The stratification is summarized in Table 2.5.

Table 2.5
Stratification Summary

Strata	Number of Pre-FIRM Policies	Population		Sample	
		Number of Communities	Percent of Communities	Number of Communities	Percent of Communities
1	0 to 134	14,448	93.4%	28	56.0%
2	135 to 555	679	4.4	8	16.0
3	556 to 2,449	255	1.6	8	16.0
4	2,450 to 9,394	63	0.4	4	8.0
5	9,395 or higher	16	0.1	2	4.0
Total		15,461	100.0	50	100.0

Clustering - Within each strata, communities with similar risk and economic characteristics were grouped together. The clustering methodology was the same one utilized for imputation. The purpose of clustering is to ensure that the sample does not consist entirely of similar communities. By clustering similar communities together, one community could be chosen from the first cluster, another community could be chosen from a second cluster, and so on. Alternative approaches were considered. A typical approach would be to stratify the population according to unique combinations of the seven characteristics; however, this would result in 432 strata. Given that only 50 communities were selected, using 432 strata was impractical. In effect, the clustering approach reduces the number of strata to a manageable number.

Systematic Sampling - Within each strata, communities were ordered by cluster, and a systematic sample was chosen from the ordered list. The purpose of systematic sampling was to ensure the sample would be representative across the seven risk and economic characteristics.

Substitution - Communities in the initial sample were replaced by communities in the same or neighboring cluster. There were several reasons for substitution, including ensuring adequate representation across the risk and economic characteristics, the pre-FIRM policy strata, geographic distribution, and the inclusion of control communities for the collection of elevation data.

The 50 selected communities and their characteristics are shown in Table 2.6.

Table 2.6
The 50 Sample Communities and Their Economic and Risk Characteristics

Community	CID	Elevation Survey	% of Comm. Land Area in Floodplain	Pop. Growth 1990-1995	Per Capita Income	Percent of Structures Built Pre-FIRM	Depth of Flooding	Urban/ Rural	Source of Flooding
Phoenix City, AZ	040051	Yes	Low	High	Low	Low	Medium	Urban	Inland
Bay City, AR	050045	No	High	Low	Low	High	Medium	Rural	Inland
Sacramento County, CA	060262	Yes	High	High	Low	Low	Shallow	Urban	Inland
Santa Cruz City, CA	060355	Yes	High	High	High	Low	Medium	Urban	Coastal
Dolores Town, CO	080122	No	High	High	Medium	High	Shallow	Rural	Inland
Otero County, CO	080132	No	Low	Low	Low	High	Medium	Rural	Inland
Fort Lauderdale City, FL	125105	Yes	High	High	High	Low	Medium	Urban	Coastal
New Smyrna Beach City, FL	125132	Yes	High	High	High	High	Medium	Urban	Coastal
St. Petersburg Beach City, FL	125149	Yes	High	Low	High	High	Deep	Urban	Coastal
Hailey City, ID	160022	No	Low	High	Medium	Low	Medium	Rural	Inland
Grundy County, IL	170256	No	Low	Low	Low	Low	Medium	Rural	Inland
Council Bluffs City, IA	190235	Yes	High	Low	High	Low	Shallow	Urban	Inland
Augusta City, KY	210022	No	High	Low	Medium	High	Deep	Rural	Inland
Lewisport City, KY	210093	No	High	High	Low	High	Deep	Rural	Inland
Louisville/Jefferson, KY	210122	Yes	High	Low	High	Low	Medium	Urban	Inland
Allen Parish, LA	220009	No	High	Low	Low	High	Medium	Rural	Inland
Shreveport City, LA	220036	Yes	High	Low	Medium	High	Medium	Urban	Inland
Jefferson Parish, LA	225199	Yes	High	Low	High	Low	Medium	Urban	Coastal
Cohasset Town, MA	250236	Yes	High	High	High	High	Shallow	Rural	Coastal
Vassar City, MI	260208	No	High	High	Medium	Low	Medium	Rural	Inland
Petal City, MS	280260	Yes	High	Low	Medium	Low	Medium	Urban	Inland
Scott County, MO	290837	No	High	High	Low	High	Medium	Rural	Inland
Pender Village, NE	310221	No	High	High	Low	High	Medium	Rural	Inland
Omaha City, NE	315274	Yes	Low	Low	High	Low	Medium	Urban	Inland
Woodstock Town, NH	330079	No	Low	Low	Medium	High	Medium	Rural	Inland
Bloomingdale Borough, NJ	345284	No	Low	High	High	Low	Shallow	Rural	Inland
Lincoln Park Borough, NJ	345300	No	High	High	High	High	Medium	Rural	Inland
Niagara Town, NY	360507	Yes	Low	Low	Medium	High	Shallow	Rural	Inland
Waterford Village, NY	360735	No	High	High	High	High	Medium	Rural	Inland
Carteret County, NC	370043	Yes	High	Low	Low	Low	Medium	Urban	Coastal
Edenton Town, NC	370062	Yes	High	High	Low	Low	Shallow	Rural	Coastal
New Miami Village, OH	390043	No	High	High	High	High	Medium	Rural	Inland
Washington County, OK	400459	No	High	High	Medium	High	Medium	Rural	Inland
Vernonia City, OR	410041	No	High	High	Medium	Low	Shallow	Rural	Inland
Lane County, OR	415591	Yes	Low	Low	High	Low	Medium	Urban	Inland
New Cumberland Borough, PA	420366	No	Low	Low	Low	Low	Deep	Rural	Inland
Lower Mt. Bethel Township, PA	420724	No	Low	Low	Medium	Low	Medium	Rural	Inland
Glen Rock Borough, PA	420924	No	Low	High	High	Low	Medium	Rural	Inland
Franklin Township, PA	421065	No	Low	Low	Medium	High	Medium	Rural	Inland
Myrtle Beach City, SC	450109	Yes	High	High	High	Low	Medium	Urban	Coastal

Table 2.6 (Continued)
The 50 Sample Communities and Their Economic and Risk Characteristics

Community	CID	Elevation Survey	% of Comm. Land Area in Floodplain	Pop. Growth 1990-1995	Per Capita Income	Percent of Structures Built Pre-FIRM	Depth of Flooding	Urban/ Rural	Source of Flooding
Lawrence County, SD	460094	No	Low	High	Medium	High	Medium	Rural	Inland
Brookside Village City, TX	480067	No	High	High	High	High	Medium	Rural	Inland
Garland City, TX	485471	Yes	High	High	High	Low	Shallow	Urban	Inland
League City, TX	485488	Yes	High	High	High	Low	Medium	Urban	Coastal
Grundy Town, VA	510025	No	Low	Low	Medium	Low	Medium	Rural	Inland
Leavenworth City, WA	530019	Yes	Low	High	Medium	High	Shallow	Rural	Inland
Ephrata City, WA	530051	No	High	High	Medium	High	Shallow	Urban	Inland
Philippi City, WV	540004	No	High	Low	Low	High	Medium	Rural	Inland
Wheeling City, WV	540152	Yes	High	Low	Medium	Low	Medium	Urban	Inland
Marlinton City, WV	540159	Yes	High	Low	Low	High	Medium	Rural	Inland

The results of the sampling for each of the seven risk and economic characteristics are summarized in Table 2.7. The population and sample percentages for some of the characteristics do not match exactly. Again, this is due to conflicts among the three sampling requirements. The statistical procedures employed were modified slightly to produce a result that balances the requirements. Deviations in the sample from the population were corrected later when the weights were computed for aggregating results to the national and other levels.

Table 2.7
Summary of Distribution of Sampling Characteristics

Characteristic	Classification	Percent in Classification	
		Population	Sample
Percent of community land area in the flood plain	Low	45 %	32 %
	High	55 %	68 %
Percent of community structures that were pre-FIRM	Low	50 %	50 %
	High	50 %	50 %
Urban/rural	Urban	32 %	38 %
	Rural	68 %	62 %
Population growth between 1990 and 1995	Low	48 %	46 %
	High	52 %	54 %
Per capita income	Low	33 %	28 %
	Medium	32 %	34 %
	High	35 %	38 %
Source of flooding	Inland	91 %	78 %
	Coastal	9 %	22 %
Depth of flooding	Shallow	10 %	22 %
	Medium	86 %	70 %
	Deep	4 %	8 %

3. The Sample of Structures

The second part of the sampling task required selecting a sample of 7,900 structures from the 23 elevation certificate communities. The sample should cover only pre-FIRM structures and be representative of the distribution of actuarial characteristics used to set insurance rates. This section discusses the approach used to select the sample of structures. It is organized as follows:

3.1 Overview and Objectives

A sample of 6,600 structures was selected from the 22 communities designated to have elevation survey work performed for this study. An additional 1,300 structures from Louisville/Jefferson County, Kentucky were selected based on the existence of elevation data for pre-FIRM properties in that community. No additional survey data were commissioned for this community; however structural characteristics for these structures were obtained using tax assessment records provided by Jefferson County.

The NFIP study communities were deconstructed into Census geographic subdivisions to facilitate selecting a sample of structures within the community that were pre-FIRM and representative of actuarial characteristics. Each NFIP community comprises several Census block groups, where each block group generally contains between 240 and 550 housing units. The block groups were then categorized by economic, demographic, and geographic attributes. A subset of block groups were selected based on the following objectives:

- Select the block groups with the highest percentage of land area in the SFHA.
- Select the block groups with the largest number of pre-FIRM structures.
- Select the block groups that are the most representative of the economic and demographic characteristics within the community, including: per capita income, average property value, population growth and flood risk characteristics.

Data from various sources and data processing techniques available in the GIS software application *Arc View* were used to meet these objectives. *Arc View* is used for data mapping, geocoding addresses and zip codes, and visually analyzing data.

The following sections describe the data sources in more detail and summarize the procedures used to select the 6,600 structures from the 22 communities designed for elevation survey work.

3.2 Gathering Data for the Structures Sample

Several types of data were used to select a sample of pre-FIRM structures within each of the 22 elevation certificate communities that best represented each community's economic, demographic, and actuarial characteristics. These are as follows:

TIGER 95 data to map block groups within the NFIP
Q3 Flood Data to map Special Flood Hazard Areas (SFHAs) onto block groups
Select Phone Electronic Phone Directory to geocode addresses onto block groups
Census data to estimate the percentage of pre-FIRM structures within the block groups
Census data to provide economic and demographic data by block group
Policy-in-Force data to locate pre-FIRM policies by block group
Flood Insurance Rate Maps to identify the flood zones within the community

Each of these data sets is described below.

Tiger 95 Data

TIGER 95 data were used to map block groups within the NFIP study communities, since NFIP communities are not based on Census geographic boundary definitions. The TIGER 95 data include geographic identifiers available at the street level that allow Census data to be matched to the NFIP boundaries.

Q3 Flood Data

The Special Flood Hazard Areas (SFHAs) were mapped from FEMA's Q3 Flood Data (which contain the boundaries of the SFHA) onto block groups for the 22 elevation certificate communities. This procedure allowed for determining which block groups were in the SFHA. The records in the SFHA were extracted from the Q3 Flood Data files. Overlaying the TIGER 95 block groups on top of the FEMA SFHA allowed for determining which block groups fell within the SFHA. These block groups within the SFHA were then in the sampling selection process of the structures. Structures in block groups that were within the buffer zones were not sampled.

Select Phone Electronic Phone Directory

The addresses from the Select Phone Electronic Phone Directory published by Pro CD, Inc. were geocoded to estimate the number of structures within each block group in the sample communities. The electronic telephone directory is published quarterly and contains names, addresses, and telephone numbers as listed in telephone directories across the U.S. To extract the addresses for only the 22 communities, the community outlines from the Q3 Flood Data were overlaid on a map of the 5-digit zip code boundaries of the U.S. This procedure allowed for determination of all zip codes that fell within these communities. Using the 5-digit zip code listings, all addresses within those zip codes were extracted from the electronic phone directory. All duplicate addresses were deleted for those households with more than one phone number. The electronic phone directory also lists a latitude and longitude for each entry, which was used to plot the location of each entry.
This procedure also allowed for estimating the number of residential and non-residential structures within a block group, because the telephone directory classifies address information into residential and non-residential properties. In addition to selecting structures that were representative of the actuarial characteristics of structures in the community, the sample was also selected to be representative of the residential and non-residential distribution of the

community. (The extrapolation of the study results to the universe of NFIP study communities relied on a different data source for estimating residential and non-residential structures. Appendix E describes how energy survey data collected by the U.S. Department of Energy/ Energy Information Administration were used for this purpose.)

Census Bureau Data

The Census data were used to estimate the percentage of pre-FIRM structures within the block groups and also contained economic and demographic data by block group.

The Census provides an aggregated count of structures built within specific time intervals for all structures within a block group. Since small area structure data is not available annually, structures were assumed to be uniformly distributed across time within each time period. The effective date of the initial FIRM was used to estimate the percentage of pre-FIRM and post-FIRM structures in each group. For example, suppose that 125 structures in a block group were built between 1960 and 1969, 277 structures were built between 1970 and 1979, and so forth. The percentage of structures built during each time period was computed. The time periods were then compared to the date when the community adopted a FIRM. In most cases, the FIRM date fell within one of the time periods. For example, if the FIRM date for a community was 1978, then 9/10ths of the 277 structures built in the 1970 to 1979 period would be considered pre-FIRM, and the remaining 1/10th of the 277 structures would be considered post-FIRM. The total number and percentage of pre-FIRM structures for each block group were estimated by combining the totals for each time period.

To determine which block groups were the most representative of the economic and demographic characteristics, the following data elements were derived from the Census Bureau data: per capita income, average property values, and population growth. Per capita income and average property values are good indications of the wealth within the community, and population growth measures the population trends within a community.

Estimates for per capita income for each block group were calculated by aggregating household income data within the block group and dividing it by the total number of persons within that block group. These estimates were calculated for each block group within the NFIP community.

An estimate for the average value of housing units for each block group was estimated by summing the property values in the Census data for all owner-occupied housing units in the block groups and dividing the sum by the total number of owner-occupied housing units in the same block group. This method was used across all block groups within the NFIP community.

Finally, estimates of the population growth for each Census tract were extracted from Claritas data. Claritas pulls 1990 population data from the 1990 Census and uses demographic models to make population projections for 1995 for each Census tract geographic division. A Census tract is a statistical subdivision of a county and includes a collection of block groups. Census tracts usually have between 2,500 and 8,000 persons and are designed to be homogeneous with respect to population characteristics, economic status, and living conditions.

Several of the communities had portions of block groups split across SFHA boundaries. To accommodate these splits, the Census data were adjusted to reflect those portions of the block groups that were included within the SFHA boundary. To estimate the portion of a block group within the SFHA, the Census results were weighted by the percentage of SFHA land area within each block group as determined by overlaying the TIGER 95 block groups on the FEMA SFHA. For example, if only 60 percent of the land area of a block group lay inside the SFHA, 60 percent of the pre-FIRM structures were assumed to be in the SFHA.

Policy-in-Force Data

The Policy-in-Force (PIF) data were geocoded to count the number of policies in each block group. Although this method excludes all structures without policies, it allows for assistance in identifying clusters of pre-FIRM structures. The PIF data were used to estimate the number of pre-FIRM structures within the block group and, more importantly, the locations of these structures within the block group. Using the post-FIRM data field in the PIF to indicate the pre-FIRM or post-FIRM status of the structure, the pre-FIRM policies were plotted and used to locate clusters of potential pre-FIRM structures within the community.

Flood Insurance Rate Maps

The Flood Insurance Rate Maps contain information on the types of flood zones within an NFIP community. The flood zone is a primary determinant for the calculation of the insurance premium. For those communities with several different types of flood zones, block groups that were representative of those variations were selected. In addition, the flood zone data field in the Policy-in-Force data was used as an alternate way to identify the types of flood zones in a community.

Overlay

Overlaying all of the data discussed above allows for estimating the following statistics for the 22 elevation certificate communities:

- The percentage of SFHA in each block group
- The number of pre-FIRM structures with policies in each block group
- The number of structures in each block group
- The age distribution of structures in each block group
- The economic and demographic characteristics of each block group: per capita income, average property values, and population growth
- The flood zones within each block group

3.3 Selecting Block Groups for Each Community

The characterization of the block groups by economic and flood data using the methods described previously allowed for narrowing the set of block groups in the 22 elevation certificate communities. Block groups were selected to preserve the representation of economic and demographic characteristics within the sample communities while ensuring efficiency in the elevation certificate process. For example, the process is made more efficient by selecting block groups with high numbers of pre-FIRM structures in densely packed areas. The following objectives were used to choose block groups in the communities for sampling the structures:

- Select block groups with the highest percentage of land area in the SFHA.
- Select block groups with the largest number and highest percentage of pre-FIRM structures.
- Select block groups that are the most representative of the economic, demographic and flood risks characteristics within the community.

In some cases, all three objectives could not be simultaneously satisfied for each block group. Specific rules were developed to simplify the selection process and prioritize the objectives in selecting the block groups.

Prior to selecting the block groups within a specific NFIP community, target numbers for structures to be sampled from each community had to be developed.

Determining the Target Number of Structures in a Community

For sampling purposes, a target number of structures for each of the 22 communities was developed used the following procedures:

1. Calculate the number of pre-FIRM structures in the SFHA for each of the 22 communities
2. Calculate the total number of pre-FIRM structures in the SFHA across all 22 communities
3. Calculate a target number of pre-FIRM structures for each community using the following equation:

$$\text{Target} = (\text{6,600 structures to be sampled}) \times \frac{(\text{Number of pre-FIRM structures for Comm.})}{(\text{Number of pre-FIRM structures for all Comm.})}$$

This calculation uses a weight equaling the total to be sampled applied to each community's share of pre-FIRM structures to provide an estimate of the target number of structures to be surveyed in each community. To get a reasonable statistical representation of structures in each community, no fewer than 75 structures and no more than 800 structures were surveyed in any given community.

Candidate Number of Structures in a Community

In addition to developing targets for sampling, other parameters were developed to facilitate the elevation surveying. A candidate number of structures and a minimum number of structures were estimated for each of the 22 communities. The candidate number of structures provides a large set of potential structures to survey and is larger than the target sample to allow for more flexibility for surveyors while in the field. This is useful because the sample would inevitably include some post-FIRM structures, which could be eliminated in the field. For most communities, the list of candidate addresses exceeded the number of target structures for the community by at least 60 percent.

Minimum Number of Structures in a Community

The minimum number of structures for a community is the smallest acceptable number of structures that would be surveyed in that community. Setting a minimum number of structures assures that a representative number of structures are surveyed in each community. The minimum number of structures for a community is generally 80 percent of the target number.

Target Number of Business Structures in a Community

The target number of business structures is a subset of the target number of structures for each community and reflects the number of business structures to be surveyed in each community. This target was developed from the Select Phone Electronic Phone Directory (which was used to estimate the number of residential and non-residential structures within the community).

Table 3.1 is an example summarizing the sample requirements for Fort Lauderdale City, Florida.

Table 3.1
Structure Number Targets for Surveying in Fort Lauderdale City, Florida

Target number of structures	700
Minimum number of structures	560
Candidate number of structures	1,501
Percent of business structures	18 %
Target number of business structures	125

Rules for Selecting Block Groups for each Community

After assigning a target number to each community, block groups were selected for the communities using the following rules, ordered by priority:

1. Select block groups with the highest percentage of SFHA.
2. Select block groups with the highest percentage and highest number of pre-FIRM structures.
3. Select block groups that are representative of the community's flood zone categories.
4. Select block groups that are representative of the community's non-residential structures.
5. Select block groups that are representative of the community's structure values.
6. Select block groups that are representative of the community's per capita income.
7. Select block groups that are representative of the community's population growth.

The highest priority was assigned to the first two selection criteria, since the purpose of the analysis is to study the economic effects of charging actuarially based flood insurance rates for pre-FIRM structures. The next level of priority was focused on having adequate representation across the flood zone categories, because the flood zone rating for a particular structure is a primary component in the determination of the insurance premium. The remaining selection criteria were ordered by priority in an effort to select block groups that were most representative of the economic and demographic characteristics within the community. Most of the selection criteria for the block groups were met in the larger communities. In some of the smaller communities, especially those with a small number of structures and/or block groups, the selection criteria were balanced.

3.4 Selecting Structures from Each Block Group

After selecting a set of block groups for each community, the target number of structures to be surveyed for the block groups was estimated.

Target Number of Structures in a Block Group

A target number of structures for each block group within the community for both residential and business structures was developed for the purpose of surveying. The target needed to be high enough to ensure that the survey teams would survey a mix of properties with varied economic, demographic, and geographic characteristics within the community. The sum of the target number of residential and business structures for each block group equals the target number of structures for the entire community. The target numbers for each block group are based on the following formula:

$$\text{Target} = \frac{\text{(Number of pre-FIRM structures for Block Group)}}{\text{(Total number of pre-FIRM structures for Block Groups in Comm.)}} \times \text{(Target structures for Comm.)}$$

The formula assigns higher targets to block groups with larger percentages of pre-FIRM structures. The targets were bracketed with a minimum of 15 structures and a maximum of 150 structures for each block group. The targets were adjusted by visually inspecting the dispersion of these structures across the block groups. The target numbers were divided into targets for residential and non-residential structures based on the percentage of business structures in the community.

Candidate Number of Structures in a Block Group

Each block group was assigned a candidate number of structures that exceeded the target number of structures for the block group, including both residential and non-residential addresses. The candidate number of addresses generally exceeded the number of target structures for the block group by at least 60 percent.

Drawing Addresses for a Community

The candidate addresses for each selected block group were selected by visually inspecting the layout of the structures within the selected block group using the GIS software. If the structures were highly clustered in the community, candidate addresses were selected from these clusters. The geocoded pre-FIRM policies were used to select potential clusters of neighboring pre-FIRM structures.

The final result of these procedures was a candidate list of addresses for each of the 22 communities. This list was integrated into an interactive application used by the surveyors to collect structural and geographical survey information.

4. Elevation Data for the Sample Structures

Actuarial flood insurance premiums are a function of various data inputs reflecting physical specifications and structure value. These data include: lowest floor elevations, lowest adjacent grades, structure "footprint" areas, replacement values, and other information which was required for each structure to be surveyed. The *Residential Cost Handbook* by Marshall & Swift and *Marshall Valuation Service* were referenced for classes and qualities of construction but only to the degree that significant parameters could be efficiently acquired without intruding on the property of structures to be surveyed.

Five Dewberry & Davis Geographic Information System (GIS) specialists were provided with the following: (1) candidate address lists for structures to be surveyed in designated communities; (2) target number and minimum number of residential and business addresses to be surveyed, by designated Census block groups, within each community; (3) planning maps plotted with Census block group boundaries, TIGER roads from the Bureau of the Census, SFHA's, and approximate geocoded locations for candidate addesses; (4) current FIRM panels and dates of first effective FIRM's for each community; and (5) laptop computers loaded with the address lists and programmed for data entry and efficient selection from "pick lists" of Marshall & Swift data.

The GIS specialists coordinated in advance with community officials to inform them of the purpose, location, and timing of surveys and to solicit community assistance in obtaining construction dates, square footage, and appraised values of the structures on address lists provided to the community, to allow for verification of estimates made in the field. The GIS specialists were tasked to locate structures on the address lists that were located within the SFHA and old enough to be pre-FIRM and then to annotate the address list for use by the GPS survey teams to follow. In order to meet their quotas, the GIS specialists were allowed to add addresses to the list that obviously met the established criteria.

4.1 Marshall & Swift Cost Data

For those structures that met the criteria, the GIS specialists were then tasked to take digital photographs and assign various information pieces as follows:

General Information

Street Address, City, County, State
Survey Link Number
Footprint Dimensions of Structure (length and width in U.S. survey feet)
Digital Photo Number
Color of Siding and Trim (needed for quality control purposes only)

Occupancy Type

Manufactured Housing
Single Family Dwelling
Multiple Family Dwelling
Apartment Building
Condominium
Town House
Row House

Commercial Building
Industrial Building
Church, Temple, etc.
School, University
Hospital/Medical
Government or Utility
Other

FEMA Building Diagram Number

At or Above Grade, Slab or Walk-Out Basement
Basement, Below Grade on All Sides
Split Level, At or Above Grade on All Sides
Split Level, Lowest Level Below Grade
Elevated, No Room Beneath
Elevated, Room Beneath is Less than Half of Area, No Utilities
Elevated, Room Beneath is More than Half of Area, Utilities
Only Crawl Space, Storage or Garage Beneath

Quality Assessment (Low, Fair, Average, Good, Very Good, or Excellent, based on Marshall &
Swift building types, guidance, and examples)

Manufactured Housing, With Carport (FEMA diagrams 1 or 5)
Manufactured Housing, Without Carport (FEMA diagrams 1 or 5)
1 Story Single Family, No Basement (FEMA diagrams 1 or 8)
1 Story Single Family, Basement (FEMA diagram 2)
1 Story Single Family, Walk-Out Basement (FEMA diagram 1)
1 _ Story Single Family, No Basement (FEMA diagrams 1 or 8)
1 _ Story Single Family, Basement (FEMA diagram 2)
1 _ Story Single Family, Walk-Out Basement (FEMA diagram 1)
2 Story Single Family, No Basement (FEMA diagrams 1 or 8)
2 Story Single Family, Basement (FEMA diagram 2)
2 Story Single Family, Walk-Out Basement (FEMA diagram 1)
>2 Story Single Family, No Basement (FEMA diagrams 1 or 8)
>2 Story Single Family, Basement (FEMA diagram 2)
>2 Story Single Family, Walk-Out Basement (FEMA diagram 1)
Split Level Single Family, all Floors at or above Grade (FEMA diagram 3)
Split Level Single Family, Lowest Floor below Grade (FEMA diagram 4)
2 Story Bi-Level Single Family, all Floors at or above Grade (FEMA diagram 1)
2 Story Bi-Level Single Family, Lowest Floor below Grade (FEMA diagram 2)
Elevated Single Family (FEMA diagrams 5, 6 or 7)
Multi Family (Row, Townhouse, Apartments), No Basement (FEMA diagrams 1 or 8)
Multi Family (Row, Townhouse, Apartments), Basement (FEMA diagram 2)
Multi Family (Row, Townhouse, Apartments), Walk-Out Basement (FEMA diagram 1)
Non-Residential Building, No Basement (FEMA diagrams 1 or 8)
Non-Residential Building, Basement (FEMA diagram 2)
Non-Residential Building, Walk-Out Basement (FEMA diagram 1)

House Exterior Finish

Siding

Brick
Plywood or Hardboard
Stucco
Wood Shingles
Logs
Stone
Concrete Block
Aluminum
Other

Roof Materials

Composition Shingles
Wood Shingles
Clay Tile
Concrete
Slate
Metal
Other

Garage

Attached
Detached
Built-In
Number of Bays

Fireplace

Yes
No

Added Features ("large" if > 100 square feet)

Porch (specify none, small or large)
Patio (specify none, small or large)
Deck (specify none, small or large)
Breezeway (specify none, small or large)
Balcony (specify none, small or large)

Slope of Ground at Foundation

Flat
Sloped

Multiple (Apartment/Condo/Duplex/Townhouse/Rowhouse)

End Row Location
Inside Row Location
Detached Row Location
Number of Units per Building
Number of Floors per Building

Number of Floors per Unit

Non-Residential, Stories and Construction Class

Structural Steel
Reinforced Concrete
Masonry
Wood Frame
Metal Frame
Number of Stories

Non-Residential Building Type

Academic Building
Automobile Dealership
Automobile Service/Repair
Farm Building
Grocery or Convenience Store
Industrial Building
Lodging
Mall
Medical or Dental Building
Other Building with Expensive Contents
Public Building, Government Services
Public Building, Professional Services
Public Building, Other
Restaurant or Tavern
Retail Store or Services
Storage Building

4.2 Changes in the Field

After the survey process began, some changes were required for various reasons.

Select Phone Electronic Phone Directory

The geocoding from the Select Phone Electronic Phone Directory published by Pro CD, Inc. was reasonably accurate in all states except for North Carolina and South Carolina. Data for Edenton Town and Carteret County, North Carolina, and Myrtle Beach City, South Carolina, were very inaccurate, causing considerable delays and numerous surveys that had to be redone, using addresses added to the original address lists. It was not clear why there was a significant amount of inaccuracies in the address data.

Map Deficiencies

Some of the FIRM panels were outdated and/or did not accurately reflect the current road networks. In several cases, the FIRM flood zone boundaries did not reflect the true flood hazards. For example, sometimes higher terrain on one side of a road was shown inside the SFHA, while the lower terrain on the other side of the road was shown outside the SFHA.

Q3 Flood Data Deficiencies

In Phoenix City, Arizona, 154 homes were surveyed that were in Zone A on the Q3 Flood Data but which were later determined to be in the 500-year flood plain. In Sacramento County, California, 18 homes were surveyed based on Zone A designations but later found to be in Zone A99, protected by dikes and not within the scope of the study. In League City, Texas, over 100 surveys had already been completed when a resident informed the GIS team that their neighborhood had been removed from the SFHA; the GIS specialist checked with the city's floodplain manager and learned that very few structures in League City remained in the SFHA. In light of these circumstances, the survey quota was reduced from 150 structures to 90 structures and resulted in the surveying of virtually every floodprone pre-FIRM structure in League City. To make up for this shortfall, additional structures were added to the surveys in Jefferson Parish, Louisiana.

Dangerous Areas

In some communities, police officials informed the GIS team that it was unsafe for them to enter certain areas to collect information and take photographs of structures. This was especially critical for two Census Block Groups in Jefferson Parish, Louisiana, where police indicated that it would be unsafe to enter and take unsolicited photographs of certain structures. In response, a new address lists and quotas for other Census Block Groups in Jefferson Parish were developed.

Shortage of Older, Floodprone Structures

In some communities, there were not enough older floodprone structures to meet the targets. This was especially true for businesses, which are more likely to take the actions necessary to obtain Letter of Map Amendments (LOMA)s for administrative removal from the SFHA. In a few cases, the GIS specialist collected the Marshall & Swift data and provided addresses to the GPS survey crew, and residents subsequently requested that the surveyors not survey their property. In anticipation of experiencing shortfalls in surveying in some communities, more than 250 additional structures were surveyed in other designated Census Block Groups in an attempt to meet overall structure quotas.

4.3 GPS Elevation Certificates

GPS Elevation Surveys

The GIS specialists provided their respective teams of GPS surveyors with final lists of addresses to be surveyed. The GPS elevation surveys were completed in accordance with Dewberry & Davis' *Standards and Specifications, "Stand-Off" GPS Elevation Surveys, Pre-FIRM Actuarial Studies*, dated January 2, 1997. These Standards and Specifications had previously been coordinated with FEMA. The GPS surveyors used state-of-the-art Trimble 4000 SSi dual-frequency GPS receivers, calibrated local benchmarks as required, and provided lowest floor and lowest adjacent grade (LAG) elevations accurate to ±5 cm (2 inches) on the NGVD29 vertical datum. They also provided the NAD83 latitude and longitude of the bottom of the front door (BFD) of each structure; the BFD served as the initial "target point" for each structure surveyed.

Automated and Manual SFHA Determinations

The GIS and GPS specialists knew that some of the surveyed locations would be "borderline"— possibly "in" and possibly "out" of the SFHA, so they surveyed 251 extra structures in each community where possible. In other communities, the majority of addresses to be considered were "borderline," and there were few extra structures to survey in attempting to satisfy target quotas.

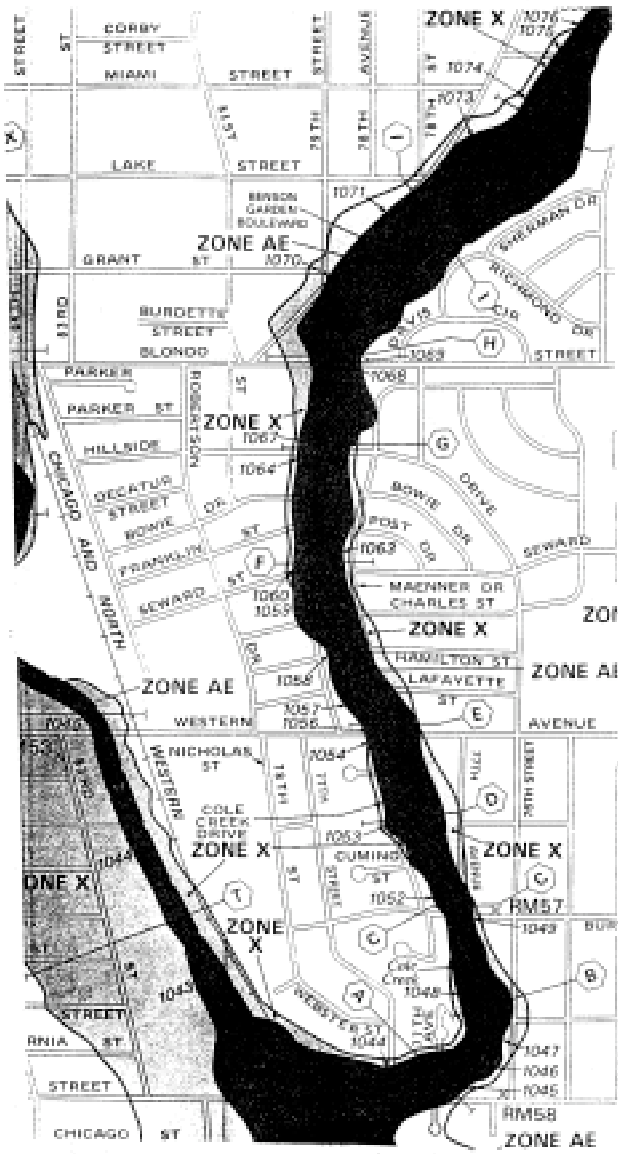
After receipt of the surveyed data, the ARC/INFO GIS were used to overlay the survey data points on the Q3 Flood Data SFHA boundaries. An automated in/out determination was initially made for each structure, followed by a manual determination. The map in Figure 4.1 illustrates why this was necessary.

The FIRM Map shows a segment of FIRM panel 25 of 50 in Omaha City, NE. The SFHA to the east includes two tree-lined streets that closely parallel the creek. The houses on these two streets are clearly in the SFHA. However, the ARC/INFO GIS Determination shows that an automated determination would plot the points outside the SFHA— not because they were actually outside the SFHA, but because the entire paper FIRM, from which the Q3 Flood Data was produced, lacks horizontal accuracy. The highly accurate GPS plots could not be as accurately registered to the less accurate base map. Such points were ruled "in" based on manual determinations.

In total, 323 manual determinations were ruled "in." A total of 523 were ruled "out" and treated as "throw aways" for the remainder of this study, but this included 172 surveys rejected as a result of the Q3 Flood Data deficiencies described above.

Figure 4.1

FIRM Map



ARC/INFO GIS Determination

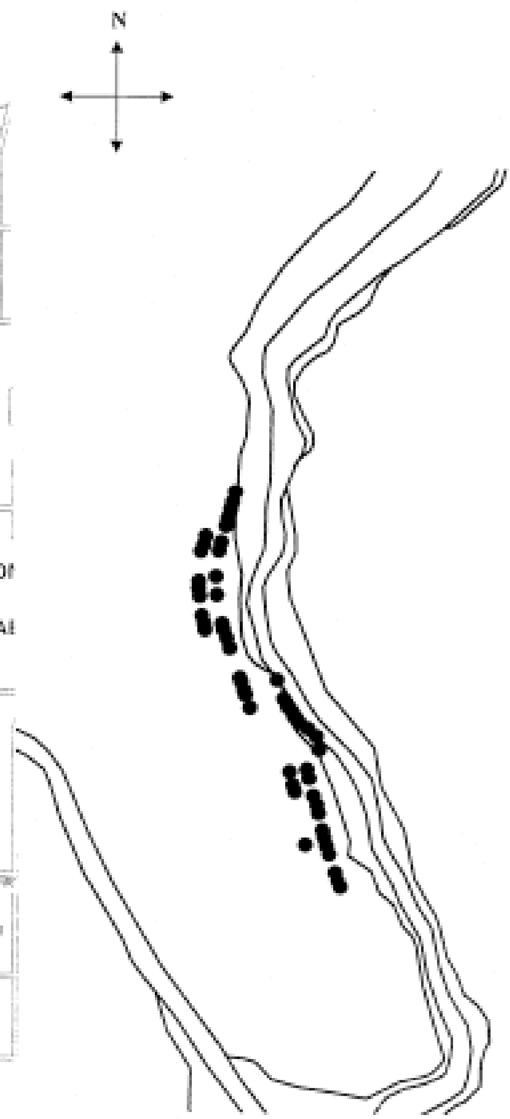


Table 4.1 shows that 8,151 total structures were surveyed, but only 7,628 total surveys were usable because of the 523 "throw aways."

The target quota for the surveys was 7,900 structures although 8,151 structures were surveyed. An additional 251 structures were surveyed, because while in the field the survey teams determined that many structures in the community were on the borderline of the SFHA. Later while processing the surveys, 523 of these structures were found to be located outside the SFHA and were not usable in the study. Hence, 7,628 structures were usable.

This means that there are 272 usable surveys fewer than the quota. This is equal to 3.4 percent of the quota and is within the statistical confidence levels. The shortfall is relatively small given the large number of usable surveys. For example, suppose 50 percent of the structures had some characteristic. If there were 7,900 structures, the 95 percent confidence limit around this estimate would be 1.10 percent. With the 7,628 structures, the confidence limit would be 1.12 percent.

Given this slight impact on the precision of the estimates, the final sample of surveyed structures excluded structures with uncertain SFHA status in order to minimize the probability of biasing the sample with non-SFHA structures.

Table 4.1
Surveyed Structures by Community

Community	Target Quota	Minimum	GPS Surveys	Throw-Aways	Usable Points
Louisville/Jefferson, KY	1,300	1,040	1,298	62	1,236
Lincoln Park Borough, NJ	250	200	270	0	270
Cohasset Town, MA	100	80	104	5	99
Niagara Town, NY	75	60	97	15	82
Wheeling City, WV	360	288	410	17	393
Edenton Town, NC	75	60	68	10	58
Carteret County, NC	650	520	650	25	625
Myrtle Beach City, SC	100	80	161	53	108
New Smyrna Beach City, FL	150	120	173	4	169
Fort Lauderdale City, FL	700	560	717	11	706
St. Petersburg Beach City, FL	300	240	311	0	311
Omaha City, NE	450	360	444	18	426
Council Bluffs City, IA	350	280	346	3	343
Petal City, MS	100	80	100	8	92
Marlinton Town, WV	100	80	159	0	159
Shreveport City, LA	100	80	105	0	105
Garland City, TX	150	120	152	25	127
League City, TX	90	75	89	11	78
Jefferson Parish, LA	860	688	870	62	808
Phoenix City, AZ	700	560	700	154	546
Santa Cruz City, CA	250	200	258	2	256
Sacramento County, CA	90	72	87	15	72
Lane County, OR	600	480	582	23	559
TOTALS	7,900	6,323	8,151	523	7,628

Base Flood Elevations (BFEs)

Since BFEs are not included in Q3 Flood Data, Dewberry & Davis obtained the appropriate FIRM panels and digitized all BFEs in the vicinity of structures that were surveyed. Then the BFEs for individual structures were interpolated to the nearest 1/10th of a foot between the upstream and downstream BFEs. Basement elevations were computed by one of two methods: (1) by subtracting 8-feet from the Top of Foundation (TOF) elevation, or (2) by subtracting 9-feet from the Bottom of Front Door (BFD) elevation. The elevation of the lowest floor, including basements, was subtracted from the BFE for each structure to determine the estimated depth of interior flooding from the base flood (e.g., 1 percent annual chance), regardless of the Lowest Adjacent Grade (LAG) elevation. For structures with basements, the elevation of the lowest adjacent grade (LAG) was also used to determine if the LAG would prevent base flood waters from inundating the basements. If the lowest floor elevation would not be flooded by the local elevation of the base flood, line 12 (Estimated Depth of Interior Flooding) was annotated "N/A" on the GPS Elevation Certificate.

Table 4.2 summarizes the results of the GPS elevation surveys for the 7,628 total usable surveys determined to be inside the SFHA. Nearly half (46.4 %) of the pre-FIRM structures surveyed in the SFHA had lowest floor elevations higher than the BFE.

Table 4.2
Surveyed Structures by Community and BFE Status in Relation to the Lowest Floor

Community	Total Usable Surveys	Structures with Lowest Floor > BFE	% of Structures with Lowest Floor > BFE	Manual Determi-nations	Manual Determi-nations of Structures with Lowest Floor > BFE
Louisville/Jefferson, KY	1,236	367 in AE	29.7 %	0	0
Lincoln Park Borough, NJ	270	12 in AE	4.4 %	0	0
Cohasset Town, MA	99	31 in AE	31.3 %	42 of 99	16 of 31
Niagara Town, NY	82	34 in AE	41.5 %	5 of 82	2 of 34
Wheeling City, WV	393	21 in AE	5.3 %	17 of 393	0
Edenton Town, NC	58	33 in AE 3 in A	62.1 %	6 of 58	6 of 36
Carteret County, NC	625	418 in AE	66.9 %	13 of 625	13 of 418
Myrtle Beach City, SC	108	46 in AE 6 in V	48.2 %	19 of 108	15 of 52
New Smyrna Beach City, FL	169	128 in AE	75.7 %	9 of 169	9 of 128
Fort Lauderdale City, FL	706	597 in AE 50 in AH	91.6 %	4 of 706	4 of 647
St. Petersburg Beach City, FL	311	8 in AE	2.6 %	0	0
Omaha City, NE	426	143 in AE	33.6 %	89 of 426	50 of 143
Council Bluffs City, IA	343	7 in AE 7 in AO	4.1 %	8 of 343	0
Petal City, MS	92	35 in AE 12 in A	51.1 %	5 of 92	4 of 47
Marlinton Town, WV	159	19 in AE	12.0 %	0	0
Shreveport City, LA	105	25 in AE 39 in AH	61.0 %	8 of 105	8 of 64
Garland City, TX	127	40 in AE	31.5 %	10 of 125	8 of 40
League City, TX	78	29 in AE 1 in VE	38.5 %	4 of 78	4 of 30
Jefferson Parish, LA	808	688 in AE 8 in AO	86.1 %	23 of 808	19 of 696
Phoenix City, AZ	546	144 in AE 81 in AH	41.2 %	8 of 546	7 of 225
Santa Cruz City, CA	256	84 in AE	32.8 %	4 of 256	2 of 84
Sacramento County, CA	72	50 in AE 10 in AO	83.3 %	28 of 72	28 of 60
Lane County, OR	559	276 in AE 84 in A	64.4 %	21 of 559	20 of 360
TOTALS	**7,628**	**3,536**	**46.4 %**	**323 of 7,628**	**215 of 3,536**

5. The Effects of Subsidy Elimination on Flood Insurance Premiums

This section presents estimates of the effects of seven subsidy elimination scenarios on the flood insurance premiums for each of the 50 sample communities. It provides: (1) a description of the seven scenarios; (2) an overview of the approach for calculating subsidized and actuarial premiums; (3) a discussion of the methods for imputing premiums; and (4) the projected flood insurance premiums for each scenario and each community. The Premium Calculator model structure and the model assumptions are described in more detail in Appendix A.

5.1 The Seven Premium Subsidy Elimination Scenarios

FEMA provided seven subsidy elimination scenarios for consideration when investigating the effects of a move from subsidized to actuarial premiums. These scenarios involve various combinations of eliminating the premium subsidy and decreasing the coverage provided by NFIP policies. The scenarios do not necessarily represent policies which the NFIP is considering implementing.

The scenarios only affect pre-FIRM structures. If the subsidy elimination results in a lower insurance premium and the structure is not already elevation rated, the participant will begin paying the lower premium immediately in 1998, under all seven scenarios. Structures with low risk and low expected losses have subsidized premiums that are higher than the actuarial premiums. Currently, these structures are only eligible for actuarial premiums if an elevation certificate is obtained. A general assumption in this study is that all pre-FIRM structures will obtain elevation certificates under the seven scenarios; thus, these structures will observe a premium decrease.

If the subsidy elimination results in a higher premium, the increase is phased in according to the specific scenario. For all seven scenarios, if a pre-FIRM structure is elevated to at or above the BFE, the structure becomes post-FIRM and immediately begins paying the actuarial premium. The 1997 subsidized and actuarial premium rates are used to calculate the subsidized and actuarial premiums for the 25-year period. Brief descriptions of the seven scenarios are provided below. These scenarios are described in greater detail in Appendix A.

Baseline

This scenario serves as a point of comparison for the seven subsidy elimination scenarios. All participating structures continue paying the current premium and have the same insurance coverage for the entire period from 1997 to 2022. Pre-FIRM structures that are not elevation rated pay the subsidized premium for all 25 years. Pre-FIRM structures that are elevation rated and post-FIRM structures pay the actuarial premium for all 25 years.

Scenario 1

This scenario eliminates the premium subsidy through an immediate premium change in 1998. For structures with a lower actuarial premium, the premium will decrease to the actuarial premium in 1998. For structures with a higher actuarial premium, the premium will increase to the actuarial premium in 1998.

Scenario 2

This scenario eliminates the premium subsidy gradually over a period of 10 years. For structures with a lower actuarial premium, the premium will decrease to the actuarial premium in 1998. For structures with a higher actuarial premium, the premium will increase steadily with an equal annual percentage growth rate for each of the 10 years from 1998 to 2007. At the end of this 10-year period, the premium will reach and remain at the actuarial rate.

Scenario 3

This scenario eliminates the premium subsidy gradually over a period of 20 years. For structures with a lower actuarial premium, the premium will decrease to the actuarial premium in 1998. For structures with a higher actuarial premium, the premium will increase steadily with an equal annual percentage growth rate for each of the 20 years from 1998 to 2017. At the end of this 20-year period, the premium will reach and remain at the actuarial rate.

Scenario 4

This scenario eliminates the premium subsidy when ownership of the structure changes or the structure is refinanced. For structures with a lower actuarial premium, the premium will decrease to the actuarial premium in 1998. For structures with a higher actuarial premium, the premium will increase to the actuarial premium when the structure is sold or refinanced.

Scenario 5

This scenario eliminates the premium subsidy with a combination of deductible increases and premium changes. For structures with a lower actuarial premium, the premium will decrease to the actuarial premium in 1998. For structures with a higher actuarial premium, the increase in deductible takes place immediately upon renewal. The deductible increases from the current $1,500 total ($750 building and $750 contents deductibles) to 15 percent of total insurance coverage. The premium change component eliminates any subsidy remaining after the deductible increase over five years with an equal annual percentage growth rate for each of the five years from 1998 to 2002.

Scenario 6

This scenario eliminates the premium subsidy with a combination of deductible increases and premium changes. For structures with a lower actuarial premium, the premium will decrease to the actuarial premium in 1998. For structures with a higher actuarial premium, the increase in deductible takes place immediately upon renewal. The deductible increases from the current $1,500 total ($750 building and $750 contents deductibles) to 3 percent of total insurance coverage. The premium change component eliminates any subsidy remaining after the deductible increase over five years with an equal annual percentage growth rate for each of the five years from 1998 to 2002.

Scenario 7

This scenario eliminates the premium subsidy with a combination of a coverage change and premium changes. For structures with a lower actuarial premium, the premium will decrease to the actuarial premium in 1998. For structures with a higher actuarial premium, the coverage change takes place immediately upon renewal. If a structure is damaged by a flood, the NFIP will only pay for builders grade materials and materials to make the structure habitable. This coverage change only affects above average quality structures since builders grade materials are assumed to be of average quality. The premium change component eliminates any subsidy remaining after the coverage change over five years with an equal annual percentage growth rate for each of the five years from 1998 to 2002.

5.2 Overview of the Approach for Calculating Premiums

The Premium Calculator is designed to calculate the subsidized and actuarial flood insurance premiums for all types of structures in the 50 sample NFIP communities. To accomplish this goal, the Premium Calculator begins with detailed structural data collected during the elevation surveys, housing cost information, and flood insurance premium rates. The calculator computes the replacement cost, subsidized annual premium, and actuarial annual premium for each of the surveyed structures. Using the results at the structure level, the Premium Calculator is able to impute replacement costs and premiums for all types of structures in the 50 sample communities.

The Premium Calculator is not a predictive model. Its function is limited to calculating 1997 subsidized and actuarial premiums based on current flood insurance rate assumptions and the structural data collected by the survey teams. These outputs are then provided to the Property Valuation Model (PVM) and Insurance Demand Model (IDM) to model the seven premium subsidy elimination scenarios over a 25 year model period. The PVM uses the outputs to model the effect changes from subsidized to actuarial premiums have on property values in the 50 sample communities. The IDM uses the outputs to capture the effect changes in premiums have on the demand for flood insurance.

The following results give the average annual premium for three types of structures in all 50 sample communities. This is the insurance premium for each structure in the community's SFHA, regardless of whether or not the structure owner chooses to purchase flood insurance. These premiums represent a weighted average, over the model period 1997-2022, based upon the number and type of structures in the individual communities.

5.3 Results

5.3.1 Factors Affecting Premium Changes

The Premium Calculator computes the subsidized and actuarial insurance premium for each property type specified in the calculator's structure categories. These premiums represent the annual premium each structure in a given structure category should expect to pay for flood insurance in 1997. A pre-FIRM structure will pay the subsidized premium, and a post-FIRM structure will pay the corresponding actuarial premium. The difference between the two premiums may be positive or negative. Structures below the BFE typically experience increases in premium rates between subsidized and actuarial premiums, while structures at or above the BFE typically experience decreases in premium rates. The difference between subsidized and actuarial premiums is especially sensitive to the elevation difference. For example, single family residential properties in St. Petersburg Beach City, Florida at or above the BFE experience an average 39% decrease from subsidized to actuarial premiums; similar structures one or two feet below the BFE experience a 116% increase; those at 3, 4, or 5 feet below the BFE experience a 435% increase; and those structures six feet or more below the BFE experience a premium increase of 894%.

The largest increases between subsidized and actuarial premiums generally occur for structures that are below the BFE. Structures above the BFE generally experience premium decreases.

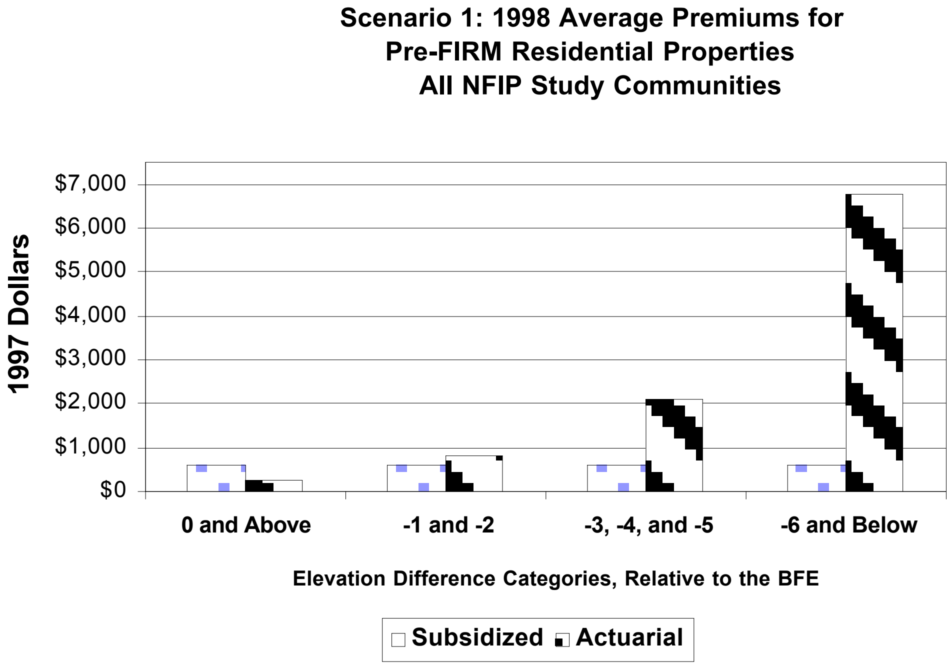
Structures with basements, even though the basement floor is located below the BFE, experience only moderate increases or even decreases in premiums. This is due to restrictions on coverage in basements and the way water enters the basement to cause damage. Water tends to enter the basement through openings near the ceiling or where there is enough hydrostatic pressure built up around the walls of the basement. Thus, if the lowest adjacent grade is at or near the BFE, the basement area may not be subject to the higher frequency floods that would cause actuarial premiums to be much greater. Also, in selecting the actuarial premium rates for pre-FIRM structures, current restrictions on coverage in basements for finishings and contents were assumed to continue, resulting in significantly lower premiums than would otherwise be required to provide the additional coverage.

5.3.2 National Level Premium Changes

At the national level, there are considerable differences in the magnitude of premium changes based on differences in relative flood risk. As measured by a structure's elevation difference (the number of feet in relation to the BFE), exposure to different levels of flood risk results in considerably different actuarial premium levels. For this study, pre-FIRM SFHA properties were classified according to one of four levels of flood risk determined by the structure's elevation difference: 0 and above (at or above the BFE); -1 and -2 (one to two feet below the BFE); -3, -4, and -5 (three to five feet below the BFE); and -6 and below (six or more feet below the BFE). Of the 4.3 million pre-FIRM SFHA structures estimated nationally in this study, about 1.9 million structures were determined to have an elevation difference of 0 and above, about 1.3 million structures were determined to have an elevation difference of -1 and -2, about 520,000 structures were determined to have an elevation difference of -3, -4 and -5, and about 550,000 structures were determined to have an elevation difference of -6 and below in 1997.

Figure 5.1 shows the subsidized premiums and actuarial premiums for Scenario 1 (immediate subsidy elimination) for 1998 for all pre-FIRM SFHA structures nationally by the four elevation difference categories. As expected, the magnitude of premium changes varies considerably by elevation difference, with structures at lower elevations experiencing larger dollar changes as premiums shift from subsidized to actuarial. For structures one to two feet below the BFE, premiums would likely rise from about $580 to about $835 as a result of subsidy elimination. For structures three to five feet below the BFE, premiums would likely rise from about $590 to about $2,100 as a result of subsidy elimination. For structures six feet or more below the BFE, premiums would likely rise from about $590 to about $6,800 as a result of subsidy elimination. Note that for structures at or above the BFE, premiums would likely decrease from about $580 to about $260 in 1998. These decreases reflect the fact that for structures at or above the BFE subsidized premiums are typically *greater than* actuarial premiums.

Figure 5.1



5.3.3 Community Level Premium Changes for Scenarios

Table 5.1 presents average annual premiums per SFHA property for properties below the BFE over the 1997 to 2022 period for the 50 sample communities for the Baseline (with no simulated premium changes) and the seven policy scenarios. While premium changes differ considerably by community, property type, and policy scenario, a number of key patterns in the results are noteworthy:

Average Baseline premiums are generally highest for non-residential properties, reflecting considerably higher average property values for these structures than for those for single or multiple family residential structures. Among the 50 sample communities, the only significant exception occurs in St. Petersburg Beach City, Florida, a community with a relatively high concentration of large high-rise condominiums whose average property value considerably exceeds that of non-residential properties.

For most communities and property types, premium increases are largest for Scenario 1, followed closely by Scenarios 5, 6, and 7, which share similar sized premium increases. The closeness among premium changes for these scenarios reflects the fact that Scenarios 1, 5, 6, and 7 are similar in that the majority of the premium subsidy is effectively eliminated in 1998, with any remaining premium subsidy fully phased out by 2002.

In decreasing order of dollar size magnitude, Scenarios 2, 3, and 4 experience the smallest premium increases for most communities and property types. In these three scenarios, the relatively smaller increases in premiums reflect the gradual nature of the phase-out of the subsidy elimination simulated in these three scenarios.

Fifteen communities – St. Petersburg Beach City, Florida; Grundy County, Illinois; Louisville City, Kentucky; Cohasset Town, Massachusetts; Lincoln Park Borough, New

Jersey; Niagara Town, New York; Franklin Township, Pennsylvania; Glen Rock Borough, Pennsylvania; New Cumberland Borough, Pennsylvania; Brookside Village, Texas; Grundy Town, Virginia; Leavenworth City, Washington; and the three West Virginia communities – experience premium increases relative to the baseline of 250% or more for all property types in Scenarios 1, 5, 6, and 7. In general, these communities contain half or more of their properties three feet or more below the BFE in 1997, and for the inland communities, fifty percent or more of single family structures contain basements. In these fifteen communities, premium increases in Scenarios 2, 3, and 4 are generally in the 100 percent to 200 percent increase range.

Five communities – Phoenix City, Arizona; Ft. Lauderdale City, Florida; New Smyrna Beach City, Florida; Jefferson Parish, Louisiana; and Carteret County, North Carolina – experience premium increases relative to the baseline of less than fifty percent for all property types in all scenarios. In general, these communities contain few properties with substantial flood risk. For these five communities, less than five percent of structures are estimated to be more than two feet below the BFE.

Table 5.1
Average Annual Premium in 1997 Dollars per SFHA Property over the 1997-2022 Period
Properties Below the BFE, Sample Communities

Community	Baseline	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6	Scenario 7
All NFIP Study Communities								
Single Family	$625	$1,872	$1,478	$1,125	$1,219	$1,808	$1,808	$1,764
Multiple Family	$981	$4,104	$3,141	$2,282	$2,581	$3,955	$3,955	$3,803
Non-Residential	$1,603	$5,268	$4,160	$3,168	$3,404	$5,175	$5,175	$5,030
Phoenix City, AZ								
Single Family	$542	$632	$610	$589	$594	$629	$629	$627
Multiple Family	$943	$1,383	$1,278	$1,175	$1,199	$1,373	$1,373	$1,339
Non-Residential	$916	$1,118	$1,073	$1,027	$1,034	$1,115	$1,115	$1,106
Bay City, AR								
Single Family	$605	$1,203	$1,039	$887	$938	$1,176	$1,176	$1,150
Multiple Family	$318	$712	$610	$502	$553	$677	$677	$670
Non-Residential	$2,118	$3,679	$3,289	$2,904	$3,059	$3,659	$3,659	$3,613
Sacramento County, CA								
Single Family	$608	$759	$722	$687	$696	$754	$754	$747
Multiple Family	$1,348	$2,053	$1,871	$1,701	$1,759	$2,050	$2,050	$1,993
Non-Residential	$2,040	$2,531	$2,411	$2,296	$2,327	$2,528	$2,528	$2,521
Santa Cruz City, CA								
Single Family	$706	$2,665	$2,099	$1,572	$1,794	$2,581	$2,581	$2,511
Multiple Family	$940	$3,261	$2,616	$2,007	$2,235	$3,176	$3,176	$3,065
Non-Residential	$2,398	$6,010	$5,022	$4,100	$4,404	$5,982	$5,982	$5,853
Dolores Town, CO								
Single Family	$708	$1,361	$1,189	$1,027	$1,071	$1,336	$1,336	$1,307
Multiple Family	$1,267	$3,073	$2,628	$2,145	$2,391	$3,011	$3,011	$2,943
Non-Residential	$1,637	$2,458	$2,259	$2,061	$2,116	$2,431	$2,431	$2,402
Otero County, CO								
Single Family	$396	$747	$658	$570	$567	$722	$722	$716
Multiple Family	$448	$1,008	$873	$733	$757	$968	$968	$951
Non-Residential	$1,338	$2,323	$2,090	$1,853	$1,869	$2,293	$2,293	$2,265
Ft. Lauderdale City, FL								
Single Family	$1,157	$1,313	$1,272	$1,234	$1,241	$1,313	$1,313	$1,309
Multiple Family	$2,061	$2,473	$2,361	$2,258	$2,282	$2,471	$2,471	$2,467
Non-Residential	$1,165	$1,261	$1,237	$1,214	$1,218	$1,260	$1,260	$1,259
New Smyrna Beach City, FL								
Single Family	$579	$707	$678	$649	$652	$705	$705	$699
Multiple Family	$1,087	$1,608	$1,484	$1,357	$1,386	$1,602	$1,602	$1,578
Non-Residential	$1,686	$2,093	$1,998	$1,901	$1,920	$2,087	$2,087	$2,082
St. Petersburg Beach City, FL								
Single Family	$853	$3,096	$2,490	$1,904	$2,058	$3,032	$3,032	$2,959
Multiple Family	$1,436	$4,708	$3,843	$3,003	$3,196	$4,679	$4,679	$4,547
Non-Residential	$1,160	$3,734	$3,060	$2,402	$2,555	$3,636	$3,636	$3,532
Hailey City, ID								
Single Family	$608	$791	$701	$611	$673	$775	$775	$762
Multiple Family	$1,056	$2,080	$1,828	$1,552	$1,774	$2,045	$2,045	$2,005
Non-Residential	$1,733	$3,709	$3,081	$2,600	$2,889	$3,629	$3,629	$3,546
Grundy County, IL								
Single Family	$639	$3,336	$2,438	$1,674	$1,934	$3,153	$3,153	$3,011
Multiple Family	$694	$5,910	$4,199	$2,741	$3,249	$5,528	$5,528	$5,285
Non-Residential	$1,302	$10,788	$7,777	$5,162	$6,033	$10,239	$10,239	$9,830
Council Bluffs City, IA								
Single Family	$405	$586	$521	$463	$464	$569	$569	$565
Multiple Family	$388	$2,339	$1,767	$1,249	$1,336	$2,165	$2,165	$2,099
Non-Residential	$1,358	$7,681	$5,793	$4,074	$4,429	$7,297	$7,297	$7,092

Table 5.1 (Continued)
Average Annual Premium in 1997 Dollars per SFHA Property over the 1997-2022 Period
Properties Below the BFE, Sample Communities

Community	Baseline	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6	Scenario 7
Augusta City, KY								
Single Family	$515	$576	$510	$448	$464	$561	$561	$554
Multiple Family	$278	$557	$478	$409	$437	$528	$528	$522
Non-Residential	$1,619	$2,331	$2,148	$1,977	$2,039	$2,314	$2,314	$2,293
Lewisport City, KY								
Single Family	$408	$414	$374	$337	$349	$403	$403	$399
Multiple Family	$306	$611	$529	$445	$483	$583	$583	$578
Non-Residential	$1,935	$2,813	$2,606	$2,387	$2,515	$2,797	$2,797	$2,774
Louisville City, KY								
Single Family	$555	$5,194	$3,689	$2,281	$2,787	$4,852	$4,852	$4,745
Multiple Family	$908	$9,540	$6,839	$4,295	$5,120	$9,169	$9,169	$8,791
Non-Residential	$712	$6,691	$4,822	$3,065	$3,641	$6,133	$6,133	$6,046
Allen Parish, LA								
Single Family	$363	$636	$562	$495	$486	$615	$615	$606
Multiple Family	$342	$682	$599	$515	$523	$653	$653	$647
Non-Residential	$1,356	$2,147	$1,921	$1,737	$1,706	$2,113	$2,113	$2,086
Jefferson Parish, LA								
Single Family	$896	$1,179	$1,103	$1,034	$1,023	$1,169	$1,169	$1,158
Multiple Family	$760	$1,096	$1,007	$923	$914	$1,083	$1,083	$1,074
Non-Residential	$1,858	$2,274	$2,169	$2,070	$2,047	$2,271	$2,271	$2,261
Shreveport City, LA								
Single Family	$370	$401	$394	$387	$386	$400	$400	$400
Multiple Family	$702	$1,151	$1,043	$933	$944	$1,137	$1,137	$1,108
Non-Residential	$1,183	$1,516	$1,439	$1,360	$1,363	$1,509	$1,509	$1,502
Cohasset Town, MA								
Single Family	$1,438	$6,864	$5,171	$3,709	$3,921	$6,737	$6,737	$6,548
Multiple Family	$1,002	$5,950	$4,428	$3,101	$3,526	$5,690	$5,690	$5,448
Non-Residential	$2,616	$12,381	$9,280	$6,789	$7,478	$12,209	$12,209	$11,728
Vassar City, MI								
Single Family	$397	$404	$363	$329	$329	$392	$392	$389
Multiple Family	$444	$934	$793	$671	$700	$893	$893	$874
Non-Residential	$1,287	$2,299	$2,056	$1,806	$1,862	$2,258	$2,258	$2,237
Petal City, MS								
Single Family	$380	$638	$569	$504	$502	$618	$618	$612
Multiple Family	$354	$704	$619	$531	$556	$675	$675	$669
Non-Residential	$1,656	$2,712	$2,460	$2,200	$2,258	$2,694	$2,694	$2,667
Scott County, MO								
Single Family	$385	$398	$358	$320	$324	$386	$386	$381
Multiple Family	$315	$539	$484	$429	$446	$520	$520	$516
Non-Residential	$1,369	$2,345	$2,071	$1,842	$1,863	$2,306	$2,306	$2,273
Omaha City, NE								
Single Family	$522	$1,274	$999	$756	$844	$1,210	$1,210	$1,189
Multiple Family	$1,307	$5,424	$4,148	$3,023	$3,413	$5,293	$5,293	$5,090
Non-Residential	$1,235	$4,979	$3,842	$2,809	$3,152	$4,758	$4,758	$4,635
Pender Village, NE								
Single Family	$670	$1,972	$1,521	$1,115	$1,042	$1,898	$1,898	$1,832
Multiple Family	$399	$1,702	$1,211	$857	$831	$1,552	$1,552	$1,495
Non-Residential	$1,144	$4,606	$3,567	$2,622	$2,554	$4,400	$4,400	$4,287
Woodstock Town, NH								
Single Family	$376	$367	$337	$307	$318	$359	$359	$356
Multiple Family	$868	$1,908	$1,644	$1,372	$1,457	$1,875	$1,875	$1,792
Non-Residential	$1,558	$2,361	$2,156	$1,955	$2,023	$2,334	$2,334	$2,307

Table 5.1 (Continued)

Average Annual Premium in 1997 Dollars per SFHA over the 1997-2022 Period
Properties Below the BFE, Sample Communities

Community	Baseline	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6	Scenario 7
Bloomingdale Borough, NJ								
Single Family	$663	$822	$703	$597	$596	$803	$803	$791
Multiple Family	$828	$2,241	$1,876	$1,525	$1,555	$2,183	$2,183	$2,118
Non-Residential	$1,121	$2,200	$1,925	$1,640	$1,694	$2,158	$2,158	$2,125
Lincoln Park Borough, NJ								
Single Family	$791	$5,486	$3,927	$2,599	$3,056	$5,281	$5,281	$5,115
Multiple Family	$923	$10,535	$7,327	$4,585	$5,637	$9,991	$9,991	$9,442
Non-Residential	$3,355	$28,889	$20,713	$13,540	$15,933	$28,750	$28,750	$27,620
Niagara Town, NY								
Single Family	$445	$1,662	$1,215	$860	$985	$1,506	$1,506	$1,450
Multiple Family	$268	$2,006	$1,459	$979	$1,180	$1,802	$1,802	$1,766
Non-Residential	$1,464	$4,639	$3,683	$2,909	$3,037	$4,514	$4,514	$4,380
Waterford Village, NY								
Single Family	$614	$1,515	$1,194	$898	$1,021	$1,455	$1,455	$1,421
Multiple Family	$544	$2,791	$2,096	$1,468	$1,772	$2,625	$2,625	$2,557
Non-Residential	$1,001	$3,010	$2,444	$1,879	$2,119	$2,885	$2,885	$2,834
Carteret County, NC								
Single Family	$707	$869	$831	$794	$796	$867	$867	$857
Multiple Family	$1,197	$1,688	$1,571	$1,452	$1,471	$1,684	$1,684	$1,644
Non-Residential	$1,511	$1,736	$1,685	$1,634	$1,635	$1,735	$1,735	$1,729
Edenton Town, NC								
Single Family	$1,133	$1,680	$1,548	$1,418	$1,374	$1,678	$1,678	$1,655
Multiple Family	$940	$1,854	$1,628	$1,393	$1,363	$1,830	$1,830	$1,788
Non-Residential	$1,867	$2,559	$2,395	$2,225	$2,185	$2,549	$2,549	$2,537
New Miami Village, OH								
Single Family	$595	$673	$599	$529	$550	$661	$661	$652
Multiple Family	$518	$998	$877	$759	$817	$972	$972	$957
Non-Residential	$1,253	$2,160	$1,943	$1,724	$1,777	$2,132	$2,132	$2,105
Washington County, OK								
Single Family	$387	$772	$670	$572	$590	$747	$747	$736
Multiple Family	$635	$1,973	$1,639	$1,282	$1,424	$1,923	$1,923	$1,838
Non-Residential	$1,279	$2,274	$2,003	$1,769	$1,803	$2,232	$2,232	$2,198
Lane County, OR								
Single Family	$557	$889	$795	$710	$744	$872	$872	$864
Multiple Family	$865	$1,845	$1,574	$1,313	$1,447	$1,810	$1,810	$1,759
Non-Residential	$1,324	$1,894	$1,756	$1,622	$1,668	$1,880	$1,880	$1,865
Vernonia City, OR								
Single Family	$646	$1,311	$1,125	$961	$982	$1,278	$1,278	$1,252
Multiple Family	$904	$2,547	$2,128	$1,684	$1,869	$2,463	$2,463	$2,403
Non-Residential	$1,267	$2,534	$2,226	$1,902	$1,976	$2,491	$2,491	$2,450
Franklin Township, PA								
Single Family	$450	$1,847	$1,396	$1,005	$962	$1,727	$1,727	$1,676
Multiple Family	$243	$2,295	$1,647	$1,074	$1,040	$2,060	$2,060	$2,020
Non-Residential	$1,679	$12,138	$8,903	$6,029	$5,697	$11,761	$11,761	$11,272
Glen Rock Borough, PA								
Single Family	$423	$1,649	$1,264	$914	$1,021	$1,550	$1,550	$1,513
Multiple Family	$286	$2,638	$1,928	$1,242	$1,540	$2,393	$2,393	$2,350
Non-Residential	$1,160	$3,712	$3,090	$2,414	$3,131	$3,592	$3,592	$3,530
Lower Mt. Bethel Township, PA								
Single Family	$494	$1,201	$960	$735	$797	$1,136	$1,136	$1,109
Multiple Family	$548	$2,593	$2,078	$1,518	$2,210	$2,464	$2,464	$2,417
Non-Residential	$1,202	$3,823	$3,184	$2,489	$3,356	$3,704	$3,704	$3,637

Table 5.1 (Continued)
Average Annual Premium in 1997 Dollars per SFHA Property over the 1997-2022 Period

Properties Below the BFE, Sample Communities

Community	Baseline	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6	Scenario 7
New Cumberland Borough, PA								
Single Family	$615	$2,828	$2,147	$1,502	$1,716	$2,700	$2,700	$2,592
Multiple Family	$447	$4,677	$3,361	$2,135	$2,587	$4,280	$4,280	$4,211
Non-Residential	$1,099	$6,773	$5,301	$3,751	$4,122	$6,454	$6,454	$6,306
Myrtle Beach City, SC								
Single Family	$995	$1,567	$1,397	$1,246	$1,308	$1,540	$1,540	$1,521
Multiple Family	$1,961	$3,065	$2,714	$2,431	$2,570	$3,043	$3,043	$2,992
Non-Residential	$2,420	$3,403	$3,163	$2,912	$3,158	$3,396	$3,396	$3,364
Lawrence County, SD								
Single Family	$419	$436	$394	$355	$370	$424	$424	$421
Multiple Family	$520	$972	$863	$749	$812	$945	$945	$935
Non-Residential	$1,341	$2,305	$2,072	$1,827	$1,926	$2,269	$2,269	$2,243
Brookside Village City, TX								
Single Family	$395	$3,363	$2,451	$1,617	$1,971	$3,073	$3,073	$3,030
Multiple Family	$493	$2,955	$1,836	$1,317	$1,657	$2,527	$2,527	$2,459
Non-Residential	$1,185	$7,733	$5,815	$3,931	$4,725	$7,335	$7,335	$7,131
Garland City, TX								
Single Family	$858	$2,057	$1,736	$1,428	$1,512	$2,020	$2,020	$1,977
Multiple Family	$819	$1,848	$1,581	$1,321	$1,391	$1,809	$1,809	$1,776
Non-Residential	$1,069	$1,907	$1,694	$1,492	$1,526	$1,868	$1,868	$1,835
League City, TX								
Single Family	$754	$2,635	$2,050	$1,509	$1,693	$2,524	$2,524	$2,460
Multiple Family	$1,154	$4,190	$3,214	$2,369	$2,703	$4,056	$4,056	$3,913
Non-Residential	$1,629	$4,393	$3,550	$2,789	$3,041	$4,254	$4,254	$4,149
Grundy Town, VA								
Single Family	$399	$1,824	$1,328	$924	$954	$1,677	$1,677	$1,619
Multiple Family	$255	$1,608	$1,108	$659	$960	$1,435	$1,435	$1,405
Non-Residential	$1,284	$8,768	$6,425	$4,396	$4,579	$8,362	$8,362	$8,044
Ephrata City, WA								
Single Family	$439	$807	$715	$624	$641	$781	$781	$775
Multiple Family	$350	$633	$561	$491	$509	$607	$607	$602
Non-Residential	$1,434	$2,339	$2,124	$1,903	$1,955	$2,309	$2,309	$2,282
Leavenworth City, WA								
Single Family	$481	$1,770	$1,393	$1,043	$1,201	$1,670	$1,670	$1,632
Multiple Family	$602	$2,531	$2,055	$1,538	$1,897	$2,410	$2,410	$2,366
Non-Residential	$1,474	$4,825	$4,019	$3,142	$4,236	$4,702	$4,702	$4,593
Marlinton Town, WV								
Single Family	$497	$1,392	$1,103	$842	$865	$1,326	$1,326	$1,289
Multiple Family	$493	$1,589	$1,256	$985	$1,074	$1,488	$1,488	$1,450
Non-Residential	$2,920	$10,093	$7,940	$5,998	$6,158	$10,002	$10,002	$9,747
Philippi City, WV								
Single Family	$413	$1,585	$1,230	$895	$853	$1,478	$1,478	$1,437
Multiple Family	$295	$2,811	$2,039	$1,296	$1,379	$2,539	$2,539	$2,491
Non-Residential	$1,066	$6,773	$5,098	$3,525	$3,357	$6,416	$6,416	$6,252
Wheeling City, WV								
Single Family	$370	$1,158	$925	$705	$687	$1,086	$1,086	$1,066
Multiple Family	$314	$2,976	$2,167	$1,403	$1,453	$2,744	$2,744	$2,624
Non-Residential	$1,124	$11,873	$8,582	$5,470	$5,728	$11,274	$11,274	$10,864

Table 5.2 presents average annual premiums per SFHA property for properties at or above the BFE over the 1997 to 2022 period for the 50 sample communities for the Baseline (with no simulated premium changes) and the seven policy scenarios. While premium changes

differ considerably by community and property type, a number of key patterns in the results are noteworthy:

Premium changes across the seven policy scenarios are not significantly different from one another, ranging in most communities and structure types from decreases of between 20 and 50 percent. These similarities reflect the fact that, for at or above BFE structures which experience premium decreases, the policy scenarios are identical. Recall that for all of the seven scenarios, premiums for structures with a lower actuarial premium are assumed to decrease to actuarial levels in 1998.

In general, relative premium decreases tend to be highest for non-residential structures and lowest for multiple family structures. For non-residential structures, larger estimated premium decreases reflect the fact that a relatively small proportion of these structures contain basements. For multiply family attached structures, relatively smaller premium decreases reflect the relatively smaller flood insurance coverage rates assumed for these types of structures.

Table 5.2
Average Annual Premium in 1997 Dollars per SFHA Property over the 1997-2022 Period
Properties At or Above the BFE, Sample Communities

Community	Baseline	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6	Scenario 7
All NFIP Study Communities								
Single Family	$401	$274	$274	$274	$274	$274	$274	$274
Multiple Family	$683	$533	$533	$533	$533	$533	$533	$533
Non-Residential	$872	$433	$433	$433	$433	$433	$433	$433
Phoenix City, AZ								
Single Family	$312	$250	$250	$250	$250	$250	$250	$250
Multiple Family	$440	$367	$367	$367	$367	$367	$367	$367
Non-Residential	$426	$313	$313	$313	$313	$313	$313	$313
Bay City, AR								
Single Family	$377	$235	$235	$235	$235	$235	$235	$235
Multiple Family	$200	$138	$138	$138	$138	$138	$138	$138
Non-Residential	$1,083	$511	$511	$511	$511	$511	$511	$511
Sacramento County, CA								
Single Family	$332	$211	$211	$211	$211	$211	$211	$211
Multiple Family	$613	$370	$370	$370	$370	$370	$370	$370
Non-Residential	$881	$415	$415	$415	$415	$415	$415	$415
Santa Cruz City, CA								
Single Family	$521	$343	$343	$343	$343	$343	$343	$343
Multiple Family	$661	$412	$412	$412	$412	$412	$412	$412
Non-Residential	$1,658	$737	$737	$737	$737	$737	$737	$737
Dolores Town, CO								
Single Family	$352	$223	$223	$223	$223	$223	$223	$223
Multiple Family	$512	$284	$284	$284	$284	$284	$284	$284
Non-Residential	$857	$376	$376	$376	$376	$376	$376	$376
Otero County, CO								
Single Family	$292	$163	$163	$163	$163	$163	$163	$163
Multiple Family	$287	$175	$175	$175	$175	$175	$175	$175
Non-Residential	$954	$386	$386	$386	$386	$386	$386	$386
Ft. Lauderdale City, FL								
Single Family	$716	$608	$608	$608	$608	$608	$608	$608
Multiple Family	$1,083	$920	$920	$920	$920	$920	$920	$920
Non-Residential	$689	$474	$474	$474	$474	$474	$474	$474
New Smyrna Beach City, FL								
Single Family	$360	$273	$273	$273	$273	$273	$273	$273
Multiple Family	$560	$433	$433	$433	$433	$433	$433	$433
Non-Residential	$754	$459	$459	$459	$459	$459	$459	$459
St. Petersburg Beach City, FL								
Single Family	$581	$500	$500	$500	$500	$500	$500	$500
Multiple Family	$863	$755	$755	$755	$755	$755	$755	$755
Non-Residential	$544	$391	$391	$391	$391	$391	$391	$391
Hailey City, ID								
Single Family	$342	$258	$258	$258	$258	$258	$258	$258
Multiple Family	$363	$247	$247	$247	$247	$247	$247	$247
Non-Residential	$727	$467	$467	$467	$467	$467	$467	$467
Grundy County, IL								
Single Family	$444	$241	$241	$241	$241	$241	$241	$241
Multiple Family	$430	$222	$222	$222	$222	$222	$222	$222
Non-Residential	$1,149	$478	$478	$478	$478	$478	$478	$478
Council Bluffs City, IA								
Single Family	$214	$133	$133	$133	$133	$133	$133	$133
Multiple Family	$192	$121	$121	$121	$121	$121	$121	$121
Non-Residential	$586	$381	$381	$381	$381	$381	$381	$381

Table 5.2 (Continued)

Average Annual Premium in 1997 Dollars per SFHA Property over the 1997-2022 Period
Properties At or Above the BFE, Sample Communities

Community	Baseline	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6	Scenario 7
Augusta City, KY								
Single Family	$387	$206	$206	$206	$206	$206	$206	$206
Multiple Family	$186	$126	$126	$126	$126	$126	$126	$126
Non-Residential	$858	$350	$350	$350	$350	$350	$350	$350
Lewisport City, KY								
Single Family	$304	$170	$170	$170	$170	$170	$170	$170
Multiple Family	$189	$130	$130	$130	$130	$130	$130	$130
Non-Residential	$892	$397	$397	$397	$397	$397	$397	$397
Louisville City, KY								
Single Family	$386	$190	$190	$190	$190	$190	$190	$190
Multiple Family	$596	$282	$282	$282	$282	$282	$282	$282
Non-Residential	$940	$323	$323	$323	$323	$323	$323	$323
Allen Parish, LA								
Single Family	$251	$153	$153	$153	$153	$153	$153	$153
Multiple Family	$212	$143	$143	$143	$143	$143	$143	$143
Non-Residential	$803	$356	$356	$356	$356	$356	$356	$356
Jefferson Parish, LA								
Single Family	$530	$422	$422	$422	$422	$422	$422	$422
Multiple Family	$424	$351	$351	$351	$351	$351	$351	$351
Non-Residential	$957	$610	$610	$610	$610	$610	$610	$610
Shreveport City, LA								
Single Family	$231	$139	$139	$139	$139	$139	$139	$139
Multiple Family	$352	$212	$212	$212	$212	$212	$212	$212
Non-Residential	$526	$259	$259	$259	$259	$259	$259	$259
Cohasset Town, MA								
Single Family	$1,121	$554	$554	$554	$554	$554	$554	$554
Multiple Family	$695	$353	$353	$353	$353	$353	$353	$353
Non-Residential	$1,712	$643	$643	$643	$643	$643	$643	$643
Vassar City, MI								
Single Family	$258	$152	$152	$152	$152	$152	$152	$152
Multiple Family	$244	$152	$152	$152	$152	$152	$152	$152
Non-Residential	$698	$337	$337	$337	$337	$337	$337	$337
Petal City, MS								
Single Family	$237	$147	$147	$147	$147	$147	$147	$147
Multiple Family	$209	$142	$142	$142	$142	$142	$142	$142
Non-Residential	$826	$393	$393	$393	$393	$393	$393	$393
Scott County, MO								
Single Family	$281	$149	$149	$149	$149	$149	$149	$149
Multiple Family	$216	$130	$130	$130	$130	$130	$130	$130
Non-Residential	$950	$391	$391	$391	$391	$391	$391	$391
Omaha City, NE								
Single Family	$287	$183	$183	$183	$183	$183	$183	$183
Multiple Family	$573	$321	$321	$321	$321	$321	$321	$321
Non-Residential	$923	$361	$361	$361	$361	$361	$361	$361
Pender Village, NE								
Single Family	$473	$245	$245	$245	$245	$245	$245	$245
Multiple Family	$250	$153	$153	$153	$153	$153	$153	$153
Non-Residential	$796	$352	$352	$352	$352	$352	$352	$352
Woodstock Town, NH								
Single Family	$279	$156	$156	$156	$156	$156	$156	$156
Multiple Family	$420	$272	$272	$272	$272	$272	$272	$272
Non-Residential	$759	$333	$333	$333	$333	$333	$333	$333

Table 5.2 (Continued)

Average Annual Premium in 1997 Dollars per SFHA Property over the 1997-2022 Period
Properties At or Above the BFE, Sample Communities

Community	Baseline	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6	Scenario 7
Bloomingdale Borough, NJ								
Single Family	$521	$243	$243	$243	$243	$243	$243	$243
Multiple Family	$459	$228	$228	$228	$228	$228	$228	$228
Non-Residential	$671	$267	$267	$267	$267	$267	$267	$267
Lincoln Park Borough, NJ								
Single Family	$352	$285	$285	$285	$285	$285	$285	$285
Multiple Family	$309	$245	$245	$245	$245	$245	$245	$245
Non-Residential	$893	$581	$581	$581	$581	$581	$581	$581
Niagara Town, NY								
Single Family	$299	$149	$149	$149	$149	$149	$149	$149
Multiple Family	$221	$122	$122	$122	$122	$122	$122	$122
Non-Residential	$1,025	$299	$299	$299	$299	$299	$299	$299
Waterford Village, NY								
Single Family	$404	$233	$233	$233	$233	$233	$233	$233
Multiple Family	$308	$199	$199	$199	$199	$199	$199	$199
Non-Residential	$607	$285	$285	$285	$285	$285	$285	$285
Carteret County, NC								
Single Family	$334	$284	$284	$284	$284	$284	$284	$284
Multiple Family	$507	$415	$415	$415	$415	$415	$415	$415
Non-Residential	$764	$474	$474	$474	$474	$474	$474	$474
Edenton Town, NC								
Single Family	$666	$541	$541	$541	$541	$541	$541	$541
Multiple Family	$507	$376	$376	$376	$376	$376	$376	$376
Non-Residential	$978	$607	$607	$607	$607	$607	$607	$607
New Miami Village, OH								
Single Family	$422	$231	$231	$231	$231	$231	$231	$231
Multiple Family	$302	$172	$172	$172	$172	$172	$172	$172
Non-Residential	$965	$419	$419	$419	$419	$419	$419	$419
Washington County, OK								
Single Family	$320	$168	$168	$168	$168	$168	$168	$168
Multiple Family	$405	$230	$230	$230	$230	$230	$230	$230
Non-Residential	$1,067	$394	$394	$394	$394	$394	$394	$394
Lane County, OR								
Single Family	$379	$191	$191	$191	$191	$191	$191	$191
Multiple Family	$538	$253	$253	$253	$253	$253	$253	$253
Non-Residential	$1,166	$380	$380	$380	$380	$380	$380	$380
Vernonia City, OR								
Single Family	$324	$202	$202	$202	$202	$202	$202	$202
Multiple Family	$372	$229	$229	$229	$229	$229	$229	$229
Non-Residential	$778	$350	$350	$350	$350	$350	$350	$350
Franklin Township, PA								
Single Family	$356	$161	$161	$161	$161	$161	$161	$161
Multiple Family	$214	$131	$131	$131	$131	$131	$131	$131
Non-Residential	$1,218	$407	$407	$407	$407	$407	$407	$407
Glen Rock Borough, PA								
Single Family	$238	$151	$151	$151	$152	$151	$151	$151
Multiple Family	$189	$134	$134	$134	$133	$134	$134	$134
Non-Residential	$800	$334	$334	$334	$329	$334	$334	$334
Lower Mt. Bethel Township, PA								
Single Family	$306	$180	$180	$180	$180	$180	$180	$180
Multiple Family	$296	$189	$189	$189	$186	$189	$189	$189
Non-Residential	$643	$292	$292	$292	$289	$292	$292	$292

Table 5.2 (Continued)

Average Annual Premium in 1997 Dollars per SFHA Property over the 1997-2022 Period
Properties At or Above the BFE, Sample Communities

Community	Baseline	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6	Scenario 7
New Cumberland Borough, PA								
Single Family	$433	$231	$231	$231	$231	$231	$231	$231
Multiple Family	$295	$180	$180	$180	$180	$180	$180	$180
Non-Residential	$798	$333	$333	$333	$333	$333	$333	$333
Myrtle Beach City, SC								
Single Family	$352	$325	$325	$325	$325	$325	$325	$325
Multiple Family	$640	$594	$594	$594	$594	$594	$594	$594
Non-Residential	$819	$578	$578	$578	$578	$578	$578	$578
Lawrence County, SD								
Single Family	$321	$166	$166	$166	$166	$166	$166	$166
Multiple Family	$313	$167	$167	$167	$167	$167	$167	$167
Non-Residential	$1,017	$420	$420	$420	$420	$420	$420	$420
Brookside Village City, TX								
Single Family	$194	$157	$157	$157	$157	$157	$157	$157
Multiple Family	$255	$183	$183	$183	$183	$183	$183	$183
Non-Residential	$500	$318	$318	$318	$318	$318	$318	$318
Garland City, TX								
Single Family	$347	$267	$267	$267	$267	$267	$267	$267
Multiple Family	$307	$236	$236	$236	$236	$236	$236	$236
Non-Residential	$350	$231	$231	$231	$231	$231	$231	$231
League City, TX								
Single Family	$444	$351	$351	$351	$351	$351	$351	$351
Multiple Family	$542	$410	$410	$410	$410	$410	$410	$410
Non-Residential	$775	$467	$467	$467	$467	$467	$467	$467
Grundy Town, VA								
Single Family	$253	$149	$149	$149	$149	$149	$149	$149
Multiple Family	$185	$127	$127	$127	$127	$127	$127	$127
Non-Residential	$728	$328	$328	$328	$328	$328	$328	$328
Ephrata City, WA								
Single Family	$269	$153	$153	$153	$153	$153	$153	$153
Multiple Family	$198	$131	$131	$131	$131	$131	$131	$131
Non-Residential	$743	$312	$312	$312	$312	$312	$312	$312
Leavenworth City, WA								
Single Family	$208	$165	$165	$165	$165	$165	$165	$165
Multiple Family	$311	$185	$185	$185	$185	$185	$185	$185
Non-Residential	$683	$378	$378	$378	$378	$378	$378	$378
Marlinton Town, WV								
Single Family	$274	$192	$192	$192	$192	$192	$192	$192
Multiple Family	$201	$172	$172	$172	$172	$172	$172	$172
Non-Residential	$1,345	$710	$710	$710	$709	$710	$710	$710
Philippi City, WV								
Single Family	$209	$146	$146	$146	$146	$146	$146	$146
Multiple Family	$175	$133	$133	$133	$133	$133	$133	$133
Non-Residential	$596	$271	$271	$271	$271	$271	$271	$271
Wheeling City, WV								
Single Family	$200	$125	$125	$125	$125	$125	$125	$125
Multiple Family	$193	$131	$131	$131	$131	$131	$131	$131
Non-Residential	$505	$255	$255	$255	$255	$255	$255	$255

6. The Effects of Subsidy Elimination on Flood Insurance Program Participation

This section presents the estimates of the effects of the seven subsidy elimination scenarios on flood insurance participation rates for structures in the SFHA. It provides a brief overview of the approach for projecting insurance demand in the Insurance Demand Model (IDM). The model structure and the model assumptions are described in detail in Appendix B.

6.1 Overview of the Approach for Projecting Insurance Demand

The Insurance Demand Model (IDM) estimates the percentage of structures in the Special Flood Hazard Area (SFHA) which purchase flood insurance. These participation rates are estimated for each year of the study (1997 to 2022), for each of the 50 sample NFIP communities, and for each of the seven subsidy elimination scenarios. (See Section 5.1 for a detailed description of the scenarios.) The IDM begins with each community's recent (1996) participation rates and estimates future demand for flood insurance based upon several different factors. These factors include:

The price of flood insurance (i.e., the premium)
Federal regulations and their effectiveness
Flood events
Historical trends in policy purchases
The marketing of flood insurance

The IDM uses inputs from the Property Simulation Model (PSM) and the Premium Calculator, as well as recent NFIP participation rates. The PSM provides annual structure counts of both new and existing structures for each community with detail concerning structural characteristics. The Premium Calculator supplies premium information to the IDM for use in modeling the premium subsidy elimination scenarios. From these inputs, the IDM calculates participation rates under these scenarios and provides the output to the Property Valuation Model (PVM) which uses them as a factor in property value determination.

The IDM uses historical trends in policy purchases, the price of flood insurance premiums and assumptions regarding compliance to legislative measures to estimate flood insurance demand. Historically, structures in the SFHA have been underinsured relative to risks for floods. However, federal legislation on mandatory flood insurance purchase requirements (MPR) passed in 1973 and 1994 has aimed to clarify the responsibilities of lenders and broaden coverage to certain mortgage servicers or mortgage guarantors.

A key modeling assumption in estimating flood insurance demand is the price elasticity. The changes in participation rates in the NFIP under premium subsidy elimination are driven by the price elasticity assumptions. The price elasticities used in the study are based on data cited in a General Accounting Office study. Despite various efforts to obtain robust and detailed price elasticities, only the GAO study was identified, and this source did not fully address price elasticities under the conditions of large premium changes. Since this assumption is critical to estimating the demand for flood insurance under potential changes in the premium subsidy, new research in estimating the price elasticity for flood insurance is recommended, but was beyond the scope of this study.

6.2 Results

Figure 6.1 shows the estimated national participation rates for all structures in the SFHA and all pre-FIRM structures in the SFHA for the Baseline. The Baseline reflects the projected trend in participation rates with no changes in the flood insurance subsidies. The national participation rate for all structures in the SFHA in the Baseline grows from 28.1 percent in 1997 to 40.2 percent in 2022. The growth in policy contracts sold for these structures is fastest from 1998 to 2002, when the participation rate increases to 35.2 percent. After 2002, growth begins to slow and flattens out by 2017. The growth trend for pre-FIRM structures is similar, although the participation rates are generally one to two percent lower.

In terms of growth in the absolute number of flood insurance policy contracts in the SFHA, the contracts count increases from 1.87 million in 1997 to 3.49 million in 2022. The national participation rate for all pre-FIRM structures in the SFHA in the Baseline increases from 25.7 percent in 1997 to 37.9 percent in 2022; these participation rates reflect an increase of flood insurance policy contracts from 1.1 million in 1997 to 1.2 million contracts in 2022.

The growth in participation is attributable to various factors. Improved compliance with the Flood Disaster Protection Act of 1973 and the National Flood Insurance Reform Act of 1994 is a significant factor. These laws hold lenders (that are already subject to federal regulations)
accountable for making sure that any SFHA structure they finance has adequate flood insurance coverage during the term of the loan. As property ownership changes over time, borrowers are subject to the improved enforcement of the mandatory purchase requirements by lenders. The Federal Insurance Administration's marketing campaign Cover America has also helped in attracting new policyholders and increasing renewal rates. The campaign was designed to raise awareness of flood risks and provide information on how to purchase flood insurance.

In the Baseline, participation rates for the pre-FIRM structures that are at or above the BFE increase from 25.7 percent in 1997 to 30.1 percent in 2002. Thereafter, growth continues but at a slower rate, reaching 32.7 percent in 2022. Participation rates for pre-FIRM structures that are below the BFE increase significantly in the Baseline from 25.8 percent in 1997 to 37.4 percent by 2002 and reach 44.2 percent by 2022. Growth for these pre-FIRM structures is a function of increased MPR compliance by lenders. Since these structures are at greater risk than structures at or above the BFE, and have higher expected losses, lenders are likely to protect their investments by enforcing the MPR.

Figure 6.2 shows the IDM results for the Baseline and the seven scenarios for the national population of structures in the SFHA (including both pre-FIRM and post-FIRM structures). Figure 6.3 shows the comparable information for the national population of pre-FIRM structures in the SFHA. In both figures, the IDM projects a decline in flood insurance participation for Scenarios 1 through 7. The subsidy elimination effectively results in a change in a pre-FIRM
structure's premium, which could be an increase or a decrease. Within each community, pre-FIRM structures below the BFE have higher risks of flooding than similar structures at or above the BFE, and thus, their actuarial premiums are higher than their subsidized rates. This increase

Figure 6.1

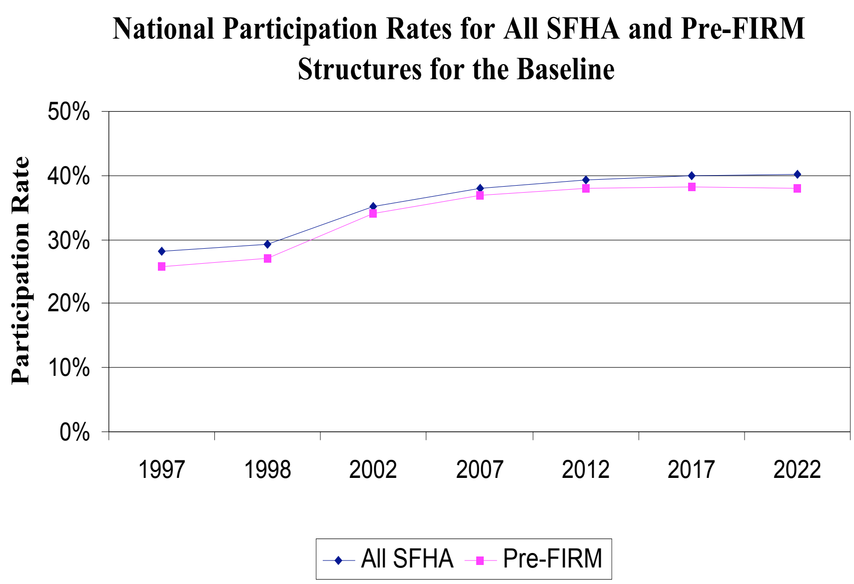


Figure 6.2

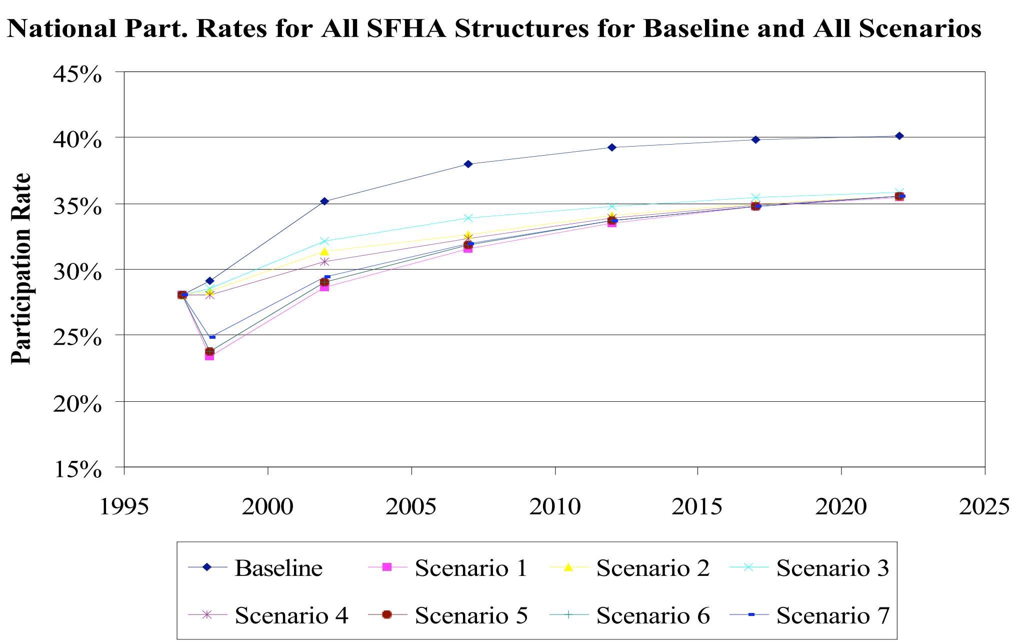
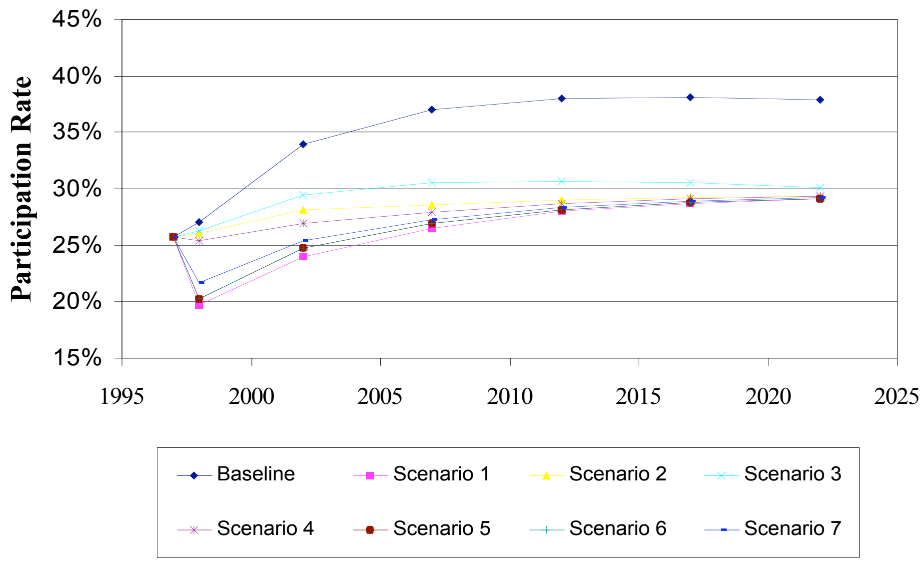


Figure 6.3

National Participation Rates for Pre-FIRM Structures for the Baseline and All Scenarios



from subsidized rates to actuarial rates can be quite significant. However, the actuarial rates for similar structures at or above the BFE are less than the subsidized rates, so these structures experience a decrease in premiums.

The IDM simulates the changes in insurance purchase behavior related to premium subsidy elimination by capturing the effect of price sensitivity to premium changes. If premiums increase, e.g., structures significantly below the BFE lose their subsidy and pay actuarial rates, then some structures that would have purchased insurance in the Baseline will now drop out of the NFIP. These structures will also be more resistant to complying to federal regulations than structures with lower premiums. Conversely, some structures who did not participate in the NFIP in the Baseline may participate under the different scenarios because their premiums decrease. This is true for SFHA properties at or above the BFE whose owners were not willing to pay subsidized rates and were unaware that they could qualify to pay lower actuarial rates. Under the scenarios, these owners are willing to pay the lower actuarial rates and will participate under the subsidy elimination scenarios. In both cases, the number of structures affected is contingent upon the magnitude of the premium change. A larger premium change will result in more structures being affected. Ultimately, under the subsidy elimination scenarios, structures with the highest risk of flood-related losses and expected losses (i.e., those that have large premium increases) will drop out, and structures with low risks of flood-related losses will participate in greater numbers relative to the Baseline.

Participation rates for the pre-FIRM structures drop significantly under the various policy scenarios, because these structures are directly affected by the subsidy elimination scenarios. (Post-FIRM structures are not subsidized; thus, there is no change in their participation rates between the Baseline and any of the subsidy elimination scenarios.) Participation rates drop because the impacts related to premium increases outweigh the impact of the increased participation among structures at or above the BFE.
In Scenario 1, the participation rates experience the largest decline relative to the other scenarios. (In Scenario 1, the premium subsidy is eliminated in full in 1998.) This is because the subsidy change is the most sudden and widespread in this scenario relative to other

scenarios. The national participation rate for all SFHA structures in Scenario 1 decreases from a 1997 rate to 23.3 percent in 1998 and then increases to 28.6 percent by 2002. This growth continues through 2022, where the participation rate reaches 35.5 percent in 2022. This is significantly less than the Baseline 2022 participation rate of 40.1 percent. The smaller growth is directly attributable to changes in participation of the national population of pre-FIRM structures in the SFHA.

In Scenario 1, the participation rate for pre-FIRM structures in the SFHA drops sharply from 25.7 percent in 1997 to 19.7 percent in 1998. The participation rate then increases to 24.0 percent by 2002 and continues to grow slowly through 2022, reaching 29.1 percent. This is significantly less than the Baseline rate of 37.9 percent reached in 2022. This change in percentage reflects the fact that approximately 280,000 flood insurance policy contracts would have been purchased in the Baseline in 2022 but would not be purchased under the Scenario 1 subsidy elimination.

Participation rates for pre-FIRM structures below the BFE drop in Scenario 1 from 25.8 percent in 1997 to 14.0 percent in 1998 reflecting the large premium increases for these structures. Beyond 1998, the participation rates increase to 18.5 percent in 2002 and to 24.3 percent by 2022. Participation for pre-FIRM structures that are at or above the BFE is slightly higher than the Baseline participation levels. For these structures participation increases from 25.7 percent in 1997 to 26.6 percent in 1998. By 2002, these structures have a participation rate of 30.5 percent, which then grows to 33.1 percent by 2022. (This 2022 level is slighter higher than the Baseline participation rate of 32.7 percent.)

The participation rates for Scenarios 2 through 7 show that the downward impact in participation is less than that of Scenario 1. Figures 6.2 and 6.3 also demonstrate that all of the participation rates for Scenarios 1 through 7 converge at a similar level in 2022. This suggests that all scenarios will achieve the similar end point over time in terms of participation by 2022. Despite this convergence, the number of structures in a given year that would have been insured in the Baseline but not under subsidy elimination varies by scenario. Figure 6.4 shows the number of flood insurance policy contracts that are purchased in the Baseline but are not purchased under subsidy elimination. The structures covered by these contracts reflect those which would likely not apply for disaster assistance in the Baseline if they were flooded because of their adequate flood insurance but would be likely to apply for disaster relief under the subsidy elimination scenarios if they were flooded.

Tables 6.1 through 6.10 show the sample community level results for participation rates for the different scenarios for the pre-FIRM structures. Table 6.1 shows the absolute net growth in
participation rates over the 25-year period for each community (i.e., participation rate for 2022 minus participation rate for 1997). The absolute net growth in participation rates for the national population of pre-FIRM structures for the Baseline is 12 percent; however at the community level, the range of net growth values spans from -8 percent in Myrtle Beach City, South Carolina to +36 percent in Franklin Township, Pennsylvania. In Scenario 1, the most severe of the subsidy elimination scenarios, net growth in the national pre-FIRM participation rates is 3 percent. This same definition of net growth at the community varies from -20 percent in Myrtle Beach City, South Carolina to +3 percent in New Miami Village, Ohio. These broad ranges
indicate a large amount of variability at the community level.

Data in Table 6.2 reflect the difference between the 2022 participation rate for each scenario and the 2022 participation rate for the Baseline. This information allows for comparing net growth relative to the Baseline across the scenarios. This difference can be calculated for the national level for pre-FIRM rates for Scenario 1 as follows:

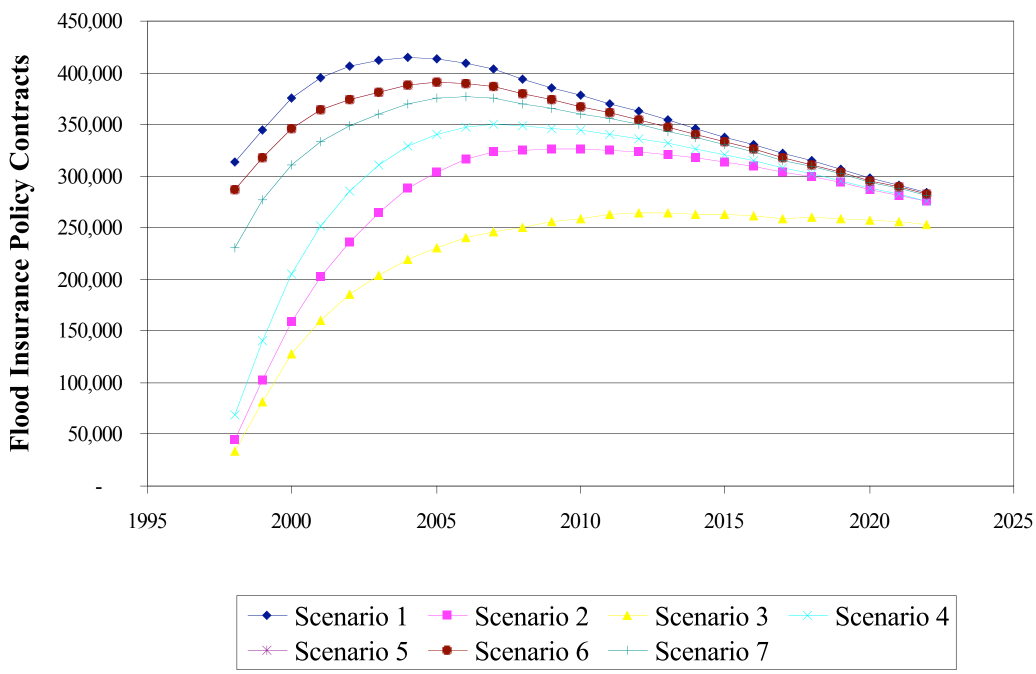
	Scenario 1 participation rate for 2022	29%
–	Baseline participation rate for 2022	38%
		-9%

At the community level, this difference varies from close to -38 percent to 0.4 percent for all scenarios except Scenario 4. In Scenario 4, this range is from -26 percent to 29 percent.

The communities that undergo the largest decreases in participation are those that have a significant number of structures with high premium increases. Structures below the BFE, in general, experience significant premium increases. The further below the BFE the greater the change between the subsidized rate and the actuarial rate, and thus the greater the premium increase under the subsidy elimination scenarios. Large premium increases will drive these structures out of the NFIP. These same structures will be resistant to compliance measures, so that they can avoid paying the large premium increases. Again, structures significantly below the BFE have flood risks greater than similar structures at or above the BFE, and since these structures will face significant premium increases, these structures with high flood risks

Figure 6.4

Policy Contracts Purchased in the Baseline but not Purchased Under Subsidy Elimination



will drop out of the NFIP under subsidy elimination.

The data for the difference between the Scenario 4 2022 participation rates and the Baseline 2022 participation rates, vary significantly from the other scenarios. (In Scenario 4, the subsidy

Tables 6.3 through 6.10 present more detailed information under the Baseline and the seven scenarios, including detail for select years between 1997 and 2022. Throughout all scenarios the communities that have the largest participation decreases are the same. The ten communities that consistently rank as having the largest participation drops relative to the Baseline include: Lincoln Park Borough, New Jersey; Brookside Village City, Texas; Wheeling City, West Virginia; Leavenworth City, Washington; Cohasset Town, Massachusetts; Louisville/Jefferson, Kentucky; Garland City, Texas; Philippi City, West Virginia; Santa Cruz City, California; and New Cumberland Borough, Pennsylvania.

Table 6.1
Change in NFIP Participation Rates for Pre-FIRM Properties from 1997 to 2022
Sample Communities

Community	Base-line	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6	Scenario 7
Phoenix City, AZ	13%	8%	9%	9%	29%	8%	8%	8%
Bay City, AR	26%	15%	15%	16%	35%	15%	15%	15%
Sacramento County, CA	19%	17%	17%	18%	39%	17%	17%	17%
Santa Cruz City, CA	22%	0%	0%	2%	15%	0%	0%	0%
Dolores Town, CO	23%	8%	9%	11%	26%	8%	8%	8%
Otero County, CO	30%	20%	21%	22%	41%	20%	20%	20%
Ft. Lauderdale City, FL	-2%	-2%	-2%	-2%	22%	-2%	-2%	-2%
New Smyrna Beach City, FL	16%	13%	13%	14%	33%	13%	13%	13%
St. Petersburg Beach City, FL	6%	-5%	-5%	-6%	10%	-5%	-5%	-5%
Hailey City, ID	5%	-1%	-1%	-1%	13%	-1%	-1%	-1%
Grundy County, IL	32%	14%	16%	18%	34%	15%	15%	15%
Council Bluffs City, IA	32%	21%	21%	22%	41%	21%	21%	21%
Augusta City, KY	19%	14%	14%	14%	35%	14%	14%	14%
Lewisport City, KY	24%	20%	20%	20%	40%	20%	20%	20%
Louisville/Jefferson, KY	25%	2%	3%	4%	21%	2%	2%	2%
Allen Parish, LA	31%	22%	23%	23%	42%	22%	22%	22%
Jefferson Parish, LA	-3%	-4%	-4%	-4%	15%	-4%	-4%	-4%
Shreveport City, LA	1%	1%	1%	1%	0%	1%	1%	1%
Cohasset Town, MA	33%	8%	9%	11%	26%	8%	8%	8%
Vassar City, MI	26%	21%	21%	22%	43%	21%	21%	21%
Petal City, MS	29%	21%	22%	22%	43%	21%	21%	21%
Scott County, MO	31%	26%	26%	26%	46%	26%	26%	26%
Omaha City, NE	31%	21%	21%	22%	42%	21%	21%	21%
Pender Village, NE	30%	15%	16%	18%	32%	15%	16%	16%
Woodstock Town, NH	22%	14%	15%	15%	36%	14%	14%	14%
Bloomingdale Borough, NJ	19%	11%	12%	13%	32%	12%	12%	12%
Lincoln Park Borough, NJ	25%	-14%	-14%	-13%	0%	-14%	-14%	-14%
Niagara Town, NY	31%	17%	17%	18%	38%	17%	17%	17%
Waterford Village, NY	29%	10%	11%	13%	28%	10%	10%	10%
Carteret County, NC	22%	18%	18%	19%	38%	18%	18%	18%
Edenton Town, NC	29%	19%	20%	23%	38%	19%	20%	20%
New Miami Village, OH	33%	29%	29%	29%	51%	29%	29%	29%
Washington County, OK	34%	24%	24%	25%	44%	24%	24%	24%
Lane County, OR	23%	20%	20%	20%	42%	20%	20%	20%
Vernonia City, OR	14%	1%	1%	2%	20%	1%	1%	1%
Franklin Township, PA	36%	22%	23%	24%	42%	22%	22%	22%
Glen Rock Borough, PA	4%	-8%	-8%	-8%	7%	-8%	-8%	-8%
Lower Mt. Bethel Township, PA	3%	-3%	-3%	-4%	8%	-3%	-3%	-3%
New Cumberland Borough, PA	17%	-2%	-1%	0%	17%	-2%	-2%	-2%
Myrtle Beach City, SC	-8%	-20%	-20%	-18%	-7%	-20%	-20%	-20%
Lawrence County, SD	24%	19%	19%	20%	40%	19%	19%	19%
Brookside Village City, TX	30%	-8%	-8%	-8%	3%	-8%	-8%	-8%
Garland City, TX	30%	7%	8%	12%	20%	7%	8%	8%
League City, TX	29%	13%	13%	15%	29%	13%	13%	13%
Grundy Town, VA	4%	-11%	-11%	-10%	9%	-11%	-11%	-11%
Ephrata City, WA	20%	7%	7%	9%	26%	7%	7%	7%
Leavenworth City, WA	30%	2%	2%	3%	15%	2%	2%	2%
Marlinton Town, WV	15%	-3%	-3%	-2%	15%	-3%	-3%	-3%
Philippi City, WV	18%	-5%	-4%	-3%	13%	-5%	-4%	-5%
Wheeling City, WV	24%	-11%	-7%	-2%	5%	-9%	-9%	-9%

Table 6.2

NFIP Participation Rates for Scenario for 2022 Minus Baseline Rate for 2022 Pre-FIRM Properties for Sample Communities

Community	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6	Scenario 7
Phoenix City, AZ	-5%	-5%	-4%	15%	-5%	-5%	-5%
Bay City, AR	-11%	-11%	-10%	9%	-11%	-11%	-11%
Sacramento County, CA	-1%	-1%	-1%	21%	-1%	-1%	-1%
Santa Cruz City, CA	-22%	-22%	-20%	-6%	-22%	-22%	-22%
Dolores Town, CO	-15%	-15%	-13%	2%	-15%	-15%	-15%
Otero County, CO	-10%	-9%	-9%	11%	-10%	-10%	-10%
Ft. Lauderdale City, FL	-1%	-1%	0%	23%	-1%	-1%	-1%
New Smyrna Beach City, FL	-3%	-3%	-2%	17%	-3%	-3%	-3%
St. Petersburg Beach City, FL	-11%	-11%	-11%	4%	-11%	-11%	-11%
Hailey City, ID	-6%	-6%	-6%	7%	-6%	-6%	-6%
Grundy County, IL	-18%	-16%	-14%	2%	-17%	-17%	-17%
Council Bluffs City, IA	-11%	-11%	-10%	9%	-11%	-11%	-11%
Augusta City, KY	-5%	-5%	-5%	16%	-5%	-5%	-5%
Lewisport City, KY	-4%	-4%	-4%	16%	-4%	-4%	-4%
Louisville/Jefferson, KY	-23%	-22%	-21%	-4%	-23%	-23%	-23%
Allen Parish, LA	-9%	-9%	-8%	10%	-9%	-9%	-9%
Jefferson Parish, LA	-1%	-1%	-1%	17%	-1%	-1%	-1%
Shreveport City, LA	0%	0%	0%	-1%	0%	0%	0%
Cohasset Town, MA	-25%	-23%	-21%	-6%	-25%	-25%	-25%
Vassar City, MI	-6%	-5%	-5%	17%	-5%	-5%	-5%
Petal City, MS	-8%	-7%	-6%	14%	-7%	-7%	-7%
Scott County, MO	-5%	-5%	-5%	15%	-5%	-5%	-5%
Omaha City, NE	-10%	-10%	-10%	11%	-10%	-10%	-10%
Pender Village, NE	-14%	-13%	-11%	2%	-14%	-14%	-14%
Woodstock Town, NH	-8%	-7%	-7%	14%	-8%	-8%	-8%
Bloomingdale Borough, NJ	-8%	-7%	-6%	13%	-8%	-8%	-8%
Lincoln Park Borough, NJ	-40%	-39%	-38%	-25%	-40%	-40%	-40%
Niagara Town, NY	-13%	-13%	-13%	8%	-13%	-13%	-13%
Waterford Village, NY	-18%	-18%	-16%	-1%	-18%	-18%	-18%
Carteret County, NC	-5%	-4%	-3%	16%	-4%	-4%	-4%
Edenton Town, NC	-9%	-8%	-6%	9%	-9%	-9%	-9%
New Miami Village, OH	-4%	-4%	-4%	17%	-4%	-4%	-4%
Washington County, OK	-10%	-10%	-9%	10%	-10%	-10%	-10%
Lane County, OR	-3%	-3%	-3%	19%	-3%	-3%	-3%
Vernonia City, OR	-14%	-13%	-12%	5%	-14%	-14%	-14%
Franklin Township, PA	-14%	-13%	-11%	6%	-13%	-13%	-14%
Glen Rock Borough, PA	-11%	-11%	-12%	3%	-11%	-11%	-11%
Lower Mt. Bethel Township, PA	-6%	-6%	-7%	5%	-6%	-6%	-6%
New Cumberland Borough, PA	-19%	-19%	-17%	0%	-19%	-19%	-19%
Myrtle Beach City, SC	-12%	-12%	-10%	1%	-12%	-12%	-12%
Lawrence County, SD	-5%	-5%	-5%	16%	-5%	-5%	-5%
Brookside Village City, TX	-38%	-38%	-38%	-26%	-38%	-38%	-38%
Garland City, TX	-23%	-22%	-19%	-10%	-23%	-22%	-23%
League City, TX	-16%	-15%	-13%	1%	-16%	-16%	-16%
Grundy Town, VA	-16%	-15%	-14%	5%	-15%	-15%	-15%
Ephrata City, WA	-13%	-12%	-11%	7%	-12%	-12%	-12%
Leavenworth City, WA	-28%	-27%	-26%	-15%	-28%	-28%	-28%
Marlinton Town, WV	-18%	-18%	-17%	0%	-18%	-18%	-18%
Philippi City, WV	-23%	-22%	-21%	-5%	-22%	-22%	-22%
Wheeling City, WV	-36%	-31%	-26%	-19%	-33%	-33%	-33%

Table 6.3

Annual NFIP Participation Rates for Pre-FIRM Properties over the 1997-2022 Period for Sample Communities for the Baseline and Total for All NFIP Study Communities

Community	1997	1998	2002	2007	2012	2017	2022
All NFIP Study Communities	26%	27%	34%	37%	38%	38%	38%
Phoenix City, AZ	25%	27%	35%	39%	39%	39%	39%
Bay City, AR	14%	18%	31%	37%	39%	40%	40%
Sacramento County, CA	14%	17%	28%	32%	32%	32%	32%
Santa Cruz City, CA	21%	25%	38%	43%	44%	43%	43%
Dolores Town, CO	16%	19%	31%	37%	39%	40%	40%
Otero County, CO	10%	13%	27%	34%	37%	39%	40%
Ft. Lauderdale City, FL	33%	32%	33%	33%	33%	32%	32%
New Smyrna Beach City, FL	17%	19%	28%	31%	33%	33%	33%
St. Petersburg Beach City, FL	84%	83%	84%	85%	88%	90%	90%
Hailey City, ID	30%	29%	33%	35%	36%	36%	35%
Grundy County, IL	11%	16%	33%	41%	43%	43%	43%
Council Bluffs City, IA	23%	27%	45%	52%	53%	55%	54%
Augusta City, KY	21%	22%	30%	35%	38%	39%	40%
Lewisport City, KY	16%	19%	31%	37%	39%	40%	40%
Louisville/Jefferson, KY	23%	26%	41%	47%	49%	49%	48%
Allen Parish, LA	7%	10%	22%	30%	34%	36%	38%
Jefferson Parish, LA	49%	48%	49%	48%	47%	46%	46%
Shreveport City, LA	98%	98%	99%	99%	99%	99%	99%
Cohasset Town, MA	16%	21%	39%	47%	48%	49%	48%
Vassar City, MI	15%	18%	31%	37%	40%	41%	41%
Petal City, MS	10%	14%	26%	34%	37%	38%	39%
Scott County, MO	9%	13%	28%	36%	39%	40%	40%
Omaha City, NE	13%	18%	36%	44%	45%	45%	45%
Pender Village, NE	13%	15%	27%	34%	38%	41%	42%
Woodstock Town, NH	20%	22%	33%	39%	41%	41%	42%
Bloomingdale Borough, NJ	24%	26%	36%	41%	42%	43%	43%
Lincoln Park Borough, NJ	31%	36%	54%	59%	59%	58%	57%
Niagara Town, NY	14%	18%	34%	41%	43%	44%	44%
Waterford Village, NY	18%	22%	39%	46%	47%	47%	46%
Carteret County, NC	13%	15%	26%	31%	33%	34%	35%
Edenton Town, NC	7%	10%	23%	30%	33%	35%	35%
New Miami Village, OH	7%	12%	30%	37%	39%	40%	40%
Washington County, OK	6%	11%	27%	35%	38%	39%	40%
Lane County, OR	12%	16%	29%	34%	35%	35%	35%
Vernonia City, OR	27%	28%	36%	40%	41%	41%	41%
Franklin Township, PA	6%	11%	28%	37%	40%	41%	42%
Glen Rock Borough, PA	82%	76%	77%	78%	79%	79%	85%
Lower Mt. Bethel Township, PA	81%	73%	76%	79%	82%	82%	84%
New Cumberland Borough, PA	28%	30%	41%	45%	47%	46%	45%
Myrtle Beach City, SC	51%	48%	45%	44%	43%	43%	43%
Lawrence County, SD	14%	17%	29%	35%	38%	38%	39%
Brookside Village City, TX	23%	28%	46%	53%	54%	55%	53%
Garland City, TX	13%	17%	34%	41%	43%	43%	43%
League City, TX	13%	16%	30%	38%	40%	41%	41%
Grundy Town, VA	39%	37%	40%	42%	42%	43%	44%
Ephrata City, WA	21%	23%	33%	38%	40%	40%	40%
Leavenworth City, WA	17%	20%	37%	46%	47%	47%	47%
Marlinton Town, WV	33%	34%	40%	45%	47%	48%	48%
Philippi City, WV	37%	38%	48%	53%	54%	55%	54%
Wheeling City, WV	30%	33%	46%	53%	55%	55%	54%

Table 6.4

Annual NFIP Participation Rates for Pre-FIRM Properties over the 1997-2022 Period for Sample Communities for Scenario 1 and Total for All NFIP Study Communities

Community	1997	1998	2002	2007	2012	2017	2022
All NFIP Study Communities	26%	20%	24%	26%	28%	29%	29%
Phoenix City, AZ	25%	25%	31%	33%	34%	34%	33%
Bay City, AR	14%	14%	21%	26%	27%	28%	29%
Sacramento County, CA	14%	17%	27%	30%	30%	31%	31%
Santa Cruz City, CA	21%	14%	17%	18%	20%	20%	21%
Dolores Town, CO	16%	14%	19%	22%	23%	24%	25%
Otero County, CO	10%	11%	19%	24%	27%	29%	30%
Ft. Lauderdale City, FL	33%	31%	32%	32%	32%	32%	31%
New Smyrna Beach City, FL	17%	18%	25%	28%	30%	30%	31%
St. Petersburg Beach City, FL	84%	32%	54%	64%	75%	78%	79%
Hailey City, ID	30%	25%	27%	29%	29%	29%	29%
Grundy County, IL	11%	10%	17%	21%	23%	25%	26%
Council Bluffs City, IA	23%	20%	32%	39%	41%	43%	43%
Augusta City, KY	21%	20%	26%	30%	32%	34%	35%
Lewisport City, KY	16%	17%	27%	32%	34%	36%	36%
Louisville/Jefferson, KY	23%	14%	17%	19%	21%	23%	24%
Allen Parish, LA	7%	8%	16%	22%	25%	27%	29%
Jefferson Parish, LA	49%	47%	47%	46%	45%	45%	45%
Shreveport City, LA	98%	94%	98%	99%	99%	99%	98%
Cohasset Town, MA	16%	11%	16%	20%	22%	22%	23%
Vassar City, MI	15%	17%	26%	32%	34%	35%	36%
Petal City, MS	10%	12%	20%	26%	28%	30%	31%
Scott County, MO	9%	12%	24%	30%	33%	34%	35%
Omaha City, NE	13%	14%	26%	32%	34%	34%	34%
Pender Village, NE	13%	11%	16%	21%	24%	26%	28%
Woodstock Town, NH	20%	19%	27%	31%	32%	33%	34%
Bloomingdale Borough, NJ	24%	23%	30%	33%	34%	35%	35%
Lincoln Park Borough, NJ	31%	9%	11%	13%	14%	16%	17%
Niagara Town, NY	14%	12%	21%	26%	28%	30%	31%
Waterford Village, NY	18%	15%	21%	24%	26%	27%	28%
Carteret County, NC	13%	14%	22%	26%	28%	29%	30%
Edenton Town, NC	7%	9%	17%	21%	24%	25%	26%
New Miami Village, OH	7%	11%	26%	32%	35%	35%	36%
Washington County, OK	6%	8%	19%	25%	28%	29%	30%
Lane County, OR	12%	16%	26%	30%	31%	32%	32%
Vernonia City, OR	27%	21%	24%	26%	26%	27%	27%
Franklin Township, PA	6%	7%	15%	21%	25%	27%	28%
Glen Rock Borough, PA	82%	46%	48%	55%	60%	63%	74%
Lower Mt. Bethel Township, PA	81%	59%	62%	68%	73%	74%	78%
New Cumberland Borough, PA	28%	19%	21%	23%	24%	25%	26%
Myrtle Beach City, SC	51%	36%	32%	30%	30%	30%	31%
Lawrence County, SD	14%	16%	25%	30%	32%	33%	34%
Brookside Village City, TX	23%	7%	8%	10%	11%	13%	15%
Garland City, TX	13%	10%	15%	17%	18%	19%	20%
League City, TX	13%	11%	17%	21%	23%	25%	25%
Grundy Town, VA	39%	26%	24%	25%	26%	27%	28%
Ephrata City, WA	21%	18%	22%	25%	26%	27%	28%
Leavenworth City, WA	17%	10%	14%	16%	17%	19%	19%
Marlinton Town, WV	33%	21%	22%	26%	28%	29%	30%
Philippi City, WV	37%	21%	24%	27%	29%	30%	32%
Wheeling City, WV	30%	11%	12%	14%	14%	17%	19%

Table 6.5

Annual NFIP Participation Rates for Pre-FIRM Properties over the 1997-2022 Period for Sample Communities for Scenario 2 and Total for All NFIP Study Communities

Community	1997	1998	2002	2007	2012	2017	2022
All NFIP Study Communities	26%	26%	28%	29%	29%	29%	29%
Phoenix City, AZ	25%	27%	33%	36%	35%	34%	34%
Bay City, AR	14%	17%	25%	28%	28%	29%	29%
Sacramento County, CA	14%	18%	28%	31%	31%	31%	31%
Santa Cruz City, CA	21%	22%	25%	24%	22%	22%	21%
Dolores Town, CO	16%	19%	25%	26%	25%	25%	25%
Otero County, CO	10%	13%	22%	27%	28%	30%	31%
Ft. Lauderdale City, FL	33%	32%	32%	32%	32%	32%	31%
New Smyrna Beach City, FL	17%	19%	26%	30%	30%	31%	31%
St. Petersburg Beach City, FL	84%	79%	70%	62%	75%	78%	79%
Hailey City, ID	30%	29%	30%	30%	30%	30%	29%
Grundy County, IL	11%	14%	23%	27%	26%	27%	27%
Council Bluffs City, IA	23%	26%	37%	42%	42%	43%	44%
Augusta City, KY	21%	23%	28%	32%	33%	34%	35%
Lewisport City, KY	16%	19%	29%	33%	35%	36%	36%
Louisville/Jefferson, KY	23%	24%	26%	24%	24%	25%	25%
Allen Parish, LA	7%	9%	18%	23%	26%	28%	29%
Jefferson Parish, LA	49%	48%	48%	47%	45%	45%	45%
Shreveport City, LA	98%	97%	98%	98%	99%	99%	98%
Cohasset Town, MA	16%	18%	23%	25%	25%	25%	25%
Vassar City, MI	15%	18%	28%	33%	35%	36%	36%
Petal City, MS	10%	13%	23%	28%	30%	31%	32%
Scott County, MO	9%	13%	26%	32%	34%	35%	35%
Omaha City, NE	13%	18%	29%	33%	34%	35%	35%
Pender Village, NE	13%	15%	20%	24%	26%	28%	29%
Woodstock Town, NH	20%	22%	30%	33%	34%	34%	34%
Bloomingdale Borough, NJ	24%	26%	33%	36%	36%	36%	36%
Lincoln Park Borough, NJ	31%	30%	24%	19%	17%	17%	17%
Niagara Town, NY	14%	16%	24%	28%	29%	30%	31%
Waterford Village, NY	18%	20%	28%	30%	29%	29%	29%
Carteret County, NC	13%	15%	24%	29%	29%	30%	30%
Edenton Town, NC	7%	10%	20%	26%	27%	27%	27%
New Miami Village, OH	7%	12%	28%	34%	35%	35%	36%
Washington County, OK	6%	10%	22%	27%	29%	30%	30%
Lane County, OR	12%	17%	27%	31%	32%	32%	32%
Vernonia City, OR	27%	28%	30%	30%	28%	28%	28%
Franklin Township, PA	6%	9%	20%	26%	27%	28%	29%
Glen Rock Borough, PA	82%	73%	61%	57%	61%	64%	74%
Lower Mt. Bethel Township, PA	81%	72%	69%	69%	73%	75%	78%
New Cumberland Borough, PA	28%	28%	28%	27%	26%	26%	26%
Myrtle Beach City, SC	51%	48%	39%	34%	31%	31%	32%
Lawrence County, SD	14%	18%	27%	31%	33%	33%	34%
Brookside Village City, TX	23%	22%	17%	12%	12%	13%	15%
Garland City, TX	13%	15%	23%	25%	22%	21%	21%
League City, TX	13%	15%	22%	25%	25%	26%	26%
Grundy Town, VA	39%	37%	31%	28%	28%	28%	28%
Ephrata City, WA	21%	22%	27%	29%	28%	28%	28%
Leavenworth City, WA	17%	18%	21%	20%	19%	19%	19%
Marlinton Town, WV	33%	32%	30%	29%	29%	29%	30%
Philippi City, WV	37%	35%	34%	32%	31%	31%	32%
Wheeling City, WV	30%	30%	29%	27%	24%	23%	23%

Table 6.6
Annual NFIP Participation Rates for Pre-FIRM Properties over the 1997-2022 Period for Sample Communities for Scenario 3 and Total for All NFIP Study Communities

Community	1997	1998	2002	2007	2012	2017	2022
All NFIP Study Communities	26%	26%	29%	31%	31%	31%	30%
Phoenix City, AZ	25%	27%	34%	37%	37%	36%	34%
Bay City, AR	14%	17%	26%	30%	31%	31%	30%
Sacramento County, CA	14%	18%	28%	32%	32%	32%	31%
Santa Cruz City, CA	21%	23%	27%	28%	27%	26%	23%
Dolores Town, CO	16%	19%	26%	29%	29%	29%	27%
Otero County, CO	10%	13%	23%	28%	30%	31%	31%
Ft. Lauderdale City, FL	33%	32%	32%	32%	32%	32%	31%
New Smyrna Beach City, FL	17%	19%	27%	30%	32%	32%	31%
St. Petersburg Beach City, FL	84%	81%	77%	73%	75%	75%	78%
Hailey City, ID	30%	29%	31%	32%	31%	31%	29%
Grundy County, IL	11%	15%	25%	29%	30%	30%	29%
Council Bluffs City, IA	23%	26%	39%	44%	44%	45%	44%
Augusta City, KY	21%	23%	29%	33%	34%	35%	35%
Lewisport City, KY	16%	19%	29%	34%	36%	37%	36%
Louisville/Jefferson, KY	23%	24%	28%	29%	29%	27%	27%
Allen Parish, LA	7%	9%	18%	25%	28%	29%	30%
Jefferson Parish, LA	49%	48%	48%	47%	46%	46%	45%
Shreveport City, LA	98%	97%	99%	99%	99%	98%	98%
Cohasset Town, MA	16%	18%	25%	28%	28%	28%	27%
Vassar City, MI	15%	18%	28%	34%	36%	37%	37%
Petal City, MS	10%	13%	24%	29%	31%	32%	32%
Scott County, MO	9%	13%	26%	33%	35%	36%	36%
Omaha City, NE	13%	18%	30%	35%	36%	36%	35%
Pender Village, NE	13%	15%	22%	26%	29%	30%	31%
Woodstock Town, NH	20%	22%	30%	34%	35%	36%	35%
Bloomingdale Borough, NJ	24%	26%	33%	37%	38%	37%	37%
Lincoln Park Borough, NJ	31%	31%	29%	26%	21%	19%	19%
Niagara Town, NY	14%	17%	26%	29%	30%	31%	32%
Waterford Village, NY	18%	21%	30%	33%	33%	32%	30%
Carteret County, NC	13%	15%	24%	29%	31%	32%	31%
Edenton Town, NC	7%	10%	21%	27%	30%	31%	30%
New Miami Village, OH	7%	12%	28%	35%	36%	36%	36%
Washington County, OK	6%	10%	22%	29%	31%	31%	31%
Lane County, OR	12%	17%	28%	32%	33%	33%	33%
Vernonia City, OR	27%	28%	31%	32%	32%	31%	29%
Franklin Township, PA	6%	10%	21%	27%	29%	31%	31%
Glen Rock Borough, PA	82%	75%	68%	64%	62%	63%	73%
Lower Mt. Bethel Township, PA	81%	73%	72%	73%	74%	74%	78%
New Cumberland Borough, PA	28%	29%	31%	31%	29%	29%	28%
Myrtle Beach City, SC	51%	48%	41%	36%	34%	34%	33%
Lawrence County, SD	14%	18%	27%	32%	34%	34%	34%
Brookside Village City, TX	23%	23%	23%	18%	15%	14%	15%
Garland City, TX	13%	15%	24%	28%	28%	27%	24%
League City, TX	13%	15%	23%	27%	29%	29%	28%
Grundy Town, VA	39%	37%	34%	31%	30%	30%	29%
Ephrata City, WA	21%	23%	28%	31%	31%	31%	29%
Leavenworth City, WA	17%	18%	24%	25%	23%	22%	21%
Marlinton Town, WV	33%	32%	32%	33%	32%	32%	31%
Philippi City, WV	37%	36%	37%	37%	34%	34%	33%
Wheeling City, WV	30%	31%	33%	33%	32%	31%	28%

Table 6.7
Annual NFIP Participation Rates for Pre-FIRM Properties over the 1997-2022 Period for Sample Communities for Scenario 4 and Total for All NFIP Study Communities

Community	1997	1998	2002	2007	2012	2017	2022
All NFIP Study Communities	26%	25%	27%	28%	29%	29%	29%
Phoenix City, AZ	25%	26%	38%	46%	51%	53%	54%
Bay City, AR	14%	15%	27%	37%	43%	46%	48%
Sacramento County, CA	14%	17%	35%	46%	50%	52%	53%
Santa Cruz City, CA	20%	20%	24%	27%	31%	34%	36%
Dolores Town, CO	16%	16%	24%	31%	36%	39%	42%
Otero County, CO	10%	12%	24%	35%	42%	47%	51%
Ft. Lauderdale City, FL	33%	31%	41%	49%	52%	54%	55%
New Smyrna Beach City, FL	17%	18%	31%	41%	46%	49%	51%
St. Petersburg Beach City, FL	80%	75%	74%	78%	88%	89%	89%
Hailey City, ID	30%	27%	33%	40%	42%	43%	43%
Grundy County, IL	11%	12%	22%	31%	37%	41%	44%
Council Bluffs City, IA	22%	24%	38%	50%	55%	60%	63%
Augusta City, KY	21%	21%	32%	42%	49%	53%	56%
Lewisport City, KY	16%	18%	32%	44%	50%	54%	56%
Louisville/Jefferson, KY	21%	21%	26%	30%	35%	39%	43%
Allen Parish, LA	6%	8%	20%	31%	39%	44%	48%
Jefferson Parish, LA	49%	46%	51%	55%	58%	61%	63%
Shreveport City, LA	97%	92%	97%	97%	97%	97%	97%
Cohasset Town, MA	15%	16%	23%	30%	35%	38%	41%
Vassar City, MI	15%	17%	32%	43%	51%	55%	58%
Petal City, MS	10%	12%	26%	37%	45%	50%	53%
Scott County, MO	9%	12%	29%	42%	49%	53%	55%
Omaha City, NE	13%	16%	32%	44%	50%	53%	55%
Pender Village, NE	12%	13%	21%	28%	34%	40%	44%
Woodstock Town, NH	19%	21%	33%	43%	49%	52%	55%
Bloomingdale Borough, NJ	23%	24%	36%	45%	50%	53%	56%
Lincoln Park Borough, NJ	29%	27%	24%	23%	23%	26%	29%
Niagara Town, NY	13%	15%	28%	38%	44%	48%	51%
Waterford Village, NY	17%	18%	27%	33%	39%	42%	45%
Carteret County, NC	12%	14%	27%	38%	44%	48%	50%
Edenton Town, NC	7%	9%	21%	31%	37%	42%	45%
New Miami Village, OH	7%	11%	32%	46%	52%	55%	57%
Washington County, OK	6%	9%	24%	36%	43%	47%	50%
Lane County, OR	12%	15%	33%	44%	50%	53%	54%
Vernonia City, OR	26%	26%	31%	37%	41%	44%	46%
Franklin Township, PA	6%	8%	20%	31%	39%	44%	48%
Glen Rock Borough, PA	79%	71%	66%	71%	75%	77%	86%
Lower Mt. Bethel Township, PA	80%	70%	72%	79%	84%	85%	88%
New Cumberland Borough, PA	27%	26%	30%	34%	37%	40%	44%
Myrtle Beach City, SC	50%	44%	39%	37%	38%	41%	43%
Lawrence County, SD	14%	16%	31%	42%	49%	52%	54%
Brookside Village City, TX	21%	19%	17%	16%	17%	20%	24%
Garland City, TX	12%	12%	19%	24%	27%	29%	32%
League City, TX	12%	13%	21%	29%	35%	39%	41%
Grundy Town, VA	39%	35%	35%	37%	41%	45%	47%
Ephrata City, WA	20%	20%	28%	36%	41%	44%	47%
Leavenworth City, WA	16%	14%	20%	23%	26%	29%	31%
Marlinton Town, WV	32%	31%	32%	37%	42%	45%	47%
Philippi City, WV	36%	34%	36%	39%	42%	44%	49%
Wheeling City, WV	29%	28%	25%	25%	25%	29%	34%

Table 6.8
Annual NFIP Participation Rates for Pre-FIRM Properties over the 1997-2022 Period for Sample Communities for Scenario 5 and Total for All NFIP Study Communities

Community	1997	1998	2002	2007	2012	2017	2022
All NFIP Study Communities	26%	20%	25%	27%	28%	29%	29%
Phoenix City, AZ	25%	26%	31%	34%	34%	34%	33%
Bay City, AR	14%	14%	22%	26%	27%	28%	29%
Sacramento County, CA	14%	17%	28%	31%	31%	31%	31%
Santa Cruz City, CA	21%	15%	19%	20%	21%	21%	21%
Dolores Town, CO	16%	15%	19%	22%	23%	24%	25%
Otero County, CO	10%	12%	20%	25%	27%	29%	30%
Ft. Lauderdale City, FL	33%	31%	32%	32%	32%	32%	31%
New Smyrna Beach City, FL	17%	18%	26%	29%	30%	31%	31%
St. Petersburg Beach City, FL	84%	34%	54%	64%	75%	78%	79%
Hailey City, ID	30%	25%	27%	29%	29%	29%	29%
Grundy County, IL	11%	10%	20%	23%	24%	25%	26%
Council Bluffs City, IA	23%	22%	35%	40%	41%	43%	43%
Augusta City, KY	21%	21%	26%	30%	32%	34%	35%
Lewisport City, KY	16%	18%	27%	32%	34%	36%	36%
Louisville/Jefferson, KY	23%	16%	19%	21%	22%	23%	24%
Allen Parish, LA	7%	9%	16%	22%	25%	27%	29%
Jefferson Parish, LA	49%	47%	47%	46%	45%	45%	45%
Shreveport City, LA	98%	94%	98%	99%	99%	99%	98%
Cohasset Town, MA	16%	11%	16%	20%	22%	22%	23%
Vassar City, MI	15%	18%	27%	32%	34%	35%	36%
Petal City, MS	10%	13%	22%	27%	29%	30%	31%
Scott County, MO	9%	13%	24%	31%	33%	34%	35%
Omaha City, NE	13%	15%	26%	32%	34%	34%	34%
Pender Village, NE	13%	11%	16%	21%	24%	26%	28%
Woodstock Town, NH	20%	21%	28%	32%	33%	33%	34%
Bloomingdale Borough, NJ	24%	24%	31%	34%	35%	35%	35%
Lincoln Park Borough, NJ	31%	9%	11%	13%	14%	16%	17%
Niagara Town, NY	14%	13%	22%	27%	29%	30%	31%
Waterford Village, NY	18%	16%	24%	26%	28%	28%	28%
Carteret County, NC	13%	14%	23%	27%	28%	29%	30%
Edenton Town, NC	7%	9%	17%	21%	24%	25%	26%
New Miami Village, OH	7%	12%	26%	33%	35%	35%	36%
Washington County, OK	6%	9%	19%	25%	28%	29%	30%
Lane County, OR	12%	16%	26%	30%	31%	32%	32%
Vernonia City, OR	27%	22%	24%	26%	27%	27%	28%
Franklin Township, PA	6%	7%	18%	23%	26%	27%	29%
Glen Rock Borough, PA	82%	51%	49%	56%	60%	63%	74%
Lower Mt. Bethel Township, PA	81%	62%	63%	68%	73%	75%	78%
New Cumberland Borough, PA	28%	20%	24%	24%	25%	25%	26%
Myrtle Beach City, SC	51%	38%	34%	31%	30%	31%	31%
Lawrence County, SD	14%	17%	25%	30%	32%	33%	34%
Brookside Village City, TX	23%	9%	9%	10%	11%	13%	15%
Garland City, TX	13%	10%	15%	17%	18%	19%	20%
League City, TX	13%	11%	19%	22%	24%	25%	26%
Grundy Town, VA	39%	28%	26%	26%	27%	28%	28%
Ephrata City, WA	21%	21%	25%	26%	27%	27%	28%

Leavenworth City, WA	17%	12%	16%	17%	18%	19%	19%
Marlinton Town, WV	33%	24%	23%	26%	28%	29%	30%
Philippi City, WV	37%	23%	26%	28%	29%	30%	32%
Wheeling City, WV	30%	21%	21%	20%	19%	20%	21%

Table 6.9
Annual NFIP Participation Rates for Pre-FIRM Properties over the 1997-2022 Period for Sample Communities for Scenario 6 and Total for All NFIP Study Communities

Community	1997	1998	2002	2007	2012	2017	2022
All NFIP Study Communities	26%	20%	25%	27%	28%	29%	29%
Phoenix City, AZ	25%	27%	32%	34%	34%	34%	34%
Bay City, AR	14%	16%	23%	27%	28%	29%	29%
Sacramento County, CA	14%	18%	28%	30%	31%	31%	31%
Santa Cruz City, CA	21%	20%	21%	21%	21%	21%	21%
Dolores Town, CO	16%	17%	22%	23%	24%	24%	25%
Otero County, CO	10%	13%	21%	26%	28%	29%	30%
Ft. Lauderdale City, FL	33%	32%	32%	32%	32%	32%	31%
New Smyrna Beach City, FL	17%	19%	26%	29%	30%	31%	31%
St. Petersburg Beach City, FL	84%	63%	57%	65%	75%	78%	79%
Hailey City, ID	30%	27%	28%	29%	29%	29%	29%
Grundy County, IL	11%	12%	20%	24%	25%	26%	26%
Council Bluffs City, IA	23%	24%	35%	40%	42%	43%	43%
Augusta City, KY	21%	22%	27%	31%	32%	34%	35%
Lewisport City, KY	16%	19%	28%	33%	35%	36%	36%
Louisville/Jefferson, KY	23%	18%	21%	21%	22%	24%	25%
Allen Parish, LA	7%	9%	17%	22%	25%	28%	29%
Jefferson Parish, LA	49%	48%	47%	46%	45%	45%	45%
Shreveport City, LA	98%	96%	98%	99%	99%	99%	98%
Cohasset Town, MA	16%	13%	19%	21%	23%	23%	24%
Vassar City, MI	15%	18%	27%	32%	34%	35%	36%
Petal City, MS	10%	13%	22%	27%	29%	30%	31%
Scott County, MO	9%	13%	25%	31%	33%	35%	35%
Omaha City, NE	13%	17%	27%	32%	34%	34%	34%
Pender Village, NE	13%	13%	18%	22%	25%	27%	28%
Woodstock Town, NH	20%	22%	29%	32%	33%	34%	34%
Bloomingdale Borough, NJ	24%	25%	32%	34%	35%	35%	35%
Lincoln Park Borough, NJ	31%	17%	15%	16%	15%	16%	17%
Niagara Town, NY	14%	15%	22%	27%	29%	30%	31%
Waterford Village, NY	18%	19%	25%	27%	28%	28%	28%
Carteret County, NC	13%	15%	23%	27%	28%	29%	30%
Edenton Town, NC	7%	10%	20%	24%	25%	26%	27%
New Miami Village, OH	7%	12%	27%	33%	35%	35%	36%
Washington County, OK	6%	10%	20%	26%	28%	29%	30%
Lane County, OR	12%	16%	27%	31%	31%	32%	32%
Vernonia City, OR	27%	26%	27%	27%	27%	28%	28%
Franklin Township, PA	6%	9%	18%	23%	26%	28%	29%
Glen Rock Borough, PA	82%	68%	51%	57%	61%	64%	74%
Lower Mt. Bethel Township, PA	81%	69%	64%	69%	73%	75%	78%
New Cumberland Borough, PA	28%	24%	24%	25%	25%	26%	26%
Myrtle Beach City, SC	51%	44%	35%	31%	30%	31%	31%
Lawrence County, SD	14%	17%	26%	30%	32%	33%	34%
Brookside Village City, TX	23%	19%	11%	10%	12%	13%	15%

Garland City, TX	13%	14%	20%	20%	20%	20%	20%
League City, TX	13%	13%	20%	23%	24%	25%	26%
Grundy Town, VA	39%	33%	26%	26%	27%	28%	28%
Ephrata City, WA	21%	22%	25%	26%	27%	27%	28%
Leavenworth City, WA	17%	17%	17%	18%	18%	19%	19%
Marlinton Town, WV	33%	30%	25%	27%	28%	29%	30%
Philippi City, WV	37%	32%	27%	29%	30%	31%	32%
Wheeling City, WV	30%	27%	22%	21%	19%	20%	21%

Table 6.10
Annual NFIP Participation Rates for Pre-FIRM Properties over the 1997-2022 Period for Sample Communities for Scenario 7 and Total for All NFIP Study Communities

Community	1997	1998	2002	2007	2012	2017	2022
All NFIP Study Communities	26%	22%	25%	27%	28%	29%	29%
Phoenix City, AZ	25%	26%	33%	34%	34%	34%	34%
Bay City, AR	14%	16%	23%	27%	28%	29%	29%
Sacramento County, CA	14%	18%	28%	30%	31%	31%	31%
Santa Cruz City, CA	21%	18%	21%	20%	21%	21%	21%
Dolores Town, CO	16%	17%	22%	23%	24%	24%	25%
Otero County, CO	10%	12%	21%	26%	28%	29%	30%
Ft. Lauderdale City, FL	33%	31%	32%	32%	32%	32%	31%
New Smyrna Beach City, FL	17%	19%	26%	29%	30%	31%	31%
St. Petersburg Beach City, FL	84%	42%	54%	64%	75%	78%	79%
Hailey City, ID	30%	27%	28%	29%	29%	29%	29%
Grundy County, IL	11%	11%	20%	23%	24%	25%	26%
Council Bluffs City, IA	23%	23%	35%	40%	41%	43%	43%
Augusta City, KY	21%	22%	27%	31%	32%	34%	35%
Lewisport City, KY	16%	19%	28%	32%	35%	36%	36%
Louisville/Jefferson, KY	23%	17%	20%	21%	22%	23%	24%
Allen Parish, LA	7%	9%	17%	22%	25%	28%	29%
Jefferson Parish, LA	49%	48%	47%	46%	45%	45%	45%
Shreveport City, LA	98%	95%	98%	99%	99%	99%	98%
Cohasset Town, MA	16%	11%	18%	21%	23%	23%	24%
Vassar City, MI	15%	18%	27%	32%	34%	35%	36%
Petal City, MS	10%	13%	22%	27%	29%	30%	31%
Scott County, MO	9%	13%	25%	31%	33%	35%	35%
Omaha City, NE	13%	15%	27%	32%	34%	34%	34%
Pender Village, NE	13%	13%	18%	22%	25%	27%	28%
Woodstock Town, NH	20%	22%	28%	32%	33%	34%	34%
Bloomingdale Borough, NJ	24%	24%	31%	34%	35%	35%	35%
Lincoln Park Borough, NJ	31%	13%	13%	14%	14%	16%	17%
Niagara Town, NY	14%	16%	22%	27%	29%	30%	31%
Waterford Village, NY	18%	17%	25%	26%	27%	28%	28%
Carteret County, NC	13%	15%	23%	27%	28%	29%	30%
Edenton Town, NC	7%	9%	20%	23%	25%	26%	27%
New Miami Village, OH	7%	12%	27%	33%	35%	35%	36%
Washington County, OK	6%	9%	20%	25%	28%	29%	30%
Lane County, OR	12%	16%	27%	31%	31%	32%	32%
Vernonia City, OR	27%	25%	27%	27%	27%	28%	28%
Franklin Township, PA	6%	8%	18%	23%	26%	27%	29%
Glen Rock Borough, PA	82%	58%	50%	56%	60%	64%	74%
Lower Mt. Bethel Township, PA	81%	65%	64%	69%	73%	75%	78%

New Cumberland Borough, PA	28%	21%	24%	25%	25%	25%	26%
Myrtle Beach City, SC	51%	41%	35%	31%	30%	31%	31%
Lawrence County, SD	14%	17%	26%	30%	32%	33%	34%
Brookside Village City, TX	23%	9%	9%	10%	11%	13%	15%
Garland City, TX	13%	12%	19%	20%	19%	19%	20%
League City, TX	13%	12%	20%	23%	24%	25%	26%
Grundy Town, VA	39%	32%	26%	26%	27%	28%	28%
Ephrata City, WA	21%	21%	25%	26%	27%	27%	28%
Leavenworth City, WA	17%	14%	16%	17%	18%	19%	19%
Marlinton Town, WV	33%	26%	25%	27%	28%	29%	30%
Philippi City, WV	37%	30%	27%	29%	29%	31%	32%
Wheeling City, WV	30%	26%	22%	20%	19%	20%	21%

7. The Number of Pre-FIRM and Post-FIRM Properties

This section presents estimates of the number of pre- and post-FIRM properties for each of the sample communities. It provides an overview of the approach for projecting the number of properties and the results of the projection. A more detailed description of the sources and methods used to develop estimates and projections of pre-FIRM and post-FIRM properties is presented in Appendix C.

7.1 Overview of the Approach for Estimating the Number of Pre-FIRM and Post-FIRM Properties

The Property Simulation Model (PSM) is designed to evaluate how changes in the stock of residential and non-residential structures will affect the universe of properties eligible for subsidized flood insurance. The PSM begins with the current universe of residential and non-residential properties in Special Flood Hazard Areas (SFHAs) and uses projections of future property removal rates, property growth rates, flood frequency rates, acquisition rates, flood damage rates, and flood mitigation fund allocations to project the universe of properties 25 years into the future.

Conceptually, the PSM is a cell-based simulation model in which housing is treated as a standard capital good, subject to depreciation, maintenance, and replacement. The model is “cell-based” in the sense that rather than modeling events for individual structures, the PSM groups structures into mutually exclusive categories or “cells” which are defined by specific structural attributes such as type of unit, age of structure, FIRM classification, and flood zone where the structure is located. The cells are detailed enough to recognize the diversity of structural characteristics across the sampled NFIP communities and throughout the nation’s SFHAs, while general enough to facilitate efficient development of the model.

For the universe of properties within the SFHAs of the 50 sampled NFIP communities, the PSM projects annual changes in the stock of residential and non-residential structures over the 25-year period from 1997 to 2022. In every year of the model simulation, a sequence of events affects the count of structures in a particular structure category.

In any given year, an individual structure may either (1) remain in the same category, (2) be relocated to a different category, or (3) be removed entirely from the stock of structures in that SFHA. Each of the 50 sampled NFIP communities is modeled individually to track changes in the stock and composition of pre-FIRM and post-FIRM structures.

The life cycle of structures will directly influence estimates of current and future properties eligible for subsidized insurance, since the starting point for the PSM will be the current universe of pre-FIRM and post-FIRM properties. As these properties age, depreciation will occur, and an increasing number of structures will be voluntarily removed, reconstructed, or damaged/destroyed by natural events. In this way, through the PSM, the analysis of properties eligible for subsidized flood insurance will directly incorporate the life cycle of structures.

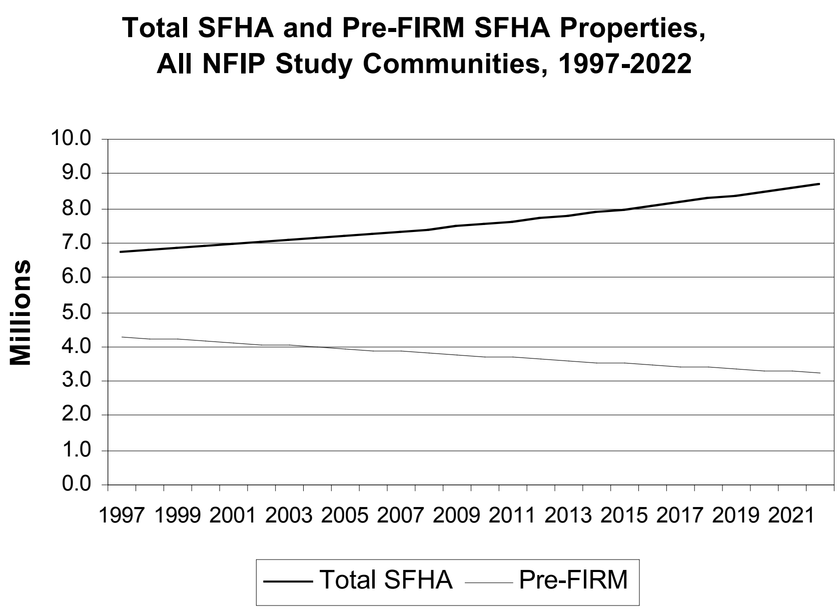
The PSM provides necessary inputs to both the Insurance Demand Model (IDM) and Property Valuation Model (PVM). The PSM also receives information from the PVM; the rate of deterioration and removal from the stock of structures will be influenced by annual changes in property values as determined by the PVM. By direct linkage to the PVM, the PSM captures changes in property values in determining natural removal rates for structures.

In the PSM, these removal rates are estimated separately for each type of event in each of the sampled NFIP community SFHAs.

7.2 National Level Results

Figure 7.1 summarizes results from the property projections at the national level for the Baseline scenario. Since the property projections for the seven policy scenarios are very similar to those in the Baseline, these data are not shown in Figure 7.1.

Figure 7.1



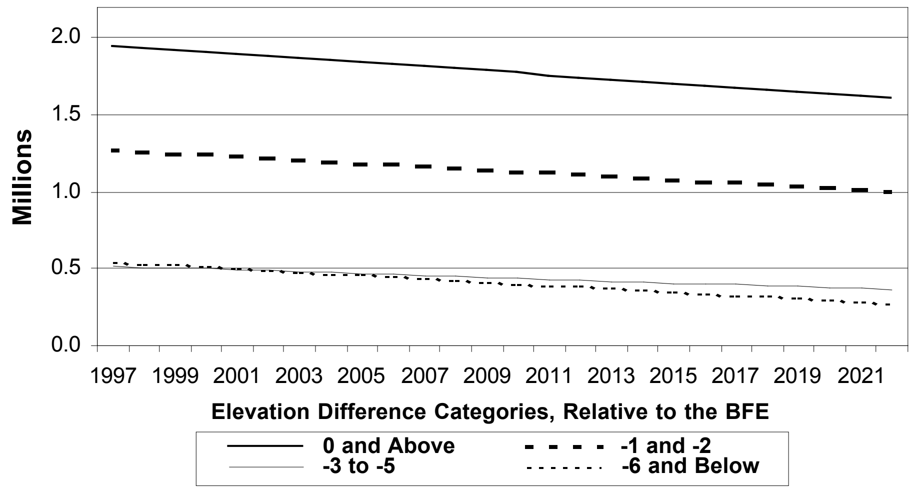
Over the 1997 to 2022 period, the number of total SFHA structures increases from 6.6 million in 1997 to 8.7 million in 2022, an annual average increase of about one percent. The number of pre-FIRM structures declines from about 4.3 million in 1997 to about 3.2 million in 2022, an annual average decline of about one percent. Pre-FIRM properties therefore decrease from 64 percent of all SFHA properties in 1997 to 37 percent of all SFHA properties by 2022.

While the total number of pre-FIRM SFHA structures estimated nationally in this study is projected to decline by about one percent a year over the 1997 to 2022 period, rates of pre-FIRM structure attrition vary considerably by the flood risk. Since federal, state, and local flood mitigation programs target those structures with the greatest flood risks, pre-FIRM structures exposed to relatively high flood risk will undergo more rapid attrition than less flood prone pre-FIRM structures. For this study, pre-FIRM SFHA properties were classified according to one of four levels of flood risk as determined by the structure's elevation difference: 0 and above (at or above the BFE); -1 and -2 (one to two feet below the BFE); -3, -4, and -5 (three to five feet below the BFE); and -6 and below (six or more feet below the BFE).

Figure 7.2 summarizes results from the property projections at the national level for the Baseline scenario for the four elevation difference categories. Since the property projections for the seven policy scenarios are very similar to those in the Baseline, these data are not shown in Figure 7.2.

Figure 7.2

Pre-FIRM SFHA Properties by Elevation Difference Category All NFIP Study Communities, 1997-2022



Over the 1997 to 2022 period, the number of pre-FIRM SFHA structures at or above the BFE is likely to decrease from about 1.9 million structures to about 1.6 million structures, a total decline of about 17 percent over this period. For similar structures one to two feet below the BFE, the number of structures is likely to decline from about 1.3 million in 1997 to about 1.0 million in 2022, a total decrease of about 21 percent. Similarly, for structures three to five feet below the BFE, the number of structures is likely to decline from about 520,000 in 1998 to about 370,000 in 2022, a total decline of about 29 percent. Finally, for pre-FIRM SFHA structures six feet or more below the BFE, the number of structures is likely to decline from about 550,000 structures in 1997 to about 270,000 in 2022, a total decline of about 50 percent.

7.3 Community Level Results

Table 7.1 below summarizes results from the PSM. For each of the 50 sample communities, the table presents the number of pre-FIRM and post-FIRM properties, the percent of all SFHA properties which are pre-FIRM, and the portion of pre-FIRM properties which are non-residential. These summary results are presented for the first and last years of the 25-year model period.
Note that the community level structure counts presented in the table are estimates based on 1990 decennial Census data and a GIS-based determination of the land area within each NFIP community's SFHA. While considerable effort was undertaken to assure the reliability and accuracy of these structure count estimates, they are subject to measurement error. A precise inventory of SFHA structures would have been possible only through conducting elevation surveys for every structure in each NFIP community to determine its exact location relative to the community's SFHA, an approach that would have been prohibitively expensive and beyond the scope of this study.

7.1.1 7.3.1 Pre-FIRM Properties

The summary model results in Table 7.1 show that the stock of pre-FIRM properties in most of the 50 sample communities declines at an annual average rate between one and two percent from 1997 to 2022. On average, the stock of pre-FIRM properties for the sample communities declines at a rate of about 1.1 percent per year, although there is considerable variation in rates of attrition. Among the 50 sample communities, annual average rates of attrition range from 4.5 percent a year in Leavenworth City, Washington, to slightly less than one percent per year in New Smyrna Beach City, Florida, St. Petersburg Beach City, Florida, and New Miami Village, Ohio. In Leavenworth City, Washington, the relatively large percentage drop in pre-FIRM properties is a decline which is very small in magnitude, from 25 properties in 1997 to 8 properties in 2022.

In the PSM in general, rates of pre-FIRM attrition are a function of the relative concentration of structures with substantial flood risk and local area housing market conditions. All other things being equal, communities with relatively high concentrations of structures with substantial flood risk (such as structures six feet or more below the BFE) will experience a relatively rapid attrition of pre-FIRM structures as the most the flood prone structures are effectively elevated or removed by flood or non-flood events at higher rates than those of less flood prone structures.

The link between local area housing market conditions and pre-FIRM property attrition is more complex than the link between flood risk and pre-FIRM property attrition. On the one hand, communities with relatively strong housing markets will tend to elevate or replace structures affected by flood related events. On the other hand, however, in communities with relatively strong housing markets, there is increased incentive for homeowners to maintain structures and less of a likelihood of abandonment for older (pre-FIRM) structures. Taken together, the combined net effects of increased flood-related pre-FIRM attrition but decreased non-flood related pre-FIRM attrition may result in either faster or slower overall attrition of pre-FIRM structures in this type of communities. Among the 50 sample communities, communities with relatively strong housing markets tend to experience lower attrition of pre-FIRM structures than those in weaker markets. In general, the communities which experience the fastest attrition of pre-FIRM structures in the PSM are communities such as Niagara Town, New York, Lower Mt. Bethel Township, Pennsylvania, and Grundy Town, Virginia, with both a relatively high concentration of substantial flood risk structures and relatively weak housing markets. Conversely, the communities with the slowest attrition of pre-FIRM structures are communities such as Phoenix City, Arizona, Sacramento County, California, and Ft. Lauderdale City, Florida, with relatively low concentrations of substantial flood risk structures and relatively strong housing markets.

Table 7.1
Pre-FIRM and Post-FIRM Properties in 1997 and 2022 for Sample Communities

	Pre-FIRM Properties			Post-FIRM Properties			Percent Of Properties That Are Pre-FIRM		Percent of Pre-FIRM Properties That Are Non-Residential	
Community	1997	2022	Avg. Annual Growth	1997	2022	Avg. Annual Growth	1997	2022	1997	2022
All NFIP Study Communities	4,294,673	6,577,979	-1.1%	2,283,306	5,453,195	3.5%	64%	37%	6%	6%
Phoenix City, AZ	17,190	13,458	-1.0%	12,616	34,577	4.1%	58%	28%	5%	6%
Bay City, AR	864	607	-1.4%	242	770	4.7%	78%	44%	11%	11%
Sacramento County, CA	12,465	9,625	-1.0%	9,837	14,656	1.6%	56%	40%	6%	6%

Santa Cruz City, CA	2,918	2,229	-1.1%	577	1,009	2.3%	83%	69%	6%	6%
Dolores Town, CO	387	284	-1.2%	114	479	5.9%	77%	37%	11%	12%
Otero County, CO	1,216	906	-1.2%	273	492	2.4%	82%	65%	11%	11%
Ft. Lauderdale City, FL	39,942	31,219	-1.0%	21,301	54,003	3.8%	65%	37%	6%	6%
New Smyrna Beach City, FL	3,956	3,154	-0.9%	3,019	5,975	2.8%	57%	35%	6%	6%
St. Petersburg Beach City, FL	3,790	3,047	-0.9%	819	1,515	2.5%	82%	67%	5%	5%
Hailey City, ID	125	75	-2.0%	146	352	3.6%	46%	18%	10%	11%
Grundy County, IL	1,273	838	-1.7%	368	756	2.9%	78%	53%	6%	6%
Council Bluffs City, IA	4,433	3,179	-1.3%	1,151	1,452	0.9%	79%	69%	6%	6%
Augusta City, KY	438	300	-1.5%	83	256	4.6%	84%	54%	13%	14%
Lewisport City, KY	357	271	-1.1%	81	323	5.7%	82%	46%	10%	11%
Louisville/Jefferson, KY	3,397	2,477	-1.3%	789	1,148	1.5%	81%	68%	5%	5%
Allen Parish, LA	2,625	1,857	-1.4%	593	1,684	4.3%	82%	52%	12%	13%
Jefferson Parish, LA	56,411	43,852	-1.0%	27,001	55,243	2.9%	68%	44%	6%	6%
Shreveport City, LA	3,054	2,225	-1.3%	1,185	4,042	5.0%	72%	36%	6%	6%
Cohasset Town, MA	482	345	-1.3%	80	160	2.8%	86%	68%	5%	5%
Vassar City, MI	343	257	-1.1%	156	273	2.3%	69%	48%	13%	13%
Petal City, MS	2,104	1,539	-1.2%	845	1,869	3.2%	71%	45%	6%	6%
Scott County, MO	2,648	1,886	-1.3%	682	1,339	2.7%	80%	58%	11%	11%
Omaha City, NE	3,599	2,518	-1.4%	2,299	3,796	2.0%	61%	40%	5%	5%
Pender Village, NE	340	256	-1.1%	75	98	1.1%	82%	72%	11%	11%
Woodstock Town, NH	217	166	-1.1%	67	291	6.1%	76%	36%	10%	9%
Bloomingdale Borough, NJ	321	241	-1.2%	77	110	1.5%	81%	69%	5%	5%
Lincoln Park Borough, NJ	2,458	1,622	-1.6%	1,821	2,607	1.4%	57%	38%	5%	5%
Niagara Town, NY	265	157	-2.1%	83	101	0.8%	76%	61%	5%	5%
Waterford Village, NY	675	521	-1.0%	182	513	4.2%	79%	50%	6%	6%
Carteret County, NC	9,363	6,916	-1.2%	10,533	31,364	4.5%	47%	18%	13%	14%
Edenton Town, NC	793	564	-1.4%	467	928	2.8%	63%	38%	11%	11%
New Miami Village, OH	2,341	1,849	-0.9%	812	1,904	3.5%	74%	49%	6%	6%
Washington County, OK	2,301	1,678	-1.3%	255	673	4.0%	90%	71%	11%	11%
Lane County, OR	8,271	6,208	-1.1%	1,936	4,062	3.0%	81%	60%	6%	6%
Vernonia City, OR	317	236	-1.2%	177	335	2.6%	64%	41%	8%	9%
Franklin Township, PA	1,962	1,412	-1.3%	235	446	2.6%	89%	76%	7%	7%
Glen Rock Borough, PA	48	27	-2.3%	16	21	1.1%	75%	56%	0%	0%
Lower Mt. Bethel Township, PA	52	26	-2.7%	38	48	0.9%	58%	35%	0%	0%
New Cumberland Borough, PA	280	192	-1.5%	83	171	2.9%	77%	53%	5%	5%
Myrtle Beach City, SC	542	350	-1.7%	1,006	4,512	6.2%	35%	7%	4%	4%
Lawrence County, SD	308	231	-1.1%	55	248	6.2%	85%	48%	10%	10%
Brookside Village City, TX	369	237	-1.8%	163	381	3.5%	69%	38%	5%	6%
Garland City, TX	3,219	2,513	-1.0%	3,980	5,669	1.4%	45%	31%	5%	5%

Table 7.1 (continued)
Pre-FIRM and Post-FIRM Properties in 1997 and 2022 for Sample Communities

	Pre-FIRM Properties			Post-FIRM Properties			Percent Of Properties That Are Pre-FIRM		Percent of Pre-FIRM Properties That Are Non-Residential	
Community	1997	2022	Avg. Annual Growth	1997	2022	Avg. Annual Growth	1997	2022	1997	2022
League City, TX	1,578	1,218	-1.0%	889	2,053	3.4%	64%	37%	6%	6%
Grundy Town, VA	167	95	-2.2%	73	82	0.5%	70%	54%	10%	12%
Ephrata City, WA	897	683	-1.1%	192	806	5.9%	82%	46%	11%	11%
Leavenworth City, WA	25	8	-4.5%	38	60	1.8%	40%	12%	0%	0%
Marlinton Town, WV	904	674	-1.2%	231	849	5.4%	80%	44%	11%	12%
Philippi City, WV	306	201	-1.7%	78	154	2.8%	80%	57%	12%	13%
Wheeling City, WV	4,144	2,837	-1.5%	821	1,053	1.0%	83%	73%	5%	5%

7.1.2 7.3.2 Post-FIRM Properties

Summary model data in Table 7.1 show that the stock of post-FIRM properties in most of the 50 sample communities increases at an annual average rate between one and six percent from 1997 to 2022. On average, the stock of post-FIRM properties for the sample communities increases at a rate of about 3.3 percent per year, although there is considerable variation in rates of annual average growth. Among the 50 sample communities, annual average rates of growth range from 6.2 percent a year in Myrtle Beach City, South Carolina to 0.5 percent in Grundy Town, Virginia. In general, the growth in post-FIRM properties is primarily a function of the projected population and household growth, with communities with the most rapid projected population and household growth experiencing the fastest growth in post-FIRM properties.

From the 1997 estimates and 1998 and later year projections of pre-FIRM and post-FIRM properties, the percentage of properties that are pre-FIRM can be computed as presented in Table 7.1. In general, the decline in the share of pre-FIRM properties from 1997 to 2022 reflects both the differential rates of attrition of pre-FIRM properties as well as differential rates of growth in post-FIRM properties. For all of the 50 communities taken together, the percent of pre-FIRM properties declines from 66 percent to 39 percent over the 1997 to 2022 period.

The last two columns in Table 7.1 show the proportion of pre-FIRM properties that are non-residential. For the 50 communities taken together, about six percent of pre-FIRM properties are non-residential, a percentage that does not significantly change throughout the 1997 to 2022 period. While the proportion of non-residential to total properties ranges from 14 percent in Augusta City, Kentucky to zero percent in Glen Rock Borough, Pennsylvania, Lower Mt. Bethel Township, Pennsylvania, and Leavenworth City, Washington, there appears to be no particular pattern to the relative concentrations of non-residential properties in the 50 sample communities.

8. The Effects of Subsidy Elimination on Property Values and Property Taxes

This section presents the Property Valuation Model's (PVM) estimates of the effects of the seven subsidy elimination scenarios on the property values and property taxes for each of the 50 sample NFIP communities. It contains: (1) an overview of the approach for valuing properties when the subsidy is eliminated; (2) a discussion of the methods for estimating Baseline property values; (3) a discussion of the method for projecting property taxes; and (4) the projected property value and property tax changes for each scenario and each community. The PVM model structure and the model assumptions are described in detail in Appendix D.

8.1 Overview of the Property Valuation Approach

The PVM is designed to assess the effect of eliminating the flood insurance subsidy on property values and property taxes for residential and non-residential structures in the Special Flood Hazard Areas (SFHAs). The PVM begins with current estimates of property values for the structures in the SFHA and uses each of the seven subsidy elimination scenarios to estimate how changes in the subsidy will effect property values and property taxes.

The PVM projects annually, for the universe of properties within the SFHAs of the 50 sampled NFIP communities, changes in property values and property taxes over the 25 year period from 1997 to 2022. Each of the 50 sampled NFIP communities is modeled individually to track these changes. These community level results are then weighted to national levels to reflect property value changes for all NFIP study communities.

The PVM relies on premium rates provided by the Premium Calculator, an inventory of structures provided by the Property Simulation Model (PSM), and insurance program participation rates provided by the Insurance Demand Model (IDM). The property values for a given sample community are directly affected by those structures participating in the flood insurance program, the magnitude of the premium change, and the timing with which the insurance subsidy is eliminated within a community. The PSM's estimates of the current and future inventory of pre-FIRM and post-FIRM structures are used in calculating the total change in property values for all pre-FIRM structures in each sample community and the total change in property taxes for each sample community. In turn, the PVM provides the PSM with changes in the current value of structures in the community in order to adjust rates of property growth and removal in each community.

8.2 Methods for Estimating Baseline Property Values

8.2.1 Background

The average property values were estimated for all 50 sample NFIP communities using data collected in the elevation survey of 7,628 structures in 23 sample communities. (See Section 2 for more information on the elevation surveys.) Within each community, average property values were estimated at the cell level, where each cell is defined as a combination of seven characteristics:

Occupancy	Floors	Basement	Flood Zone

Single family detached	One floor	Basement	A Zone
Multiple family attached	Two floors	No basement	V Zone
Condominium	No floors indicated		
Manufactured housing			
Non-residential			

Elevation Difference	Age	FIRM Status
0 and above	0-19 years	Pre-FIRM
-1, -2, -3	20-50 years	Post-FIRM
-4 and below	51 or more years	

For example, one cell in a community contains all structures that are single family detached, two floors, basement, A Zone, 0 and above elevation, 20-50 years old, and pre-FIRM.

There were three challenges in estimating property values:

1. The year built, and hence the age and FIRM Status characteristics, were unknown for 5,235 of the 7,628 surveyed structures.
2. For the 23 surveyed communities, not all cells were represented by surveyed structures.
3. No survey data were available for the remaining 27 communities.

Each of these challenges was addressed using statistical techniques explained in detail below.

8.2.2 Approach

In order to use all of the surveyed structures for estimating property values and premium changes, it was necessary to first impute the age and FIRM Status for structures that were missing this information. Then these property values, along with Census and the Census Public Use Microdata Sample (PUMS) property value data, were used to estimate the average property value in each community and cell.

1. Estimating the Year Built and Age of Surveyed Structures

Discriminant analysis was used to estimate the age of the surveyed structures that were missing age data by using the known property value of the structure and PUMS data about average property values in the community. Structures missing age data were classified into either the 20-50 years old category or the over 50 years old category. Nearly 70 percent of structures that were missing age data were located within a handful of communities. The survey teams reported that the structures surveyed in these communities appeared to be built in the late 1950's, the 1960's, and the early 1970's. Hence, the less than 20 years old age category was not used in the discriminant analysis. For this same reason, all structures with missing age data were classified as pre-FIRM.

The PUMS data provide average property values for structures by occupancy, floors, age, and FIRM status. However, the geographic coverage of the PUMS data do not identically match the FEMA community definition; the PUMS geographic coverage usually encompasses a larger area. Also, the PUMS data do not contain property value information by basement, flood zone, or elevation difference. For each permutation of the combination of sample community, occupancy type and floor category, an average PUMS property value was computed by taking a weighted average across the age and FIRM status categories. This average was used in the discriminant analysis. Each surveyed structure was assigned an average PUMS property value based on the community in which it resided, and by its occupancy type and number of floors.

In addition, property values were known for nearly all of the 7,628 surveyed structures.

The discriminant analysis compared the known property value to the PUMS average property value and classifies the structure into one of the age categories. Using the 2,330 surveyed structures where the age was known, a discriminant function was computed. The discriminant function was a linear (or quadratic) function of the known property value and the PUMS property data. For each of the 2,330 structures, if the value of the discriminant function was above a cut-off point, the structure was classified in the 20-50 years old category. If the discriminant function was below the cut-off point, the structure was classified in the over 50 age category. The cut-off point was chosen to minimize the misclassification of age. A discriminant analysis was performed separately for each of the five occupancy categories.

For each of the 5,235 surveyed structures that were missing age data, the structure's known property value and PUMS average property value were put into the discriminant function, compared against the cut-off point, and then the structure was classified into one of the two age categories. Ultimately, 4,863 of these structures were classified, resulting in a total of 7,193 structures that could be used to estimate average property values and evaluate premium changes.

8.2.3 Estimating the Impact on Property Value Attributable to the Community and Each of the Seven Characteristics

Analysis of variance (ANOVA) was used to estimate the impact on property value attributable to the community and each of the seven characteristics. This technique was chosen because not every cell combination was surveyed in each community. For example, single family detached structures surveyed in community A may all have had basements. In this case, the effect on property values reflecting the absence of a basement cannot be determined. However, structures without basements in communities B, C, and D were surveyed, and this information was used to estimate the impact of not having a basement on property values in community A.

The single family detached category was further divided into two categories— a category for one floor and another category for two floors. For each community and cell, the average property value of the surveyed structures was computed. Since a multiplicative model was used, the natural logarithm of the average property value was taken. Then, for each of the six occupancy categories, a regression model was estimated. The form of the regression model was:

$$\log(\textit{average property value}) = \quad + \alpha_{community} + \beta_{Basement} + \delta_{Elevation\,Difference} + \gamma_{Age} + \phi_{FIRM} + \quad \lambda_{Zone}$$

Not all of the 23 communities were represented for each occupancy type. For example, multiple family attached structures were surveyed in only 15 of the communities. For each of these 15 communities, the average property value in each cell was estimated using the results of the regression. However, for the other eight communities, the average property values could not be estimated.

8.2.4 Estimating a Property Value Level for Each Community Not Surveyed

While the ANOVA could not provide average property values if the community was not surveyed, Census and PUMS property values were available for all communities. Census data were available for residential and non-residential structures matching the geographic boundaries of the FEMA community. However, Census data were not detailed by occupancy, basement, or any of the other cell characteristics. Conversely, PUMS data did not match the geographic boundaries, but contained pertinent detailed for occupancy, floors, age, and FIRM status.

A factor analysis was used to explore the relation between Census and PUMS data. These two data sets were highly correlated with one another, meaning that nearly all of the variability in the two data sets could be explained by one factor that is equal to the average of the Census and PUMS data. For each occupancy type, a factor was computed for each community.

Clustering was used to group communities with similar property values. At least one of the surveyed communities was included in a cluster. The clustering was performed based on factor equal to the average of the Census and PUMS data. For each occupancy type, up to six clusters of communities were formed. The Census and PUMS average property values were similar for the communities in a cluster.

Within a cluster, the average property value for each cell was computed from the communities that were surveyed. The average Factor was also computed across these communities. For the communities that were not surveyed, the average property value for the cell was computed using the formula:

$$\textit{Average Property Value in Surveyed Communities} \times \frac{\textit{Community Factor}}{\textit{Average Community Factor in Surveyed Communities}}$$

8.3 Factors Affecting Property Value Changes

The PVM estimates the change in a structure's property value resulting from the premium change occurring under a given policy scenario for all pre-FIRM structures. In the PVM, the estimated property value changes reflect the influence of several combined key factors. For pre-FIRM structures these factors include: (1) the change in premiums; (2) NFIP participation rates; and (3) the stock of pre-FIRM structures. For structures at or above the BFE, PVM estimated property value changes reflect these factors and an additional factor, (4) the percent of structures determined to have been elevation rated prior to 1998.

8.3.1 Changes in Premiums

For each pre-FIRM cell category in the PVM, the Premium Calculator estimates the change in insurance premium resulting from charging actuarially based premium rates to pre-FIRM structures. (These changes reflect the difference in the subsidized and actuarial premiums for structures in each cell category.) The premium changes estimated in the Premium Calculator are a function of a structure's occupancy type, number of floors, presence or absence of a basement, flood zone, and elevation difference.

In standard housing finance theory, a structure's value can be estimated by considering the operations and maintenance costs along with the equivalent of a rental income stream. In the PVM, flood insurance premiums are considered a cost of operating and maintaining a home. The treatment of insurance premiums is no different from the treatment of other household operation and maintenance expenses such as local property taxes, which are capitalized into a structure's value under standard housing finance theory. Thus, an approximation of flood insurance premiums is assumed to be reflected in the value of a structure, and a change in the flood insurance premium will result in a change in the structure's value. For pre-FIRM structures below the BFE, the present discounted value of premium increases results in a corresponding decrease in that structure's property value under the shift from subsidized to actuarial premiums beginning in 1998, all other things being equal. In this way, increases in flood insurance costs are capitalized into a decrease in the total value of the property.

While structures subjected to premium increases may experience property value decreases, conversely, structures subjected to premium decreases may experience property value increases as a result of subsidy elimination. Specifically, for pre-FIRM structures at or above the BFE for which actuarial premiums are less than subsidized premiums, subsidy elimination will involve a reduction in operation and maintenance expenses for that structure, and this cost reduction will cause an increase in that structure's property value. The recognition of the economic effects of premium decreases as well as increases is consistent with standard housing finance theory.

8.3.2 NFIP Participation Rates

NFIP participation rates estimated by the Insurance Demand Model (IDM) influence the property value changes estimated in the PVM. In the IDM, participation rates are a function of several different factors, including: (1) the price of flood insurance; (2) Federal regulations and their effectiveness; (3) the elevation difference of a structure; (4) historical trends in policy purchases; and (5) the marketing of flood insurance. In the IDM, the major difference between the Baseline Scenario and Scenarios 1-7 is the price of flood insurance. In Scenarios 1-7, the sensitivity of policy purchase behavior to changes in premiums is captured through the use of price elasticities. The price elasticities are parameters that cause a change in participation when premiums shift from subsidized to actuarial for a particular cell. For a given scenario, for example, if premiums for a particular cell increase in 1998, there is a corresponding decrease in participation for that cell, all other things being equal. In the IDM, the price elasticities for premium increases are larger in magnitude than the price elasticities for premium decreases. This asymmetry reflects the fact that policyholders (and potential policyholders) are more sensitive to price increases than they are to price decreases of the same magnitude.

8.3.3 Modeling Effects of Subsidy Elimination on Property Values

The PVM estimates changes in property values as a function of changes in premiums. A key assumption in developing the estimates of property value changes is that the current owner of any particular structure and all potential buyers of that structure have the same likelihood of buying flood insurance. This assumption reflects the fact that the risk of flooding is linked to that structure, not to the owner.

The extent to which premium changes are assumed to affect the value of a particular property varies based on whether the property is insured under the Baseline and under the subsidy elimination scenario. Structures can be grouped into four categories:

In_1/In_2 – The In_1/In_2 structures are those that are insured in the Baseline and remain insured with subsidy elimination, regardless of whether the premium for the structure increases or decreases. Structures in this category incur the full effect of subsidy elimination.

Out_1/Out_2 – The Out_1/Out_2 structures are those that are not insured in the Baseline and not insured with subsidy elimination, regardless of whether the premium for the structure increases or decreases. Structures in this category incur no effects from subsidy elimination.

In_1/Out_2 – The In_1/Out_2 structures are those that are insured in the Baseline and drop out of the insurance program with subsidy elimination because they experience an increase in premiums. Dropping out of the program exposes the structure to flood losses, thereby decreasing its value. Owners of such properties are willing to pay the subsidized premium, but they are not willing to pay the higher actuarial premium. The decrease in property value for structures in this category is equal to the perceived increase in exposure to flood losses that results from dropping out of the program, which can not be measured. However, this perceived increase in flood loss exposure is somewhere between the subsidized premium the owner is willing to pay and the higher actuarial premium the owner is not willing to pay. The best estimate of the perceived increase in flood loss exposure is therefore equal to the midpoint between the subsidized and actuarial premiums, and this amount is used to estimate the decrease in property value for structures in this category.

Out_1/In_2 – The Out_1/In_2 structures are those that are not insured in the Baseline and enter the insurance program with subsidy elimination because they are eligible for a lower premium. Entering the program eliminates the exposure of the structure to flood losses, thereby increasing its value. Owners of such properties are not willing to pay the subsidized premium, but they are willing to pay the lower actuarial premium. The increase in property value for structures in this category is equal to the perceived decrease in exposure to flood losses that results from entering the program, which can not be measured. However, this perceived decrease in flood loss exposure is somewhere between the subsidized premium the owner is not willing to pay and the lower actuarial premium the owner is willing to pay. The best estimate of the perceived decrease in flood loss exposure is therefore equal to the midpoint between the subsidized and actuarial premiums, and this amount is used to estimate the increase in property value for structures in this category.

8.3.4 The Stock of Pre-FIRM Structures

The stock of pre-FIRM structures estimated by the Property Simulation Model (PSM) influences the property value changes estimated in the PVM, since premium changes are a function of specific structure characteristics. At the community level, the distribution of pre-FIRM structures by the four elevation difference categories (at or above the BFE; 1 or 2 feet below the BFE; 3, 4, or 5 feet below the BFE; and 6 feet or more below the BFE) largely determines the magnitude and direction of premium changes capitalized into property values in the PVM. At the community level, communities with a greater percentage of structures below the BFE and with greater concentrations of those structures in the lowest elevation difference categories (3, 4, 5, and 6 feet or more below the BFE) will experience, on average, larger premium increases and therefore correspondingly larger property value declines, all other things being equal. Over time, the greatest risk structures are removed from the stock of structures faster than less high risk structures due to various flood mitigation programs as well as natural attrition. As a result, a community is left with a relatively smaller stock of the highest risk structures by 2022. All other things being equal, in a typical community, the differentially higher attrition of the greatest risk structures will tend to cause a moderate downward trend in property value declines due to premium increases over the 1998 to 2022 period.

8.3.5 The Percent of Elevation Rated Structures Prior to 1998

For pre-FIRM structures at or above the BFE, estimated property value increases resulting from premium decreases as premiums shift from subsidized to actuarial rates are influenced at the community level by the percentage of these structures that are elevation rated prior to 1998.
Pre-FIRM structures that are at or above the BFE can obtain elevation certificates verifying their base flood elevation, and thus, become eligible for actuarial premiums that are lower than subsidized premiums. Structures that have obtained these elevation certificates are said to be "elevation rated." Since these elevation rated structures are assumed to already be taking advantage of lower actuarial rates, they experience no property value changes for any of the policy scenarios in the PVM. All other things being equal, communities with greater concentrations of elevation rated pre-FIRM structures at or above BFE will experience proportionally smaller increases in property values as premiums shift from subsidized to actuarial rates.

For each of the seven subsidy elimination scenarios, the PVM assumes that all pre-FIRM structures for which actuarial premiums are lower than the subsidized premiums become elevation rated in 1998 and pay the lower subsidized premiums at that time. Although it is recognized that only by obtaining an elevation certificate can a structure's actuarial premium be correctly identified, considerations regarding the mechanism for obtaining elevation certificates (and their associated costs) for these structures were beyond the scope of this study.

8.4 Results for National Property Value Changes for Scenarios 1-7

The results discussion are divided into two parts: (1) results for structures below the BFE and (2) results for structures at or above the BFE.

8.4.1 Structures Below the BFE

Table 8.1 presents national property value changes for pre-FIRM structures below the BFE for selected years.

Since premium increases for structures below the BFE vary considerably by a structure's elevation difference category, the PVM results display considerable variation in property value changes. Property values decrease within a range of about 1 percent to 7 percent. Although the property value changes differ significantly by scenario, structure type, and time period, several key patterns in the results are noteworthy:

For all scenarios and time periods, PVM estimates of property value decreases are largest for multiple family attached structures and smallest for single family detached structures. For multiple family attached structures, larger estimated property value decreases reflect the fact that relative to average property values, average premium increases for multiple family attached structures tend to be larger than those of other structure types. This is primarily due to the relatively higher concentrations of these structure types located in coastal areas. For single family detached structures, smaller estimated property value decreases reflect the fact that relative to average property values, average premium increases for single family structures tend to be smaller than those of other structure types. This is primarily due to the relatively smaller concentrations of these structure types located in coastal areas.

For Scenarios 1, 5, 6, and 7, property value declines are largest in 1998 and smaller in subsequent years as many properties that experience large increases in insurance premiums drop out of the NFIP after 1998 while the stock of structures in the highest flood risk categories declines faster than structures with lower flood risk. As discussed above, for structures that drop out of the NFIP, the midpoint between subsidized and actuarial rates is used in estimating the effective insurance cost change resulting from subsidy elimination. In terms of premium changes, Scenarios 1, 5, 6, and 7 are similar in that the majority of the premium subsidy is effectively eliminated in 1998, with any remaining premium subsidy fully phased out by 2002.

In Scenarios 2, 3, and 4, declines in property values are initially smaller but ultimately similar to those of Scenarios 1, 5, 6, and 7 by 2022. These smaller declines reflect the nature of how the subsidy elimination is phased in more gradually relative to other scenarios. This gradual phase-in also results in less of a decline in the participation rates, relative to the Scenarios 1, 5, 6, and 7.

8.4.2 Structures At or Above the BFE

Table 8.2 presents national property value changes for pre-FIRM structures at or above the BFE for selected years.

Table 8.1
Percent Change from Baseline for Average Real Pre-FIRM Property Values from 1997 to 2022 for Property Elevations Below the BFE
All NFIP Study Communities

Scenario	1998	2002	2007	2012	2017	2022
Scenario 1						
Single Family	-3.5%	-1.9%	-1.9%	-2.0%	-1.9%	-1.9%
Multiple Family	-6.7%	-3.9%	-4.1%	-4.4%	-4.5%	-4.5%
Non-Residential	-4.3%	-2.7%	-2.8%	-2.9%	-2.9%	-2.9%
Scenario 2						
Single Family	-1.7%	-2.1%	-2.2%	-2.0%	-2.1%	-2.0%
Multiple Family	-3.2%	-4.0%	-4.4%	-4.2%	-4.6%	-4.7%
Non-Residential	-2.4%	-2.9%	-3.1%	-2.9%	-2.9%	-2.9%
Scenario 3						
Single Family	-1.2%	-1.5%	-2.0%	-2.3%	-2.4%	-2.4%
Multiple Family	-2.2%	-3.0%	-3.9%	-4.5%	-4.8%	-5.1%

Non-Residential	-1.8%	-2.2%	-2.8%	-3.1%	-3.2%	-3.1%
Scenario 4						
Single Family	-0.9%	-1.3%	-1.7%	-1.9%	-2.1%	-2.1%
Multiple Family	-1.7%	-2.5%	-3.2%	-3.7%	-4.0%	-4.2%
Non-Residential	-1.4%	-2.0%	-2.5%	-2.8%	-3.0%	-3.0%
Scenario 5						
Single Family	-3.3%	-2.1%	-2.1%	-2.1%	-2.0%	-2.0%
Multiple Family	-6.5%	-4.1%	-4.3%	-4.4%	-4.5%	-4.6%
Non-Residential	-4.3%	-2.8%	-2.9%	-2.9%	-2.9%	-2.9%
Scenario 6						
Single Family	-2.7%	-2.2%	-2.1%	-2.1%	-2.1%	-2.1%
Multiple Family	-5.5%	-4.2%	-4.3%	-4.4%	-4.6%	-4.6%
Non-Residential	-3.9%	-2.9%	-3.0%	-3.0%	-2.9%	-2.9%
Scenario 7						
Single Family	-3.0%	-2.1%	-2.1%	-2.1%	-2.1%	-2.0%
Multiple Family	-5.8%	-4.2%	-4.3%	-4.4%	-4.6%	-4.6%
Non-Residential	-4.0%	-2.9%	-2.9%	-3.0%	-2.9%	-2.9%

As seen in Table 8.2, property value increases for these structures are within a relatively narrow range of 0.7 percent to 1.6 percent. Despite this narrow range, several patterns in the results are noteworthy:

All structure types experience a small, though noticeable, increase in property value increases over time in response to lower insurance costs. This rise is primarily due to increasing NFIP participation rates which increase the share of structures affected by premium decreases.

For all years, property value increases are highest for non-residential structures and lowest for multiple family attached structures. For non-residential structures, larger estimated property value increases reflect the fact that, relative to property values, premium decreases for non-residential structures tend to be slightly larger than those for other types of structures, reflecting the relatively low proportion of these structures with basements. For multiple family attached structures, smaller estimated property value increases reflect the fact that, relative to property values, premium decreases for multiple family attached structures tend to be slightly smaller than those of other types, reflecting the relatively smaller coverage rates assumed for these structure types.

Table 8.2
Percent Change from Baseline for Average Real Pre-FIRM Property Values from 1997 to 2022 for Property Elevations at or above the BFE
All NFIP Study Communities

Scenario	1998	2002	2007	2012	2017	2022
Scenario 1						
Single Family	1.0%	1.2%	1.2%	1.3%	1.3%	1.3%
Multiple Family	0.7%	0.8%	0.8%	0.9%	0.9%	1.0%
Non-Residential	1.3%	1.5%	1.6%	1.6%	1.6%	1.6%

Scenario 2						
Single Family	1.0%	1.2%	1.2%	1.3%	1.3%	1.3%
Multiple Family	0.7%	0.8%	0.8%	0.9%	0.9%	1.0%
Non-Residential	1.3%	1.5%	1.6%	1.6%	1.6%	1.6%
Scenario 3						
Single Family	1.0%	1.2%	1.2%	1.3%	1.3%	1.3%
Multiple Family	0.7%	0.8%	0.8%	0.9%	0.9%	1.0%
Non-Residential	1.3%	1.5%	1.6%	1.6%	1.6%	1.6%
Scenario 4						
Single Family	1.0%	1.2%	1.2%	1.3%	1.3%	1.3%
Multiple Family	0.7%	0.8%	0.8%	0.9%	0.9%	1.0%
Non-Residential	1.3%	1.5%	1.6%	1.6%	1.6%	1.6%
Scenario 5						
Single Family	1.0%	1.2%	1.2%	1.3%	1.3%	1.3%
Multiple Family	0.7%	0.8%	0.8%	0.9%	0.9%	1.0%
Non-Residential	1.3%	1.5%	1.6%	1.6%	1.6%	1.6%
Scenario 6						
Single Family	1.0%	1.2%	1.2%	1.3%	1.3%	1.3%
Multiple Family	0.7%	0.8%	0.8%	0.9%	0.9%	1.0%
Non-Residential	1.3%	1.5%	1.6%	1.6%	1.6%	1.6%
Scenario 7						
Single Family	1.0%	1.2%	1.2%	1.3%	1.3%	1.3%
Multiple Family	0.7%	0.8%	0.8%	0.9%	0.9%	1.0%
Non-Residential	1.3%	1.5%	1.6%	1.6%	1.6%	1.6%

In comparing the seven scenarios, there are no significant property value change differences among Scenarios 1-7. These similarities reflect the fact that, for at or above BFE structures which experience premium decreases, the policy scenarios are identical. Recall that for all of the seven scenarios, premiums for structures with a lower actuarial premium are assumed to decrease to actuarial levels in 1998.

8.5 Results for Community Level Pre-FIRM Property Value Changes for Scenarios 1-7

8.5.1 Pre-FIRM Structures Below the BFE

The graphs on pages 8-14 through 8-38 present community level property value changes for pre-FIRM structures below the BFE and at or above the BFE for selected years. Rather than presenting the graphs sorted alphabetically by state and community as has been done in the community tables throughout this study, the community graphs are presented in order of magnitude of the property value effects resulting from subsidy elimination. Specifically, the order of the graphs was developed by ranking the 50 communities from largest negative to largest positive changes in 1998 property values. The resulting order, presented in the tables below, reflects overall community average property value changes for Scenario 1 for all pre-FIRM structures for 1998. Although the property value change estimates differ by year and by policy scenario, the rankings presented in the tables do not significantly change for alternative policy scenarios or different years.

While the seven scenarios are presented separately in the graphs for properties below the BFE, the average of all seven scenarios is presented for properties at or above the BFE since there are no significant property value change differences by year or structure type between scenarios. These similarities reflect the fact that results for structures at or above the BFE for Scenarios 1 through 7 are identical. For all of the seven scenarios, premiums for structures with a lower actuarial premium are assumed to decrease to actuarial levels in 1998.

PVM community level results disaggregated by three structures types with results from 1998 through 2022 at five year increments are presented in Appendix F.

Overall, while comparisons among scenarios at the community level mirror those at the national level, a number of key observations for results for properties below the BFE are noteworthy:

In general, for all scenarios, the PVM estimates property value decreases on the order of one to seven percent for most communities and most structure types over the 1998 to 2022 period. Given the magnitude of premium decreases for most structures below the BFE, the present discounted value of the effects of these premium changes on property values are consistent with expectations. For single family detached structures, for example, premium increases are generally in the $200 to $1,500 range for structures below the BFE that generally range in value from about $40,000 to $125,000 in the 50 sample communities.

For many communities, even in Scenarios 1, 5, 6, and 7, the decline in property value diminishes moderately over time as the stock of pre-FIRM structures in the highest risk categories declines faster than that of lower risk structures. In some communities, the effects of high risk structure attrition are largely, if not completely, offset by rising participation rates which increase the number and share of structures for which the full flood insurance cost increases are capitalized into each structure's property value.

Although not apparent in the graphs, the detailed results in Appendix F for several communities in all scenarios indicate an increase in property values for single family detached structures. These communities contain a relatively high proportion of pre-FIRM structures in the 1 and 2 feet below BFE elevation difference category containing basements where the floor is 1 or 2 feet below the BFE. For these types of properties in these communities, actuarial premiums are lower than subsidized premiums.

Nine communities (St. Petersburg Beach City, Florida; Louisville City, Kentucky; Glen Rock Borough, Pennsylvania; Lower Mt. Bethel Township, Pennsylvania; New Cumberland Borough, Pennsylvania; Brookside Village City, Texas; Grundy Town, Virginia; Philippi City, West Virginia; and Wheeling City, West Virginia) experience decreases in property values of more than ten percent for one or more structure types in one or more years in every scenario over the 1998 to 2022 period. In general, these relatively large property value decreases reflect large concentrations of high risk structures in communities with relatively high participation rates. In all of these nine communities, two-thirds or more of structures below the BFE reside in the 3, 4, and 5 feet below and 6 feet and below BFE elevation difference categories. In addition, NFIP participation rates in all of these communities are near or above the national average rates of 26 percent in 1997.

8.5.2 Pre-FIRM Structures At or Above the BFE

For structures at or above the BFE, property values are estimated to increase as a result of premium decreases which occur as premiums shift from subsidized to actuarial rates. For these structures, premium decreases are influenced at the community level by the percentage of these structures that are elevation rated prior to 1998. Since these elevation rated structures are assumed to already be taking advantage of lower actuarial rates, they experience no property value changes for any of the policy scenarios in the PVM. All other things being equal, communities with greater concentrations of elevation rated pre-FIRM structures at or above the BFE will experience proportionally smaller increases in property values as premiums shift from subsidized to actuarial rates.

While many of the PVM results at the community level mirror those at the national level, several observations of results for properties at or above the BFE are noteworthy:

For all scenarios, the PVM estimates property value increases on the order of 0.5 percent to 3.5 percent for most communities and most structure types over the 1997 to 2022 period. Given the magnitude of premium decreases for these structures, the present discounted value of the amounts of these premium changes on property values are consistent with expectations. For single family detached structures, for example, premium decreases are generally in the $200 to $500 range for structures that generally range in value from about $50,000 to $150,000 in the 50 sample communities.

For most communities and property types, the PVM estimates small but steady increases in the rate of property value increases over the 1997 to 2022 period in response to lower insurance costs. This is primarily due to increasing NFIP participation rates for communities over time which increase the number and proportion of properties which experience property value increases as a result of premium decreases from 1997 to 2022.

Two communities, Hailey City, Idaho and Brookside Village City, Texas, experience no measurable increase in property values because virtually all the structures at or above BFE in these communities were determined to have been elevation rated prior to 1998. In addition, Glen Rock Borough, Pennsylvania, Lower Mt. Bethel Township, Pennsylvania, and Leavenworth City, Washington experience zero property value change for selected property types by 2022. This is due to the attrition of pre-FIRM structures which results in a drop of pre-FIRM structures to zero by 2022 for certain structure types in these communities.

Four communities (Louisville City, Kentucky; Omaha City, Nebraska; Glen Rock Borough, Pennsylvania; and Lower Mt. Bethel Township, Pennsylvania) experience increases in property values of more than 3.5 percent for one or more structure types in one or more years over the 1997 to 2022 period. In general, these relatively sizeable property value increases reflect the low numbers of pre-FIRM structures determined to have been elevation rated prior to 1998 in these communities. In all of these communities, less than six percent of pre-FIRM structures were determined to have been elevation rated prior to 1998; and therefore, upon subsidy elimination, the majority of structures experience premium decreases which cause property value increases for these properties.

The following graphs on pages 8-14 through 8-38 present property value changes for all pre-FIRM structures below the BFE for each of the Scenarios 1-7; and the property value changes for all pre-FIRM structures at or above the BFE for Scenarios 1-7, averaged across all seven scenarios.

8.6 Methods for Estimating Property Taxes

Property tax revenues are a function of tax rates, the property value and number of taxable properties. To calculate the property tax three pieces of information are necessary: the property tax rate or millage rate of the community, the tax assessment rate for the community, and the assessed value of the property.

The first step for calculating property taxes for an individual property is multiplying the assessed value of the property times the tax assessment rate, yielding the tax assessed value of the property. The tax assessment rate is generally equal to or less than 100 percent, thus, the tax assessed value is generally equal to or less than the assessed value of the property.

The millage rate is measured in collectable tax dollars per unit of assessed value. Some communities define the millage rate as tax dollars per $100 of assessed value. Other communities define the millage rate as collectable tax dollars per $1,000 of assessed value. Since the millage rate definition varied across communities, many of the interviews with staff at tax assessor offices included asking a staff member to calculate the property tax for a property with a fair market value of $50,000. Since the definition of assessment rates was uniform across communities, the millage denominator can be calculated by using the quoted tax on a $50,000 property and the quoted millage rate. This calculation was used to establish if the millage rate was in dollars per $1,000 of assessed property value or dollars per $100 of assessed value. The millage rates were normalized for use in the PVM, so that the millage definition referred to tax dollars per $100 of assessed property value.

In some local governments, the millage rates varied by school district (primary and secondary schools) and other districts defined for delivering public services such as: fire protection; reduced damages from flood and mud; ambulance service; municipal water systems; sewer systems; and libraries. Since the PVM is designed to accept a single property tax rate for each sample community, data for communities with multiple property tax rates were averaged to derive a property tax rate representative of the property owners in the community. For these communities, property tax rate data on all the districts were collected within a community and then averaged to yield a single property tax rate for the community. It was not possible to estimate weighted averages because of data limitations, but these simple averages are reasonable approximations.

8.7 Tax Revenue Change Results

8.7.1 National Results

Table 8.3 presents the percent change in average real tax revenues for SFHA structures for all NFIP communities nationally over the 1997 to 2022 period for Scenarios 1 through 7. Since local property tax revenues are a function of property tax rates and property values and tax rates are assumed constant over the 1997 to 2022 period, the estimated changes in local property tax revenues reflect the changes in SFHA property values presented in the previous section. In general, the percent changes in property taxes are smaller in magnitude than the percent changes

in property values, since property tax changes from subsidy elimination reflect the combined net effects of all SFHA property value increases as well as decreases resulting from subsidy elimination. Finally, property tax changes within a community reflect the revenue changes relative to property tax revenues for all SFHA structures within that community, including post-FIRM as well as pre-FIRM SFHA structures.

Table 8.3
Percent Change from Baseline for Average Real Tax Revenues
Over the 1997 to 2022 Period
All NFIP Study Communities

Scenario	1998	2002	2007	2012	2017	2022
Scenario 1	-1.3%	-0.5%	-0.4%	-0.3%	-0.3%	-0.2%
Scenario 2	-0.5%	-0.5%	-0.5%	-0.3%	-0.3%	-0.2%
Scenario 3	-0.1%	-0.2%	-0.3%	-0.3%	-0.2%	-0.2%
Scenario 4	0.2%	0.2%	0.1%	0.1%	0.1%	0.1%
Scenario 5	-1.0%	-0.3%	-0.3%	-0.2%	-0.2%	-0.1%
Scenario 6	-0.8%	-0.4%	-0.3%	-0.2%	-0.2%	-0.1%
Scenario 7	-0.9%	-0.4%	-0.3%	-0.2%	-0.2%	-0.1%

As seen in Table 8.3, average changes in property tax revenues resulting from subsidy elimination are relatively small for all years and scenarios at the national level. In general, the pattern of differences in property tax revenue changes over time and among the seven scenarios follows the changes in property values presented previously. As with property value changes for Scenarios 1, 5, 6, and 7, property tax declines are largest in 1998 and smaller in subsequent years as many properties that experience large increases in premiums drop out of the NFIP after 1998; meanwhile the stock of structures in the highest flood risk categories declines faster than those in lower flood risk categories. In Scenarios 2 and 3, declines in property tax revenues are initially smaller but ultimately similar to those of Scenarios 1, 5, 6, and 7. In Scenarios 2, 3, and 4, the slow acceleration of property value declines over time reflects the gradual nature of the phase-in of subsidy elimination, large enough to significantly and increasingly affect many property values but not large enough to result in drops in NFIP participation as dramatic as those experienced in Scenarios 1, 5, 6, and 7.

Particularly noteworthy in Table 8.3 is Scenario 4, the only scenario in which the net change in property tax revenues at the national level is positive. In general, the slight increases in property tax revenues in Scenario 4 reflect the fact that the immediate effects of tax revenue changes for property value increases for structures at or above the BFE more than offset the gradual effects of tax revenue changes for property value decreases for most structures below the BFE, which, in Scenario 4, experience higher post-FIRM premiums only when the ownership of the structure changes or the structure is refinanced.

8.7.2 Community Level Results

Tables 8.4 through 8.10 present the percent change in average real tax revenues over the 1997 to 2022 period for Scenarios 1 through 7 for each of the 50 sample communities. As in the national results, the community level changes in local tax revenues follow the changes in property values, but the tax revenue declines are of a smaller magnitude, with many communities experiencing net property tax revenue increases.

In Scenarios 1 and 5, ten communities (St. Petersburg Beach City, Florida; Louisville City, Kentucky; Lincoln Park, Borough, New Jersey; Glen Rock Borough, Pennsylvania; Lower Mt. Bethel Township, Pennsylvania; New Cumberland Borough, Pennsylvania; Brookside Village City, Texas; Grundy Town, Virginia; Philippi City, West Virginia; and Wheeling City, West Virginia) would experience a decline in property tax revenue of five percent or more in at least one year over the 1997 to 2022 period. In Scenario 1, 26 communities would experience local property tax revenue declines of one to five percent while the remaining 14 communities would experience no revenue change or revenue increases as a result of subsidy elimination. In Scenario 5, 20 communities would experience local property tax revenue declines of one to five percent while the remaining 20 communities would experience no revenue change or revenue increases as a result of subsidy elimination

In Scenarios 2 and 3, two communities, St. Petersburg Beach City, Florida and Glen Rock Borough, Pennsylvania would experience a decline in property tax revenue of five percent or more in at least one year over the 1997 to 2022 period. In Scenario 2, 29 communities would experience local property tax revenue declines of one to five percent while the remaining 19 communities would experience no revenue change or revenue increases as a result of subsidy elimination. In Scenario 3, 24 communities would experience local property tax revenue declines of one to five percent while the remaining 24 communities would experience no revenue change or revenue increases as a result of subsidy elimination.

In Scenario 4, three communities, St. Petersburg Beach City, Florida, Glen Rock Borough, Pennsylvania, and Lower Mt. Bethel Township, Pennsylvania would experience a decline in property tax revenue of five percent or more in at least one year over the 1997 to 2022 period. Fourteen communities would experience local property tax revenue declines of one to five percent while the remaining 33 communities would experience no revenue change or revenue increases as a result of subsidy elimination.

In Scenarios 6 and 7, nine communities (St. Petersburg Beach City, Florida; Louisville City, Kentucky; Lincoln Park Borough, New Jersey; Glen Rock Borough, Pennsylvania; Lower Mt. Bethel Township, Pennsylvania; Brookside Village City, Texas; Grundy Town, Virginia; Philippi City, West Virginia; and Wheeling City, West Virginia) would experience a decline in property tax revenue of five percent or more in at least one year over the 1997 to 2022 period. Twenty-one communities would experience local property tax revenue declines of one to five percent while the remaining 20 communities would experience no revenue change or revenue increases as a result of subsidy elimination.

Table 8.4
Percent Change from Baseline for Average Real Tax Revenues Over the 1997-2022 Period
Calculated in 1997 Dollars, Sample Communities, Scenario 1

Community	1998	2002	2007	2012	2017	2022
All NFIP Study Communities	-1.3%	-0.5%	-0.4%	-0.3%	-0.3%	-0.2%
Phoenix City, AZ	-0.2%	-0.1%	-0.1%	0.0%	0.0%	0.0%
Bay City, AR	-0.3%	0.0%	0.1%	0.1%	0.1%	0.1%
Sacramento County, CA	0.6%	0.8%	0.8%	0.7%	0.7%	0.6%
Santa Cruz City, CA	-1.8%	-0.6%	-0.6%	-0.4%	-0.3%	-0.3%
Dolores Town, CO	-0.2%	0.1%	0.1%	0.1%	0.1%	0.1%
Otero County, CO	0.0%	0.2%	0.2%	0.2%	0.2%	0.3%
Ft. Lauderdale City, FL	0.2%	0.2%	0.2%	0.1%	0.1%	0.1%
New Smyrna Beach City, FL	-0.1%	-0.1%	-0.1%	0.0%	0.0%	0.0%
St. Petersburg Beach City, FL	-13.0%	-11.5%	-11.8%	-11.2%	-10.4%	-9.7%
Hailey City, ID	-0.3%	-0.1%	-0.1%	-0.1%	0.0%	0.0%
Grundy County, IL	-1.5%	0.0%	0.2%	0.3%	0.3%	0.3%
Council Bluffs City, IA	-4.8%	-1.9%	-1.5%	-1.4%	-1.2%	-1.0%
Augusta City, KY	0.0%	0.3%	0.3%	0.3%	0.3%	0.3%
Lewisport City, KY	0.0%	0.2%	0.2%	0.2%	0.2%	0.1%
Louisville/Jefferson, KY	-6.0%	-1.8%	-1.6%	-1.4%	-1.1%	-0.8%
Allen Parish, LA	-0.2%	-0.1%	0.0%	0.0%	0.0%	0.0%
Jefferson Parish, LA	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%
Shreveport, LA	-1.1%	-0.9%	-0.8%	-0.7%	-0.6%	-0.4%
Cohasset Town, MA	-1.6%	-0.2%	0.0%	0.1%	0.1%	0.2%
Vassar City, MI	0.3%	0.5%	0.5%	0.5%	0.5%	0.5%
Petal City, MS	-0.1%	0.1%	0.1%	0.1%	0.2%	0.2%
Scott County, MO	0.0%	0.1%	0.1%	0.2%	0.2%	0.2%
Omaha City, NE	-0.5%	0.3%	0.4%	0.4%	0.4%	0.4%
Pender Village, NE	-1.1%	-0.2%	-0.1%	0.0%	0.1%	0.2%
Woodstock Town, NH	0.1%	0.3%	0.3%	0.3%	0.3%	0.3%
Bloomingdale Borough, NJ	0.1%	0.5%	0.5%	0.5%	0.5%	0.5%
Lincoln Park Borough, NJ	-8.3%	-3.1%	-2.7%	-2.5%	-2.2%	-1.9%
Niagara Town, NY	-2.0%	0.0%	0.2%	0.3%	0.4%	0.4%
Waterford Village, NY	-2.3%	-0.7%	-0.5%	-0.4%	-0.3%	-0.2%
Carteret County, NC	0.1%	0.2%	0.2%	0.2%	0.2%	0.2%
Edenton Town, NC	-0.1%	-0.1%	-0.1%	-0.1%	0.0%	0.0%
New Miami Village, OH	0.6%	0.8%	0.8%	0.8%	0.7%	0.7%
Washington County, OK	-0.1%	0.1%	0.1%	0.1%	0.2%	0.2%
Lane County, OR	0.4%	0.6%	0.6%	0.6%	0.5%	0.5%
Vernonia City, OR	-0.4%	-0.1%	0.0%	0.0%	0.0%	0.0%
Franklin Township, PA	-0.8%	0.1%	0.2%	0.2%	0.3%	0.3%
Glen Rock Borough, PA	-35.2%	-27.6%	-31.5%	-33.1%	-33.2%	-33.7%
Lower Mt. Bethel Township, PA	-7.2%	-5.2%	-3.5%	-2.1%	-1.1%	-0.9%
New Cumberland Borough, PA	-5.6%	-1.9%	-1.7%	-1.4%	-1.1%	-0.8%
Myrtle Beach City, SC	-0.7%	-0.2%	-0.1%	-0.1%	0.0%	0.0%
Lawrence County, SD	0.4%	0.6%	0.6%	0.6%	0.5%	0.4%
Brookside Village City, TX	-8.6%	-3.1%	-2.7%	-2.2%	-1.9%	-1.5%
Garland City, TX	-0.4%	-0.2%	-0.1%	-0.1%	-0.1%	-0.1%
League City, TX	-1.3%	-0.6%	-0.5%	-0.4%	-0.3%	-0.3%
Grundy Town, VA	-6.3%	-2.5%	-2.0%	-1.6%	-1.2%	-1.0%
Ephrata City, WA	-0.5%	-0.1%	-0.1%	0.0%	0.0%	0.0%
Leavenworth City, WA	-1.5%	-0.9%	-0.7%	-0.6%	-0.5%	-0.6%
Marlinton Town, WV	-4.4%	-1.7%	-1.3%	-1.0%	-0.8%	-0.6%
Philippi City, WV	-10.1%	-4.3%	-3.8%	-3.4%	-3.0%	-2.3%
Wheeling City, WV	-11.0%	-4.3%	-4.0%	-3.6%	-2.9%	-2.5%

Table 8.5
Percent Change from Baseline for Average Real Tax Revenues Over the 1997-2022 Period
Calculated in 1997 Dollars, Sample Communities, Scenario 2

Community	1998	2002	2007	2012	2017	2022
All NFIP Study Communities	-0.5%	-0.5%	-0.5%	-0.3%	-0.3%	-0.2%
Phoenix City, AZ	-0.1%	-0.2%	-0.1%	-0.1%	0.0%	0.0%
Bay City, AR	0.0%	0.0%	0.0%	0.1%	0.1%	0.1%
Sacramento County, CA	0.6%	0.7%	0.8%	0.7%	0.7%	0.6%
Santa Cruz City, CA	-0.7%	-0.8%	-0.7%	-0.4%	-0.4%	-0.3%
Dolores Town, CO	0.0%	0.0%	0.0%	0.1%	0.1%	0.1%
Otero County, CO	0.0%	0.0%	0.1%	0.1%	0.2%	0.2%
Ft. Lauderdale City, FL	0.2%	0.2%	0.1%	0.1%	0.1%	0.1%
New Smyrna Beach City, FL	0.0%	-0.1%	-0.1%	-0.1%	0.0%	0.0%
St. Petersburg Beach City, FL	-8.4%	-10.4%	-11.7%	-11.2%	-10.4%	-9.7%
Hailey City, ID	-0.1%	-0.1%	-0.1%	-0.1%	0.0%	0.0%
Grundy County, IL	-0.4%	-0.4%	-0.1%	0.1%	0.2%	0.3%
Council Bluffs City, IA	-2.1%	-2.2%	-1.8%	-1.3%	-1.0%	-0.8%
Augusta City, KY	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%
Lewisport City, KY	0.2%	0.1%	0.1%	0.2%	0.2%	0.1%
Louisville/Jefferson, KY	-1.7%	-1.9%	-1.6%	-1.1%	-0.9%	-0.9%
Allen Parish, LA	-0.2%	-0.2%	-0.2%	-0.1%	0.0%	0.0%
Jefferson Parish, LA	0.4%	0.3%	0.3%	0.3%	0.3%	0.3%
Shreveport, LA	-0.6%	-0.8%	-0.8%	-0.7%	-0.6%	-0.4%
Cohasset Town, MA	-0.6%	-0.7%	-0.5%	-0.2%	0.0%	0.1%
Vassar City, MI	0.4%	0.4%	0.4%	0.5%	0.5%	0.4%
Petal City, MS	0.0%	0.0%	0.0%	0.1%	0.1%	0.1%
Scott County, MO	0.0%	0.0%	0.0%	0.1%	0.1%	0.1%
Omaha City, NE	0.1%	0.1%	0.2%	0.4%	0.4%	0.4%
Pender Village, NE	-0.4%	-0.5%	-0.5%	-0.2%	-0.1%	0.0%
Woodstock Town, NH	0.2%	0.2%	0.2%	0.3%	0.3%	0.3%
Bloomingdale Borough, NJ	0.3%	0.3%	0.3%	0.4%	0.4%	0.4%
Lincoln Park Borough, NJ	-2.8%	-3.0%	-2.5%	-1.9%	-2.1%	-1.9%
Niagara Town, NY	-0.6%	-0.5%	-0.2%	0.1%	0.3%	0.4%
Waterford Village, NY	-0.8%	-0.9%	-0.7%	-0.3%	-0.3%	-0.2%
Carteret County, NC	0.1%	0.1%	0.2%	0.2%	0.2%	0.2%
Edenton Town, NC	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	0.0%
New Miami Village, OH	0.6%	0.7%	0.7%	0.7%	0.7%	0.6%
Washington County, OK	-0.1%	-0.1%	0.0%	0.1%	0.1%	0.1%
Lane County, OR	0.5%	0.5%	0.6%	0.6%	0.5%	0.5%
Vernonia City, OR	-0.1%	-0.1%	-0.1%	0.0%	0.0%	0.0%
Franklin Township, PA	-0.5%	-0.6%	-0.4%	-0.2%	-0.1%	0.0%
Glen Rock Borough, PA	-21.8%	-26.9%	-31.6%	-33.0%	-33.2%	-33.7%
Lower Mt. Bethel Township, PA	-5.3%	-4.8%	-3.5%	-2.1%	-1.1%	-0.9%
New Cumberland Borough, PA	-1.6%	-1.7%	-1.4%	-1.3%	-1.1%	-0.8%
Myrtle Beach City, SC	-0.2%	-0.2%	-0.2%	-0.1%	0.0%	0.0%
Lawrence County, SD	0.5%	0.6%	0.5%	0.5%	0.5%	0.4%
Brookside Village City, TX	-2.8%	-3.1%	-2.5%	-1.7%	-1.9%	-1.5%
Garland City, TX	-0.3%	-0.3%	-0.3%	-0.2%	-0.1%	-0.1%
League City, TX	-0.6%	-0.7%	-0.6%	-0.5%	-0.3%	-0.3%
Grundy Town, VA	-1.9%	-1.9%	-1.8%	-1.3%	-1.2%	-1.0%
Ephrata City, WA	-0.2%	-0.2%	-0.2%	-0.1%	0.0%	0.0%
Leavenworth City, WA	-1.0%	-1.0%	-0.8%	-0.5%	-0.4%	-0.6%
Marlinton Town, WV	-1.5%	-1.6%	-1.3%	-0.8%	-0.8%	-0.6%
Philippi City, WV	-3.7%	-4.1%	-3.7%	-2.8%	-2.3%	-2.3%

Wheeling City, WV	-3.9%	-4.6%	-4.2%	-3.2%	-2.7%	-2.7%

Table 8.6
Percent Change from Baseline for Average Real Tax Revenues Over the 1997-2022 Period
Calculated in 1997 Dollars, Sample Communities, Scenario 3

Community	1998	2002	2007	2012	2017	2022
All NFIP Study Communities	-0.1%	-0.2%	-0.3%	-0.3%	-0.2%	-0.2%
Phoenix City, AZ	0.3%	0.2%	0.2%	0.1%	0.1%	0.1%
Bay City, AR	0.6%	0.6%	0.5%	0.4%	0.4%	0.4%
Sacramento County, CA	0.7%	0.8%	0.8%	0.7%	0.7%	0.6%
Santa Cruz City, CA	-0.4%	-0.5%	-0.7%	-0.6%	-0.4%	-0.4%
Dolores Town, CO	0.6%	0.6%	0.5%	0.5%	0.4%	0.4%
Otero County, CO	0.6%	0.7%	0.6%	0.6%	0.6%	0.6%
Ft. Lauderdale City, FL	0.2%	0.2%	0.2%	0.2%	0.2%	0.1%
New Smyrna Beach City, FL	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
St. Petersburg Beach City, FL	-5.7%	-7.2%	-8.9%	-9.9%	-10.2%	-9.5%
Hailey City, ID	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Grundy County, IL	-0.3%	-0.3%	-0.3%	-0.2%	-0.1%	0.1%
Council Bluffs City, IA	-1.4%	-1.6%	-1.7%	-1.6%	-1.3%	-1.0%
Augusta City, KY	0.8%	0.8%	0.7%	0.6%	0.6%	0.6%
Lewisport City, KY	0.4%	0.4%	0.3%	0.3%	0.3%	0.2%
Louisville/Jefferson, KY	-0.8%	-1.0%	-1.3%	-1.2%	-0.9%	-0.7%
Allen Parish, LA	-0.5%	-0.6%	-0.6%	-0.6%	-0.4%	-0.3%
Jefferson Parish, LA	0.5%	0.5%	0.4%	0.4%	0.4%	0.3%
Shreveport, LA	0.0%	-0.1%	-0.2%	-0.2%	-0.2%	-0.1%
Cohasset Town, MA	-0.3%	-0.4%	-0.4%	-0.4%	-0.3%	-0.1%
Vassar City, MI	-0.2%	-0.2%	-0.3%	-0.2%	-0.1%	0.0%
Petal City, MS	0.3%	0.3%	0.3%	0.2%	0.2%	0.3%
Scott County, MO	0.2%	0.3%	0.2%	0.2%	0.2%	0.2%
Omaha City, NE	0.3%	0.3%	0.3%	0.3%	0.4%	0.4%
Pender Village, NE	-0.1%	-0.2%	-0.3%	-0.3%	-0.2%	-0.1%
Woodstock Town, NH	0.8%	0.8%	0.7%	0.6%	0.6%	0.6%
Bloomingdale Borough, NJ	0.8%	0.9%	0.8%	0.8%	0.8%	0.8%
Lincoln Park Borough, NJ	-1.7%	-2.0%	-2.1%	-2.0%	-1.7%	-1.9%
Niagara Town, NY	-0.2%	-0.2%	-0.2%	-0.1%	0.1%	0.2%
Waterford Village, NY	-0.4%	-0.4%	-0.5%	-0.4%	-0.2%	-0.2%
Carteret County, NC	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
Edenton Town, NC	0.0%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%
New Miami Village, OH	1.0%	1.1%	1.1%	1.0%	1.0%	0.9%
Washington County, OK	0.5%	0.6%	0.6%	0.5%	0.5%	0.5%
Lane County, OR	0.8%	0.9%	0.9%	0.8%	0.8%	0.7%
Vernonia City, OR	0.5%	0.5%	0.4%	0.4%	0.3%	0.3%
Franklin Township, PA	-0.3%	-0.5%	-0.5%	-0.5%	-0.5%	-0.3%
Glen Rock Borough, PA	-15.0%	-19.5%	-25.1%	-29.4%	-31.8%	-32.5%
Lower Mt. Bethel Township, PA	-3.1%	-2.9%	-2.4%	-1.6%	-0.9%	-0.7%
New Cumberland Borough, PA	-0.9%	-1.0%	-1.2%	-1.1%	-1.3%	-0.9%
Myrtle Beach City, SC	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Lawrence County, SD	1.0%	1.0%	0.9%	0.9%	0.8%	0.7%
Brookside Village City, TX	-1.7%	-2.0%	-2.2%	-1.9%	-1.5%	-1.5%
Garland City, TX	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.1%
League City, TX	-0.4%	-0.4%	-0.5%	-0.5%	-0.4%	-0.3%
Grundy Town, VA	-1.0%	-1.2%	-1.3%	-1.2%	-1.1%	-1.1%
Ephrata City, WA	0.5%	0.5%	0.4%	0.4%	0.3%	0.3%
Leavenworth City, WA	-0.7%	-0.7%	-0.7%	-0.6%	-0.5%	-0.6%
Marlinton Town, WV	-0.8%	-1.0%	-0.9%	-0.8%	-0.6%	-0.6%
Philippi City, WV	-2.2%	-2.7%	-3.1%	-3.0%	-2.7%	-2.0%

Wheeling City, WV	-2.4%	-3.1%	-3.6%	-3.7%	-3.1%	-2.6%

Table 8.7
Percent Change from Baseline for Average Real Tax Revenues Over the 1997-2022 Period
Calculated in 1997 Dollars, Sample Communities, Scenario 4

Community	1998	2002	2007	2012	2017	2022
All NFIP Study Communities	0.2%	0.2%	0.1%	0.1%	0.1%	0.1%
Phoenix City, AZ	0.6%	0.6%	0.6%	0.5%	0.4%	0.4%
Bay City, AR	1.1%	1.3%	1.2%	1.1%	1.0%	0.9%
Sacramento County, CA	1.4%	1.8%	1.8%	1.7%	1.6%	1.4%
Santa Cruz City, CA	0.1%	0.0%	0.3%	0.2%	0.2%	0.2%
Dolores Town, CO	1.2%	1.3%	1.2%	1.2%	1.0%	0.9%
Otero County, CO	1.1%	1.2%	1.3%	1.4%	1.4%	1.3%
Ft. Lauderdale City, FL	0.3%	0.4%	0.4%	0.4%	0.3%	0.3%
New Smyrna Beach City, FL	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%
St. Petersburg Beach City, FL	-5.0%	-7.9%	-9.7%	-8.5%	-8.6%	-8.4%
Hailey City, ID	-0.1%	-0.1%	0.0%	0.0%	0.0%	0.0%
Grundy County, IL	0.8%	0.8%	0.8%	0.7%	0.8%	0.6%
Council Bluffs City, IA	-0.9%	-1.2%	-1.5%	-0.7%	-0.8%	-0.8%
Augusta City, KY	1.2%	1.4%	1.5%	1.4%	1.6%	1.2%
Lewisport City, KY	0.6%	0.6%	0.6%	0.6%	0.5%	0.5%
Louisville/Jefferson, KY	0.1%	-0.1%	0.5%	0.4%	0.5%	0.4%
Allen Parish, LA	-0.1%	-0.2%	0.0%	-0.1%	-0.2%	-0.2%
Jefferson Parish, LA	0.5%	0.6%	0.6%	0.6%	0.5%	0.5%
Shreveport, LA	-0.2%	-0.3%	-0.3%	-0.2%	-0.2%	-0.1%
Cohasset Town, MA	0.5%	0.5%	0.8%	0.8%	0.8%	0.7%
Vassar City, MI	0.2%	0.2%	0.5%	0.4%	0.4%	0.3%
Petal City, MS	0.7%	0.9%	0.9%	0.9%	0.8%	0.8%
Scott County, MO	0.4%	0.5%	0.5%	0.5%	0.8%	0.5%
Omaha City, NE	0.7%	0.8%	0.8%	1.1%	1.0%	0.8%
Pender Village, NE	0.3%	0.4%	0.3%	0.5%	0.5%	0.5%
Woodstock Town, NH	1.4%	1.5%	1.5%	1.3%	1.3%	1.2%
Bloomingdale Borough, NJ	1.2%	1.4%	1.5%	1.7%	3.5%	1.6%
Lincoln Park Borough, NJ	-1.1%	-1.6%	-1.1%	-1.2%	-1.1%	-1.1%
Niagara Town, NY	0.6%	0.6%	0.6%	0.4%	1.0%	0.7%
Waterford Village, NY	0.2%	0.0%	0.4%	0.3%	0.3%	0.2%
Carteret County, NC	0.5%	0.6%	0.6%	0.6%	0.5%	0.5%
Edenton Town, NC	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%
New Miami Village, OH	1.7%	2.0%	2.1%	2.0%	1.9%	1.7%
Washington County, OK	1.0%	1.2%	1.3%	1.3%	1.3%	1.2%
Lane County, OR	1.4%	1.7%	1.9%	1.8%	1.7%	1.6%
Vernonia City, OR	0.8%	0.9%	0.9%	1.0%	0.9%	0.8%
Franklin Township, PA	0.5%	0.9%	0.9%	0.9%	0.8%	0.9%
Glen Rock Borough, PA	-17.5%	-23.5%	-28.3%	-30.8%	-31.7%	-30.6%
Lower Mt. Bethel Township, PA	-6.3%	-6.6%	-6.2%	-4.7%	-2.6%	-0.6%
New Cumberland Borough, PA	-0.3%	-0.6%	-0.6%	-0.7%	-0.2%	-0.3%
Myrtle Beach City, SC	0.2%	0.2%	0.1%	0.1%	0.1%	0.1%
Lawrence County, SD	1.7%	1.9%	1.9%	1.7%	1.6%	1.4%
Brookside Village City, TX	-1.4%	-2.0%	-1.9%	-2.0%	-2.0%	-1.8%
Garland City, TX	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
League City, TX	-0.2%	-0.2%	-0.3%	-0.3%	-0.3%	-0.2%
Grundy Town, VA	-0.5%	-0.6%	-0.8%	-0.8%	-0.8%	-0.4%
Ephrata City, WA	1.0%	1.2%	1.2%	1.1%	1.0%	0.9%
Leavenworth City, WA	-1.0%	-1.1%	-1.0%	-0.9%	-0.8%	-0.7%
Marlinton Town, WV	-0.3%	0.0%	-0.1%	-0.2%	-0.3%	-0.2%
Philippi City, WV	-1.2%	-1.7%	-2.0%	-2.2%	-1.3%	-1.3%
Wheeling City, WV	-1.1%	-1.7%	-2.1%	-1.1%	-1.3%	-1.3%

Table 8.8
Percent Change from Baseline for Average Real Tax Revenues Over the 1997-2022 Period
Calculated in 1997 Dollars, Sample Communities, Scenario 5

Community	1998	2002	2007	2012	2017	2022
All NFIP Study Communities	-1.0%	-0.3%	-0.3%	-0.2%	-0.2%	-0.1%
Phoenix City, AZ	0.1%	0.2%	0.2%	0.2%	0.2%	0.2%
Bay City, AR	0.4%	0.5%	0.5%	0.5%	0.4%	0.4%
Sacramento County, CA	0.6%	0.8%	0.8%	0.8%	0.7%	0.7%
Santa Cruz City, CA	-1.7%	-0.6%	-0.5%	-0.3%	-0.3%	-0.2%
Dolores Town, CO	0.5%	0.6%	0.6%	0.5%	0.4%	0.4%
Otero County, CO	0.5%	0.6%	0.7%	0.6%	0.6%	0.6%
Ft. Lauderdale City, FL	0.2%	0.2%	0.2%	0.2%	0.2%	0.1%
New Smyrna Beach City, FL	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
St. Petersburg Beach City, FL	-12.4%	-11.3%	-11.7%	-11.1%	-10.4%	-9.6%
Hailey City, ID	-0.1%	-0.1%	0.0%	0.0%	0.0%	0.0%
Grundy County, IL	-1.5%	-0.1%	0.1%	0.2%	0.2%	0.3%
Council Bluffs City, IA	-4.3%	-1.9%	-1.5%	-1.3%	-1.1%	-1.0%
Augusta City, KY	0.6%	0.7%	0.7%	0.7%	0.6%	0.6%
Lewisport City, KY	0.3%	0.4%	0.3%	0.3%	0.3%	0.2%
Louisville/Jefferson, KY	-5.4%	-1.8%	-1.5%	-1.3%	-1.0%	-0.7%
Allen Parish, LA	-1.0%	-0.4%	-0.2%	-0.1%	-0.1%	0.0%
Jefferson Parish, LA	0.5%	0.5%	0.4%	0.4%	0.4%	0.3%
Shreveport, LA	-0.4%	-0.4%	-0.3%	-0.2%	-0.2%	-0.1%
Cohasset Town, MA	-1.5%	-0.2%	0.0%	0.2%	0.2%	0.2%
Vassar City, MI	-0.8%	-0.2%	-0.1%	0.1%	0.1%	0.1%
Petal City, MS	0.2%	0.3%	0.3%	0.3%	0.3%	0.3%
Scott County, MO	0.2%	0.2%	0.3%	0.3%	0.3%	0.2%
Omaha City, NE	-0.3%	0.4%	0.5%	0.5%	0.5%	0.5%
Pender Village, NE	-0.9%	-0.1%	0.0%	0.1%	0.2%	0.3%
Woodstock Town, NH	0.7%	0.8%	0.7%	0.7%	0.6%	0.6%
Bloomingdale Borough, NJ	0.7%	0.9%	0.9%	0.9%	0.9%	0.9%
Lincoln Park Borough, NJ	-8.0%	-3.1%	-2.7%	-2.5%	-2.2%	-1.9%
Niagara Town, NY	-1.5%	0.0%	0.2%	0.3%	0.4%	0.5%
Waterford Village, NY	-2.0%	-0.6%	-0.4%	-0.3%	-0.2%	-0.1%
Carteret County, NC	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
Edenton Town, NC	-0.1%	-0.1%	0.0%	0.0%	0.0%	0.0%
New Miami Village, OH	0.9%	1.1%	1.1%	1.1%	1.0%	0.9%
Washington County, OK	0.4%	0.5%	0.6%	0.6%	0.6%	0.5%
Lane County, OR	0.6%	0.9%	0.9%	0.8%	0.8%	0.7%
Vernonia City, OR	0.3%	0.4%	0.4%	0.4%	0.4%	0.3%
Franklin Township, PA	-0.9%	-0.1%	0.1%	0.1%	0.2%	0.2%
Glen Rock Borough, PA	-32.0%	-27.3%	-31.5%	-33.1%	-33.1%	-33.5%
Lower Mt. Bethel Township, PA	-6.5%	-4.9%	-3.4%	-2.0%	-1.0%	-0.8%
New Cumberland Borough, PA	-5.3%	-2.1%	-1.8%	-1.5%	-1.2%	-0.9%
Myrtle Beach City, SC	-0.5%	-0.1%	-0.1%	0.0%	0.0%	0.0%
Lawrence County, SD	0.9%	1.0%	0.9%	0.9%	0.8%	0.7%
Brookside Village City, TX	-7.3%	-3.1%	-2.6%	-2.2%	-1.9%	-1.5%
Garland City, TX	-0.3%	-0.1%	-0.1%	-0.1%	0.0%	0.0%
League City, TX	-1.1%	-0.5%	-0.4%	-0.3%	-0.3%	-0.2%
Grundy Town, VA	-5.8%	-2.6%	-2.1%	-1.7%	-1.3%	-1.1%
Ephrata City, WA	0.4%	0.5%	0.5%	0.4%	0.4%	0.4%
Leavenworth City, WA	-1.3%	-0.8%	-0.6%	-0.5%	-0.5%	-0.5%
Marlinton Town, WV	-3.7%	-1.6%	-1.2%	-0.9%	-0.7%	-0.6%
Philippi City, WV	-8.8%	-4.4%	-3.8%	-3.4%	-3.0%	-2.3%

Wheeling City, WV	-9.1%	-4.7%	-4.1%	-3.8%	-3.0%	-2.6%

Table 8.9
Percent Change from Baseline for Average Real Tax Revenues Over the 1997-2022 Period
Calculated in 1997 Dollars, Sample Communities, Scenario 6

Community	1998	2002	2007	2012	2017	2022
All NFIP Study Communities	-0.8%	-0.4%	-0.3%	-0.2%	-0.2%	-0.1%
Phoenix City, AZ	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
Bay City, AR	0.4%	0.5%	0.5%	0.5%	0.4%	0.4%
Sacramento County, CA	0.7%	0.8%	0.8%	0.8%	0.7%	0.7%
Santa Cruz City, CA	-1.2%	-0.7%	-0.5%	-0.3%	-0.3%	-0.2%
Dolores Town, CO	0.5%	0.6%	0.6%	0.5%	0.4%	0.4%
Otero County, CO	0.5%	0.6%	0.6%	0.6%	0.6%	0.6%
Ft. Lauderdale City, FL	0.2%	0.2%	0.2%	0.2%	0.2%	0.1%
New Smyrna Beach City, FL	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
St. Petersburg Beach City, FL	-11.2%	-11.6%	-11.8%	-11.1%	-10.4%	-9.6%
Hailey City, ID	-0.1%	-0.1%	0.0%	0.0%	0.0%	0.0%
Grundy County, IL	-1.2%	-0.2%	0.1%	0.2%	0.2%	0.3%
Council Bluffs City, IA	-3.1%	-1.8%	-1.5%	-1.3%	-1.1%	-1.0%
Augusta City, KY	0.7%	0.7%	0.7%	0.7%	0.6%	0.6%
Lewisport City, KY	0.3%	0.3%	0.3%	0.3%	0.3%	0.2%
Louisville/Jefferson, KY	-4.7%	-1.8%	-1.5%	-1.3%	-1.0%	-0.7%
Allen Parish, LA	-0.8%	-0.5%	-0.3%	-0.2%	-0.1%	-0.1%
Jefferson Parish, LA	0.5%	0.5%	0.4%	0.4%	0.4%	0.3%
Shreveport, LA	-0.3%	-0.4%	-0.3%	-0.2%	-0.2%	-0.1%
Cohasset Town, MA	-1.3%	-0.3%	0.0%	0.1%	0.2%	0.2%
Vassar City, MI	-0.5%	-0.3%	-0.1%	0.1%	0.1%	0.1%
Petal City, MS	0.2%	0.3%	0.3%	0.3%	0.3%	0.3%
Scott County, MO	0.2%	0.2%	0.2%	0.3%	0.2%	0.2%
Omaha City, NE	-0.1%	0.3%	0.4%	0.5%	0.5%	0.5%
Pender Village, NE	-0.8%	-0.2%	0.0%	0.1%	0.2%	0.2%
Woodstock Town, NH	0.7%	0.8%	0.7%	0.7%	0.6%	0.6%
Bloomingdale Borough, NJ	0.7%	0.9%	0.9%	0.9%	0.9%	0.9%
Lincoln Park Borough, NJ	-7.2%	-3.2%	-2.7%	-2.4%	-2.2%	-1.9%
Niagara Town, NY	-0.9%	-0.2%	0.2%	0.4%	0.5%	0.5%
Waterford Village, NY	-1.2%	-0.6%	-0.3%	-0.2%	-0.2%	-0.1%
Carteret County, NC	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
Edenton Town, NC	-0.1%	-0.1%	-0.1%	0.0%	0.0%	0.0%
New Miami Village, OH	0.9%	1.1%	1.1%	1.1%	1.0%	0.9%
Washington County, OK	0.4%	0.5%	0.6%	0.6%	0.6%	0.5%
Lane County, OR	0.7%	0.8%	0.9%	0.8%	0.8%	0.7%
Vernonia City, OR	0.3%	0.4%	0.4%	0.4%	0.4%	0.3%
Franklin Township, PA	-0.7%	-0.3%	-0.1%	0.0%	0.1%	0.1%
Glen Rock Borough, PA	-27.7%	-28.2%	-31.9%	-33.3%	-33.2%	-33.6%
Lower Mt. Bethel Township, PA	-6.0%	-5.0%	-3.4%	-2.1%	-1.1%	-0.9%
New Cumberland Borough, PA	-3.4%	-1.7%	-1.7%	-1.5%	-1.2%	-0.9%
Myrtle Beach City, SC	-0.4%	-0.1%	-0.1%	0.0%	0.0%	0.0%
Lawrence County, SD	0.9%	1.0%	0.9%	0.9%	0.8%	0.7%
Brookside Village City, TX	-5.1%	-3.0%	-2.3%	-2.2%	-1.9%	-1.5%
Garland City, TX	-0.2%	-0.2%	-0.1%	-0.1%	0.0%	0.0%
League City, TX	-1.0%	-0.5%	-0.4%	-0.3%	-0.3%	-0.2%
Grundy Town, VA	-4.5%	-2.6%	-2.0%	-1.7%	-1.3%	-1.1%
Ephrata City, WA	0.4%	0.4%	0.5%	0.4%	0.4%	0.4%
Leavenworth City, WA	-0.9%	-0.8%	-0.6%	-0.4%	-0.5%	-0.5%
Marlinton Town, WV	-2.8%	-1.6%	-1.2%	-0.9%	-0.7%	-0.6%
Philippi City, WV	-6.5%	-4.2%	-3.7%	-3.3%	-2.9%	-2.3%

Wheeling City, WV	-6.7%	-4.4%	-3.8%	-3.4%	-3.0%	-2.6%

Table 8.10
Percent Change from Baseline for Average Real Tax Revenues Over the 1997-2022 Period
Calculated in 1997 Dollars, Sample Communities, Scenario 7

Community	1998	2002	2007	2012	2017	2022
All NFIP Study Communities	-0.9%	-0.4%	-0.3%	-0.2%	-0.2%	-0.1%
Phoenix City, AZ	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
Bay City, AR	0.4%	0.5%	0.5%	0.5%	0.4%	0.4%
Sacramento County, CA	0.7%	0.8%	0.8%	0.8%	0.7%	0.7%
Santa Cruz City, CA	-1.3%	-0.6%	-0.5%	-0.3%	-0.3%	-0.2%
Dolores Town, CO	0.5%	0.6%	0.6%	0.5%	0.4%	0.4%
Otero County, CO	0.5%	0.6%	0.6%	0.6%	0.6%	0.6%
Ft. Lauderdale City, FL	0.2%	0.2%	0.2%	0.2%	0.2%	0.1%
New Smyrna Beach City, FL	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
St. Petersburg Beach City, FL	-11.6%	-11.5%	-11.7%	-11.1%	-10.4%	-9.6%
Hailey City, ID	-0.1%	-0.1%	0.0%	0.0%	0.0%	0.0%
Grundy County, IL	-1.3%	-0.1%	0.1%	0.2%	0.3%	0.3%
Council Bluffs City, IA	-3.6%	-2.0%	-1.5%	-1.3%	-1.1%	-1.0%
Augusta City, KY	0.7%	0.7%	0.7%	0.7%	0.6%	0.6%
Lewisport City, KY	0.3%	0.3%	0.3%	0.3%	0.3%	0.2%
Louisville/Jefferson, KY	-5.1%	-1.8%	-1.5%	-1.3%	-1.0%	-0.7%
Allen Parish, LA	-0.8%	-0.5%	-0.3%	-0.2%	-0.1%	-0.1%
Jefferson Parish, LA	0.5%	0.5%	0.4%	0.4%	0.4%	0.3%
Shreveport, LA	-0.3%	-0.4%	-0.3%	-0.2%	-0.2%	-0.1%
Cohasset Town, MA	-1.4%	-0.2%	0.0%	0.1%	0.2%	0.2%
Vassar City, MI	-0.7%	-0.2%	-0.1%	0.1%	0.1%	0.1%
Petal City, MS	0.2%	0.3%	0.3%	0.3%	0.3%	0.3%
Scott County, MO	0.2%	0.2%	0.2%	0.3%	0.2%	0.2%
Omaha City, NE	-0.2%	0.4%	0.5%	0.5%	0.5%	0.5%
Pender Village, NE	-0.8%	-0.2%	0.0%	0.1%	0.2%	0.2%
Woodstock Town, NH	0.7%	0.8%	0.7%	0.7%	0.6%	0.6%
Bloomingdale Borough, NJ	0.7%	0.9%	0.9%	0.9%	0.9%	0.9%
Lincoln Park Borough, NJ	-7.3%	-3.2%	-2.7%	-2.4%	-2.2%	-1.9%
Niagara Town, NY	-0.6%	-0.1%	0.2%	0.4%	0.5%	0.5%
Waterford Village, NY	-1.8%	-0.6%	-0.4%	-0.2%	-0.2%	-0.1%
Carteret County, NC	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
Edenton Town, NC	-0.1%	-0.1%	-0.1%	0.0%	0.0%	0.0%
New Miami Village, OH	0.9%	1.1%	1.1%	1.1%	1.0%	0.9%
Washington County, OK	0.4%	0.5%	0.6%	0.6%	0.6%	0.5%
Lane County, OR	0.7%	0.8%	0.9%	0.8%	0.8%	0.7%
Vernonia City, OR	0.3%	0.4%	0.4%	0.4%	0.4%	0.3%
Franklin Township, PA	-0.7%	-0.1%	0.0%	0.1%	0.2%	0.2%
Glen Rock Borough, PA	-28.7%	-28.0%	-31.8%	-33.2%	-33.2%	-33.8%
Lower Mt. Bethel Township, PA	-6.3%	-4.9%	-3.4%	-2.0%	-1.0%	-0.8%
New Cumberland Borough, PA	-4.8%	-2.0%	-1.8%	-1.5%	-1.2%	-0.9%
Myrtle Beach City, SC	-0.4%	-0.1%	-0.1%	0.0%	0.0%	0.0%
Lawrence County, SD	0.9%	1.0%	0.9%	0.9%	0.8%	0.7%
Brookside Village City, TX	-7.0%	-3.1%	-2.6%	-2.2%	-1.9%	-1.5%
Garland City, TX	-0.3%	-0.2%	-0.1%	-0.1%	0.0%	0.0%
League City, TX	-1.0%	-0.5%	-0.4%	-0.3%	-0.3%	-0.2%
Grundy Town, VA	-4.4%	-2.7%	-2.1%	-1.7%	-1.3%	-1.1%
Ephrata City, WA	0.4%	0.4%	0.5%	0.4%	0.4%	0.4%
Leavenworth City, WA	-1.1%	-0.8%	-0.6%	-0.5%	-0.5%	-0.5%
Marlinton Town, WV	-3.1%	-1.6%	-1.2%	-0.9%	-0.7%	-0.6%
Philippi City, WV	-7.1%	-4.1%	-3.7%	-3.4%	-3.0%	-2.4%

Wheeling City, WV	-6.8%	-4.4%	-3.8%	-3.4%	-3.0%	-2.6%

9. Estimation of Effects of Subsidy Elimination on All NFIP Study Communities

This section presents a discussion of the method for extrapolating the results for the 50 sample communities to the universe of all 15,461 NFIP study communities. As presented in the preceding sections, the results of the study include national level effects of the seven subsidy elimination scenarios on:

- Premiums
- NFIP participation
- Property types
- Homeowners
- Property values
- Property taxes
- Local area economy

This section also provides a discussion of the method and estimates of the number of pre- and post-FIRM properties for all NFIP study communities nationally.

9.1 Method for Extrapolating

To extrapolate the results of the 50 sample communities to the universe of all 15,461 NFIP communities included in this study, the following steps were followed:

- A count of the number of housing units for each of the 15,461 study communities from the 1990 decennial Census data was developed.
- The count of housing units was converted to a count of residential structures.
- The number of non-residential structures was estimated for the 15,461 study communities.
- The estimates of residential and non-residential properties were disaggregated into pre-FIRM and post-FIRM property types and adjusted to reflect property counts for 1997.
- The universe of 1997 pre-FIRM and post-FIRM property totals was applied to the community sampling weights to facilitate national SFHA property count estimates by selected NFIP community economic and flood risk characteristics.

1. Estimating Counts of Housing Units

As a first step, the SFHAs from Q3 Flood Data were mapped onto block groups based on land area for all 7,767 Q3 communities. This procedure allowed the determination of which block groups or portions of block groups were located in a particular SFHA. Although the Q3 communities include only about half of the 15,461 NFIP communities included in this study, the Q3 communities, at the time the estimates were made, accounted for about 75 percent of the households and properties located in the universe of study communities.

For the remaining 7,694 non-Q3 communities, the number of housing units was measured in several steps. First, the number of households in each NFIP community was estimated using data from FEMA's Community Information System (CIS) database supplemented with the 1980 Census data. To assure accuracy and consistency in the CIS-reported housing unit data, these data were compared with the 1980 Census housing unit data for the Census place corresponding to each NFIP community. In a small number of cases where the CIS housing unit estimates were judged to be inaccurate based on analysis of the reported 1980 Census housing unit count for that community, an independent housing unit count was derived using the Census data and the percent of land area in the floodplain as reported in the CIS data. Since both the CIS and Census derived estimates reflect housing unit counts from the 1980 Census, the counts were adjusted to reflect 1990 counts using the 1980 to 1990 change in housing units for the Census place which corresponded to each NFIP community. Next, the 1990 estimates of NFIP community housing units were applied to the estimated percent of land area in the flood plain developed for the community sampling. This yielded an estimate of housing units in the SFHA for each of the 7,694 non-Q3 communities.

Using 1990 decennial Census data, data on the number of housing units by single family detached, single-unit or multiple-attached, condominium, or manufactured housing unit type were then extracted for all block groups contained within each of the 15,461study community SFHAs. Using the Census housing unit data, the total number of housing units within each block group were distributed based on the estimated proportion of each block group's land area contained within the SFHA. The block groups, or block group portions, were then summed to SFHA totals to estimate the total number of housing units for each of the 15,461 study SFHAs.

2. Estimating Residential Structures

In the second step of developing structure counts, housing units were converted to residential structures by estimating the number of residential structures per housing unit for all multiple-unit housing units. Using both the Census Residential Finance Survey and the American Housing Survey, which report the number of units per building for multi-unit residential structures, the average number of residential units per building was estimated for each multi-unit housing group. The total number of multi-unit residential structures was estimated by dividing multiple housing units by the average number of residential properties per housing unit.

3. Estimating Non-residential Structures

A count of non-residential structures for the 15,461 study communities was estimated using data on the number of commercial buildings and workers by Census region and urban or rural status from the 1989 Commercial Building Energy Consumption Survey (CBECS) conducted by the U.S. Department of Energy. Rather than using a later CBECS, the 1989 CBECS survey was used for consistency since it was the CBECS which coincided most closely with the 1990 decennial Census.

As a first step in estimating non-residential structures at the detailed community level, the ratio of commercial workers to commercial buildings by Census region and by urban and rural status, the most detailed geographic levels identified in the CBECS, was estimated. Next, this ratio was applied to an estimate of the number of commercial employees in each community in 1989. The estimate of the number of commercial employees in each community was derived by using county level tabulations of commercial workers obtained from the 1989 County Business Patterns adjusted to the population of the sample community SFHA:

Number of commercial workers in SFHA =

$$\frac{\text{The number of commercial workers in associated county}}{\text{Total population of associated county}} \times \text{Total population in SFHA}$$

The number of commercial properties for each SFHA was estimated by dividing the estimate of the number of commercial workers in each SFHA by the CBECS-derived estimate of the number of commercial workers per commercial building:

$$\text{Number of commercial buildings} = \frac{\text{Number of commercial workers in SFHA}}{\text{Number of commercial workers per commercial building}}$$

On average for the 15,461 study communities, we estimate non-residential structures to account for about six percent of all structures.

4. Estimating Pre-FIRM and Post-FIRM Properties

The classification of structures as pre-FIRM or post-FIRM was determined using the decennial Census data, which provides an aggregated count of structures built within specific time intervals for all structures within a given area. Assuming a uniform distribution of structures built within each time period – a standard statistical procedure for developing estimates for small geographic areas for which annual observations are not available – the effective date of the initial FIRM was used to estimate the percentage of pre-FIRM and post-FIRM structures in each group.

For the universe of NFIP study communities as a whole, about 65 percent of properties were estimated to be pre-FIRM structures in 1997.

5. Estimating Property Counts for 1997

Since the data used to initially estimate the count of properties in each sample community were for 1990, the 1990 stock of structures had to be adjusted to reflect the 1997 stock of structures. To accomplish this adjustment, the 1990 stock of structures was adjusted to 1997 levels using an estimate of the 1990 to 1997 net growth of structures based on the 1990 to 1997 growth in local area age 21 to 65 population applied to the historic relationship between net growth in structures and the growth in age 21 to 65 population. This adjustment was accomplished in two steps as detailed below.

First, the ratio of the growth in housing units to the growth in the age 21 to 65 population was estimated using 1980 and 1990 decennial Census data for the Census place which corresponded to the sample community:

$$\text{Housing unit growth to growth in age 21 to 65 population} = \frac{\dfrac{\text{1990 housing units}}{\text{1980 housing units}}}{\dfrac{\text{1990 age 21 to 65 population}}{\text{1980 age 21 to 65 population}}}$$

Next, this ratio was multiplied by the 1990 to 1997 change in the age 21 to 65 population for the corresponding county or Census place estimate of the growth in properties from 1990 to 1997. The source for the 1990 to 1997 population change was data from the Census

Bureau's small area population program which provided Census place estimates through 1996. The rate of change from 1995-96 was used to developed population estimates for 1997.

1990-97 growth in properties =

$$\frac{\text{1997 population - 1990 population}}{\text{1990 population}} \times \text{Housing unit growth to growth in age 21 to 65 population}$$

Using this methodology, 4,294,673 pre-FIRM and 6,577,979 total SFHA properties in the universe of 15,461 NFIP study communities in 1997 were estimated. Of these totals, 306,925 pre-FIRM and 440,139 total SFHA properties were estimated to be non-residential properties.

6. Applying Estimated Property Totals to Community Sampling Weights

To develop property weights to facilitate the grouping of the national estimates of pre-FIRM and post-FIRM properties by the economic and risk characteristics identified for the community sampling, the estimated universe of 1997 pre-FIRM and post-FIRM properties was applied to the community sampling weights.

As described in Section 2 of this report, the methodology used to select the sample of communities and structures included in this study included constructing a set of community weights for the 50 sample communities. These community weights reflect the 15,461 study communities grouped by the 7 economic and risk characteristics identified for the community sampling procedures. To develop pre-FIRM property weights from these community weights, the community weights were first multiplied by the number of pre-FIRM properties estimated in each of the 50 sample communities and summed to a sample community total. Next, the estimated universe total of 4,294,673 pre-FIRM properties was divided by this sample community total to derive a pre-FIRM property weight conversion factor. This pre-FIRM property weight conversion factor was then applied to each of the 50 sampling community weights to arrive at a set of pre-FIRM property weights which would reflect the universe of 4,294,673 estimated pre-FIRM properties. A similar approach was used to develop a set of post-FIRM property weights.

For each of the community-level results for premium changes, NFIP structure counts, NFIP policies, property value changes, and property tax changes, the pre-FIRM property weights were applied to each detailed property type to arrive at national level results. These national level results are presented along with the community level results in the appropriate sections of this report.

10. Case Studies of Economic Effects of Subsidy Elimination

This section presents an analysis of community case studies evaluating selected economic effects of premium subsidy elimination for the 50 sample communities. The case studies include information on the economic and risk characteristics for the 50 sample communities and the premium subsidy elimination's potential economic impact on homeowners, businesses, and overall economic climate.

10.1 Framework for Community Groupings

The results for the case studies for the 50 communities were sorted by the percent change in property value in pre-FIRM structures, from largest negative to largest positive changes in 1998 property values for Scenario 1, where full subsidy elimination occurs in 1998. Although the property value change estimates differ by year and by policy scenario, the ranking used in this analysis does not significantly change for alternative policy scenarios or different years. The ranked communities were subdivided into five groups:

Group 1 contains communities that experience a ten percent or greater decrease in property values in Scenario 1 in 1998.
Group 2 contains communities that experience a five to ten percent decrease in property values in Scenario 1 in 1998.
Group 3 contains communities that experience a one to five percent decrease in property values in Scenario 1 in 1998.
Group 4 contains communities that experience a decrease of one percent or less in property values in Scenario 1 in 1998.
Group 5 contains communities that either have no change or experience an increase in property values in Scenario 1 in 1998.

Ten community characteristics are included for each community to highlight both the similarities and differences among communities within each group and to compare the community groups. The characteristics are included in Tables 10.1 - 10.5 and serve as a summary profile of each community. The characteristics include:

1. 1998 property value change for all structures
2. 1998 property value change for pre-FIRM structures below BFE
3. Source of flooding – inland or coastal
4. The percent of pre-FIRM structures out of all structures in the SFHA in 1997
5. 1997 population
6. Average annual projected change in the number of properties over the 1997 to 2022 period
7. Median household income as a percent of that of the U.S.
8. Average single family property value as a percent of U.S.
9. 1997 flood insurance program participation
10. Average annual local area employment growth from 1990 to 1997

The source of flooding (inland or coastal) and the percent pre-FIRM properties are the community characteristics developed to stratify communities for sampling in the study's initial selection of the 50 sample communities from the universe of NFIP communities. As indicated above, the 1998 property value changes for properties at all base flood elevation (BFE) levels were derived through the Property Valuation Model (PVM) simulation of subsidy elimination Scenario 1. The average single family property value as a percent of that of the

U.S. was also derived from results obtained in the PVM. Each community's 1997 population and the 1997 to 2022 average annual change in the number of properties were derived from results obtained in the Property Simulation Model (PSM). The 1997 NFIP participation rate was derived from results obtained in the Insurance Demand Model (IDM). Median household income as a percent of the U.S. is based on 1990 decennial Census data for each of the communities. Finally, the 1990 to 1997 average local area employment estimates are from the Commerce Department's *Local Area Personal Income* reports and reflect total employment growth for the county in which the corresponding NFIP community is located.

The community case studies presented in this section are intended to highlight the range of potential economic impacts to NFIP communities as a result of subsidy elimination. As indicated from the analysis presented here, a number of key characteristics are important in determining how severe or modest the economic impacts would likely be as a result of subsidy elimination. Specifically, as indicated in the case studies presented here, communities with relatively high concentrations of pre-FIRM structures with substantial flood risk, relatively high NFIP community participation rates, relatively low median household incomes, and relatively weak economic growth would be most adversely affected by subsidy elimination. Conversely, communities with few structures with substantial flood risk, low NFIP participation, high median household incomes, and strong economic growth would be least affected and could even experience modest economic benefits as a result of subsidy elimination.

Throughout the discussion of community results in the section, overall group averages for a particular variable are calculated as the simple mean of that variable for all communities represented within that group.

10.2 Community Group 1

Table 10.1 presents the selected community characteristics for the six communities classified in Group 1.

Table 10.1
Selected Community Characteristics for Group 1

Community	1998 Pre-FIRM Property Value Change	1998 Pre-FIRM Below BFE Property Value Change	Source of Flooding	1997 Popu-lation	Average Annual Change in Number of Properties 1997 to 2022	Median House-hold Income As % of U.S.	Percent Pre-FIRM Properties	Average Single Family Property Value As % of U.S.	1997 NFIP Partici-pation Rate	Average Local Area Employ-ment Growth 1990-97

Glen Rock Borough, PA	-41.2%	-43.3%	Inland	149	-0.8%	101%	84%	53%	82%	0.1%
St. Petersburg Beach City, FL	-15.8%	-16.3%	Coastal	15,969	-0.7%	101%	82%	151%	84%	1.9%
Lincoln Park Borough, NJ	-14.5%	-15.2%	Inland	11,969	0.0%	179%	57%	160%	31%	-1.0%
Wheeling City, WV	-12.8%	-13.6%	Inland	13,033	-0.7%	70%	83%	36%	30%	1.9%
Philippi City, WV	-12.6%	-13.3%	Inland	853	1.3%	55%	80%	53%	37%	1.4%
Brookside Village City, TX	-12.4%	-13.0%	Inland	1,228	2.1%	122%	70%	54%	23%	1.1%

10.2.1 Community Characteristics for Group 1

The six communities presented in Table 10.1 are those among the 50 sample communities estimated to experience the most severe property value declines as a result of subsidy elimination. Of the six communities in Group 1, all communities except Lincoln Park Borough, New Jersey contain a concentration of pre-FIRM properties in excess of the national ratio of 65 percent. With respect to flooding source, only one community of the six, St. Petersburg Beach City, Florida, experiences coastal flooding.

Despite a relatively large concentration of high flood risk structures in these six communities, current NFIP participation varies considerably among them. Except for Brookside Village City, Texas, all of the six communities had NFIP participation rates exceeding the national average of 26 percent in 1997. Given the fact that property value changes are experienced only by properties that participate in the NFIP at some point over the 1997 to 2022 period, it is not surprising that most of the communities in Group 1 contain 1997 NFIP participation rates which exceed the national average.

For all of the six communities in Group 1, relatively large numbers of flood insurance policies would be cancelled as a result of large premium changes associated with subsidy elimination. In Scenario 1 for example, the immediate shift from subsidized to actuarial rates would cause, on average, a 50 percent reduction in flood insurance policies from 1997 to 1998. Among the six communities individually, the 1997 to 1998 reduction in policies for Scenario 1 ranges from a high of 63 percent in Brookside Village City, Texas, to a low of 33 percent in Glen Rock Borough, Pennsylvania and Philippi City, West Virginia.

Reflecting considerable differences in relative income, the six communities in Group 1 contain a wide range of median household income levels. Among the six communities, median household income (in 1997 dollars) ranges from $21,572 in Philippi City, West Virginia, to $69,915 in Lincoln Park Borough, New Jersey.

In addition to having large variations in relative incomes, the six communities reflect considerable differences in local area housing markets, with the six communities in Group 1 containing a wide range of property values. For average single family properties, property values range from $193,262 in Lincoln Park Borough, New Jersey, to $43,618 in Wheeling City, West Virginia, with the latter community's property value being the third lowest among the 50 sample communities.

10.2.2 Local Area Homeowner Impacts

In all of the six communities, premium increases resulting from subsidy elimination would have a substantial negative effect on residential property values. While the communities in Group 1 vary significantly by the various characteristics presented in the Table 10.1, all of the communities contain a large concentration of properties with substantial flood risk. Among the six communities for example, all contain more than 95 percent of their pre-FIRM structures below the BFE. Further, the communities in Group 1 have at least 75 percent of their residential pre-FIRM structures at least six feet below the BFE with the exception of St. Petersburg Beach City, Florida where a majority of pre-FIRM properties are in the -3, -4, and -5 elevation difference category.

Average premium increases are estimated to be substantial for the six communities in Group 1 due to the large concentration of pre-FIRM properties six feet or more below the BFE. For residential pre-FIRM properties below the BFE, average premiums (as calculated by the simple mean) for the six communities are estimated to increase from $558 to $3,995, an increase of $3,437 as a result of subsidy elimination. Average residential property premium increases for these properties range from an estimated $7,047 increase in Lincoln Park Borough, New Jersey to an estimated $1,898 increase in Philippi City, West Virginia.

As a result of subsidy elimination, relatively large estimated premium increases and property value declines in the six communities in Group 1 would most likely result in significant negative effects for local area homeowners. For residential pre-FIRM properties below the BFE, premium increases would be a sizeable share of income for these communities, accounting for an estimated eight percent of median household income on average. For the six communities individually, the range of premium increases as a percent of median household income ranges from ten percent in Lincoln Park Borough, New Jersey, to six percent in Glen Rock Borough, Pennsylvania. While these large residential premium increases would significantly impact all of the six communities, the impacts could be especially severe in Philippi City, West Virginia and Wheeling City, West Virginia, where median household incomes and average property values are relatively low and the total number of SFHA properties is projected to grow at rates below the projected 1.5 percent national average over the 1997 to 2022 period. Negative impacts from subsidy elimination would also be particularly severe in Glen Rock Borough, Pennsylvania, where average property values are well below the national average and the total number of SFHA properties is projected to decline over the 1997 to 2022 period.

10.2.3 Local Area Business and Fiscal Impacts

The concentration of non-residential properties varies considerably among the six communities in Group 1, with the proportion of non-residential to total properties ranging from less than one percent in Glen Rock Borough, Pennsylvania to about 12 percent in Philippi City, West Virginia. In these communities, premiums for pre-FIRM non-residential properties below the BFE are estimated to increase, on average, from $1,360 to $11,812, an increase of $10,452 as a result of subsidy elimination. For these properties, average premium increases are estimated to range from a $24,981 increase in Lincoln Park Borough, New Jersey (a particularly high increase due to the relatively large average size of non-residential properties in this community) to a $3,023 increase in St. Petersburg Beach City, Florida.

Due to the relatively large increases in premiums for non-residential pre-FIRM properties below the BFE, subsidy elimination would substantially affect local area business conditions and employment in the six communities in Group 1. Large increases in average premiums for pre-FIRM non-residential properties located below the BFE could have a significant impact on some commercial establishments located in these communities, and premium increases could account for as much as 20 percent of total business expenses for some commercial establishments. Given this relatively high added cost of doing business, some commercial establishments, particularly small food service, retail, and lodging establishments, could suffer significantly as a result of subsidy elimination. Particularly, Glen Rock Borough, Pennsylvania, Lincoln Park Borough, New Jersey, and Brookside Village City, Texas could be affected by potential impacts on employment, where local area economic growth is already weak, as highlighted by the fact that employment growth from 1990 to 1997 has been significantly less than the 1.5 percent experienced by the nation for the same period.

The overall fiscal impacts of subsidy elimination are less severe than the direct impacts on homeowners and businesses located in the six communities since overall fiscal impacts reflect the combined net effects of all SFHA property value changes in the community, both those SFHA properties that experience value decreases as a result of premium increases as well as those which experience value increases as a result of premium decreases. Nonetheless, the estimated decreases in local property tax revenues would be considerable for the communities in Group 1. Due to the reduction in property values resulting from premium increases, local property tax revenues for SFHA structures are estimated to drop by an average of 14 percent in 1998, ranging from a drop of 35 percent in Glen Rock Borough, Pennsylvania to a drop of 8 percent in Lincoln Park Borough, New Jersey. Given the high increased costs imposed on many homeowners and businesses located in these communities, the estimated declines in local property tax revenues would significantly exacerbate the negative effects of subsidy elimination.

10.3 Community Group 2

Table 10.2 presents the selected community characteristics for the six communities classified in Group 2.

Table 10.2
Selected Community Characteristics for Group 2

Community	1998 Pre-FIRM Property Value Change	1998 Pre-FIRM Below BFE Property Value Change	Source of Flooding	1997 Population	Average Annual Change in Number of Properties 1997 to 2022	Median Household Income As % of U.S.	Percent Pre-FIRM Properties	Average Single Family Property Value As % of U.S.	1997 NFIP Participation Rate	Average Local Area Employment Growth 1990-97
Lower Mt. Bethel Township, PA	-9.7%	-14.2%	Inland	223	-0.3%	99%	72%	71%	81%	2.0%
Grundy Town, VA	-8.5%	-15.5%	Inland	551	-0.5%	89%	70%	49%	39%	-2.5%
Louisville City, KY	-7.4%	-11.5%	Inland	14,548	-0.5%	67%	81%	74%	23%	1.5%
New Cumberland Borough, PA	-7.1%	-13.0%	Inland	1,066	0.6%	113%	79%	106%	28%	1.7%
Council Bluffs City, IA	-5.8%	-6.2%	Inland	16,211	-0.9%	83%	79%	38%	23%	2.8%
Marlinton Town, WV	-5.5%	-6.4%	Inland	1,397	1.6%	48%	80%	84%	33%	0.7%

10.3.1 Community Characteristics

The six communities presented in Table 10.2 are those estimated to experience property value declines between five and ten percent in 1998 as a result of subsidy elimination of the 50 sample communities. All of the six communities in Group 2 contain a concentration of pre-FIRM properties in excess of the national proportion of 65 percent. With respect to flooding source, none of the communities of the six experiences coastal flooding.

Despite a relatively large concentration of high flood risk structures in these communities, current NFIP participation varies widely among the six communities. Three communities have a NFIP participation above the national average rate of 26 percent in 1997, while the other three communities are below this average. Among all the 50 sample communities, Lower Mt. Bethel Township, Pennsylvania in Group 2 contains one of the highest community participation rates. For the six communities on average, the participation rate is 38 percent in 1997. Since property value changes are experienced only by properties that participate in the NFIP at some point over the 1997 to 2022 period, it is not surprising that most of the communities in Group 2 contain 1997 NFIP participation rates which either exceed, or are not significantly below the national average.

For all of the communities in Group 2, relatively large numbers of flood insurance policies would be cancelled as a result of large premium changes associated with subsidy elimination. In Scenario 1 for example, the immediate shift from subsidized to actuarial rates would cause, on average, a 24 percent reduction in flood insurance policies from 1997 to 1998. Among the six communities individually, the 1997 to 1998 reduction in policies for Scenario 1 ranges from a high of 44 percent in Louisville City, Kentucky to a low of 12 percent in Council Bluffs City, Iowa.

The six communities in Group 2 contain a wide range of median household income levels, reflecting considerable differences in relative income, though the relative differences are not as extreme as those observed among the communities in Group 1. Among the six communities in Group 2, median household income (in 1997 dollars) ranges from $18,610 in Marlinton Town, West Virginia, to $44,294 in New Cumberland Borough, Pennsylvania.

In addition to large variations in relative incomes, the six communities reflect considerable differences in local area housing markets. The six communities in Group 2 contain a wide range of property values. In Group 2, however, all communities except New Cumberland Borough, Pennsylvania are below U.S. average property values. New Cumberland Borough, Pennsylvania is only slightly above the national average. For average single family properties, property values range from $127,494 in New Cumberland Borough, Pennsylvania, to $45,824 in Council Bluffs City, Iowa, with the latter community's property value being the fourth lowest among the 50 sample communities.

10.3.2 Local Area Homeowner Impacts

In all of the six communities, premium increases resulting from subsidy elimination would have a substantial negative effect on residential property values. While the communities in Group 2 vary significantly by the various characteristics presented in Table 10.2, all of the communities contain a large concentration of properties with substantial flood risk. For example, more than 25 percent of the residential pre-FIRM structures are at least six below the BFE in all six communities.

Due to the large concentration of pre-FIRM properties six feet or more below the BFE, average premium increases are estimated to be substantial for many residential properties located in the six communities in Group 2. For residential pre-FIRM properties below the BFE, average premiums for the six communities are estimated to increase from $509 to $3,188, an increase of $2,679 as a result of subsidy elimination. Average residential property premium increases for pre-FIRM properties below the BFE range from an estimated $5,949 increase in Louisville City, Kentucky to an estimated $1,077 increase in Marlinton Town, West Virginia.

While the communities in Group 2 contain relatively high concentrations of structures with substantial flood risk, many of these communities contain a considerable proportion of residential properties at or above the BFE. For those residential properties at or above the BFE, actuarial premiums are below subsidized premiums, and these properties would experience premium decreases as a result of subsidy elimination. Except for Council Bluffs City, Iowa, and Marlinton Town, West Virginia, the communities in Group 2 contain a quarter or more of their residential properties at or above the BFE. On average, for the six communities in Group 2, residential premiums for pre-FIRM residential structures at or above the BFE would decrease from $477 to $176, a decrease of $301. Average residential property premium decreases for pre-FIRM properties at or above the BFE range from an estimated $396 decrease in Louisville City, Kentucky, to an estimated $208 decrease in Council Bluffs City, Iowa.

Despite having properties at or above the BFE that would experience premium decreases as a result of subsidy elimination, the relatively large estimated premium increases and property value decreases in the six communities in Group 2 would likely cause significant local area economic impacts. For residential pre-FIRM properties below the BFE, premium increases would be a sizeable share of income for these communities, equaling an estimated ten percent of median household income on average. Within Group 2, the range of premium increases as a percent of median household income ranges from 22 percent in Louisville City, Kentucky to four percent in Council Bluffs City, Iowa. While these large residential premium increases would significantly impact all of the six communities, the impacts would likely be particularly severe in Lower Mt. Bethel Township, Pennsylvania, Grundy Town, Virginia, Louisville City, Kentucky, and Council Bluffs City, Iowa, where median household incomes and property values are relatively low and the total number of SFHA properties is projected to decline over the 1997 to 2022 period.

10.3.3 Local Area Business and Fiscal Impacts

In the six communities in Group 2, the concentration of non-residential properties varies considerably, with the proportion of non-residential to total properties ranging from less than one percent in Lower Mt. Bethel Township, Pennsylvania to about 11 percent in Marlinton Town, West Virginia. In these communities, premiums for non-residential pre-FIRM properties are estimated to increase, on average, from $1,267 to $7,890, an increase of $6,623 as a result of subsidy elimination. For these properties, average premium increases are estimated to range from a $9,273 increase in Grundy Town, Virginia, to a $3,875 increase in Lower Mt. Bethel Township, Pennsylvania.

While the communities in Group 2 contain relatively high concentrations of non-residential structures with substantial flood risk, many of these communities contain a considerable proportion of non-residential properties at or above the BFE which would experience premium decreases as a result of subsidy elimination. On average, for the six communities in Group 2, premiums for non-residential pre-FIRM structures at or above the BFE would decrease from $1,364 to $301, a decrease of $1,063. Average decreases for non-residential pre-FIRM properties at or above the BFE range from an estimated $1,828 decrease in Marlinton Town, West Virginia, to an estimated $552 decrease in Council Bluffs City, Iowa.

Due to the relatively large increases in premiums for non-residential pre-FIRM properties below the BFE, subsidy elimination would substantially affect local area business conditions and employment in the six communities in Group 2. Large increases in average premiums for non-residential pre-FIRM properties located below the BFE would likely have a significant impact on some commercial establishments located in the six communities. Premium increases could account for as much as 12 percent of total business expenses for some commercial establishments. Given this relatively high added cost of doing business, some commercial establishments, particularly small food service, retail, and lodging establishments, could suffer significantly as a result of subsidy elimination. Grundy Town, Virginia, and Marlinton Town, West Virginia would be particularly affected by potential impacts on employment, where local area economic growth is already weak. In these two communities, the employment growth from 1990 to 1997 has been significantly less than the 1.5 percent experienced by the nation as a whole for the same period.

The overall fiscal impacts of subsidy elimination are less severe than the direct impacts on homeowners and businesses located in the six communities, since overall fiscal impacts reflect the combined net effects of all SFHA property value changes in the community, both those properties that experience value decreases as well as those experiencing value increases. Nonetheless, the estimated decreases in local property tax revenues for SFHA structures would be considerable for all of the communities in Group 2. From the reduction of property values due to premium increases, local property tax revenues for SFHA structures are estimated to drop by an average of five percent in 1998, ranging from a drop of seven percent in Lower Mt. Bethel Township, Pennsylvania to a drop of three percent in Marlinton Town, West Virginia. Given the high increased costs imposed on many homeowners and businesses located in these communities, the estimated declines in local property tax revenues would significantly exacerbate the negative effects of subsidy elimination.

10.4 Community Group 3

Table 10.3 presents the selected community characteristics for the six communities classified in Group 3.

Table 10.3
Selected Community Characteristics for Group 3

Community	1998 Pre-FIRM Property Value Change	1998 Pre-FIRM Below BFE Property Value Change	Source of Flooding	1997 Population	Average Annual Change in Number of Properties 1997 to 2022	Median Household Income As % of U.S.	Percent Pre-FIRM Properties	Average Single Family Property Value As % of U.S.	1997 NFIP Participation Rate	Average Local Area Employment Growth 1990-97
Waterford Village, NY	-2.9%	-4.3%	Inland	2,774	0.8%	101%	80%	106%	18%	2.1%
Leavenworth City, WA	-2.8%	-3.7%	Inland	138	1.2%	76%	54%	59%	17%	1.9%
Niagara Town, NY	-2.5%	-5.4%	Inland	895	-0.9%	68%	78%	104%	13%	0.1%
Santa Cruz City, CA	-2.2%	-3.9%	Coastal	12,684	-0.6%	106%	83%	125%	21%	1.4%
Myrtle Beach City, SC	-2.1%	-5.1%	Coastal	4,475	4.8%	83%	36%	105%	51%	3.7%
League City, TX	-2.0%	-3.4%	Coastal	6,105	1.2%	150%	64%	98%	13%	2.7%
Grundy County, IL	-1.9%	-4.3%	Inland	4,697	0.3%	119%	78%	112%	11%	0.5%

Cohasset Town, MA	-1.8%	-3.4%	Coastal	1,477	-0.7%	219%	88%	227%	16%	0.9%
Shreveport City, LA	-1.5%	-4.8%	Inland	13,293	1.5%	73%	68%	36%	98%	4.3%
Pender Village, NE	-1.4%	-2.2%	Inland	1,045	-0.8%	76%	83%	115%	13%	2.0%

10.4.1 Community Characteristics

The ten communities presented in Table 10.3 would experience property value declines between one and five percent in 1998 as a result of subsidy elimination. Three communities in Group 3— Leavenworth City, Washington, Myrtle Beach City, South Carolina, and League City, Texas— contain concentrations of pre-FIRM properties below the national proportion of 65 percent. The remaining seven communities in Group 3 contain concentrations of pre-FIRM properties above the national rate. Four of the ten communities, Santa Cruz City, California, Myrtle Beach City, South Carolina, League City, Texas, and Cohasset Town, Massachusetts experience coastal flooding.

Compared to other community groups, Group 3 has the largest range of current NFIP participation rates. The NFIP participation rate varies from a 98 percent participation rate in Shreveport City, Louisiana (the highest participation rate among the 50 sample communities) to 11 percent in Grundy County, Illinois. Shreveport City, Louisiana, and Myrtle Beach City, South Carolina are the only communities in Group 3 whose NFIP participation rates exceed the national average rate of 26 percent in 1997. The average participation rate for the ten communities is 27 percent in 1997. Many of these communities had low participation rates throughout the 1997 to 2022 period. Since the extent of property value changes is a function of a community's participation rate during the timeframe, many of the communities in Group 3 show relatively moderate declines in property value at the community level.

For most of the communities in Group 3, considerable numbers of flood insurance policies would be cancelled as a result of large premium changes associated with subsidy elimination. In Scenario 1 for example, the immediate shift from subsidized to actuarial rates would cause, on average, a 21 percent reduction in flood insurance policies from 1997 to 1998. Among the ten communities individually, the 1997 to 1998 reduction in policies for Scenario 1 ranges from a high of 44 percent in Cohasset Town, Massachusetts, to a low of one percent in Niagara Town, New York.

Group 3 has a broad range of median household income. Median household income (in 1997 dollars) ranges from $85,730 in Cohasset Town, Massachusetts (the highest median household income among the 50 sample communities) to $26,599 in Niagara Town, New York.

Within Group 3 is the largest variation in the property values for the community groups, reflecting considerable variation in the strength of the local housing markets. For average single family properties, property values range from $273,794 in Cohasset Town, Massachusetts, (the highest among the 50 sample communities) to $43,651 in Shreveport City, Louisiana (the second lowest among the 50 sample communities).

10.4.2 Local Area Homeowner Impacts

Overall, premium increases resulting from subsidy elimination for the ten communities in Group 3 would have a moderate impact on pre-FIRM residential and non-residential property values. But a significant share of residential properties would have relatively large premium increases. For residential pre-FIRM structures below the BFE, premium increases from subsidy elimination would have a significant impact on property values in all communities except Shreveport City, Louisiana. While the communities in Group 3 vary significantly by the various characteristics presented in Table 10.3, six of the ten communities contain a large concentration of properties with substantial flood risk. In Group 3, the communities of Waterford Village, New York, Leavenworth City, Washington, Niagara Town, New York, Grundy County, Illinois, Cohasset Town, Massachusetts, and Pender Village, Nebraska each have more than 25 percent of pre-FIRM structures at least six feet below the BFE. Among the communities in Group 3, Shreveport City, Louisiana, contains the properties with the least flood risk, with no properties at three feet or more below the BFE.

With the relatively large concentration of pre-FIRM properties six feet or more below the BFE for six of the ten communities in Group 3, average premium increases for residential pre-FIRM structures below the BFE are estimated to be substantial for these six communities. In all ten communities, average premiums for these residential properties are estimated to increase from $684 to $3,526, an increase of $2,842, as a result of subsidy elimination. Average premium increases for residential pre-FIRM properties below the BFE range from an estimated $4,368 increase in Grundy County, Illinois to an estimated $104 increase in Shreveport City, Louisiana.

While the communities in Group 3 contain relatively high concentrations of structures with substantial flood risk, all of these communities contain a quarter or more of their residential properties at or above the BFE. On average, for the ten communities in Group 3, residential premiums for residential pre-FIRM structures at or above the BFE would decrease from $645 to $277, a decrease of $368. Average residential property premium decreases for pre-FIRM properties at or above the BFE range from an estimated $790 decrease in Cohasset Town, Massachusetts to an estimated $231 decrease in Shreveport City, Louisiana.

Despite premium decreases for the residential properties at or above the BFE, as a result of subsidy elimination, the relatively large estimated premium increases and property value declines for pre-FIRM properties located below the BFE in the Group 3 communities would likely cause significant local area economic impacts in all communities except Shreveport City, Louisiana. (The premium increases in Shreveport City, Louisiana are relatively small.) For residential pre-FIRM properties below the BFE, premium increases would be a sizeable share of income for these communities, equivalent to an estimated six percent of median household income on average. Excluding Shreveport City, Louisiana, the range of premium increases as a percent of median household income for the communities in Group 3 ranges from 11 percent in Niagara Town, New York to five percent in Santa Cruz City, California. While these large residential premium increases would significantly impact all of the nine communities, the impacts would be particularly severe in Leavenworth City, Washington, and Niagara Town, New York, where median incomes and average property values are relatively low and the total number of SFHA properties is projected to decline (in the case of Niagara Town, New York) or increase at relatively low rates (in the case of Leavenworth City, Washington) over the 1997 to 2022 period.

10.4.3 Local Area Business and Fiscal Impacts

As in Groups 1 and 2, the concentration of non-residential properties varies considerably for the ten communities in Group 3, with the proportion of non-residential to total properties ranging from less than one percent in Leavenworth City, Washington to about 11 percent in Pender Village, Nebraska. In the ten communities in Group 3, average premium increases are significant for non-residential pre-FIRM properties below the BFE. For these types of non-residential properties, premiums are estimated to increase, on average, from $1,525 to $6,798, an increase of $5,273, as a result of subsidy elimination. Average premium increases are estimated to range from a $11,716 increase in Cohasset Town, Massachusetts to a $455 increase in Shreveport City, Louisiana.

While the communities in Group 3 contain relatively high concentrations of non-residential structures with substantial flood risk, many of these communities contain a considerable proportion of non-residential properties at or above the BFE which would experience premium decreases as a result of subsidy elimination. On average, for the ten communities in Group 3, premiums for non-residential structures at or above the BFE would decrease from $1,763 to $481, a decrease of $1,282. Average decreases for non-residential pre-FIRM properties at or above the BFE range from an estimated $2,545 decrease in Myrtle Beach City, South Carolina, to an estimated $623 decrease in Shreveport City, Louisiana.

Overall, subsidy elimination would moderately affect local business conditions and employment in nine of the ten communities in Group 3. Although premium increases are large for some non-residential properties, the relatively small concentration of non-residential, below BFE properties in these communities limit the number of businesses affected.

For those affected non-residential properties, however, premium increases could account for as much as ten percent of total business expenses for some commercial establishments. Given this relatively high added cost of doing business, some commercial establishments, particularly small food service, retail and lodging establishments, could suffer significantly as a result of subsidy elimination. Niagara Town, New York, and Grundy County, Illinois would be most affected by potential impacts on employment, because local area economic growth is relatively weak. Employment growth from 1990 to 1997 in these two communities has been significantly less than the 1.5 percent experienced by the nation for the same period.

The combined net effects of property value changes for both at or above BFE and below BFE SFHA structures result in a net decrease in local property tax revenues, although the decreases are relatively small. As a result of subsidy elimination, local property tax revenues for SFHA structures are estimated to decline by an average of 1.5 percent in 1998 for the communities in Group 3, ranging from a decline of two percent in Waterford Village, New York to a drop of 0.5 percent in Shreveport City, Louisiana. Given their relatively small magnitude, the estimated declines in local property tax revenues would not significantly heighten the negative effects of subsidy elimination.

10.5 Community Group 4

Table 10.4 on the following page presents the selected community characteristics for the 14 communities classified in Group 4.

10.5.1 Community Characteristics

The 14 communities presented in Table 10.4 are estimated to experience an overall property value decline of less than one percent in 1998 as a result of subsidy elimination. Of the 14 communities, seven contain concentrations of pre-FIRM properties below the national proportion of 65 percent. The remaining seven communities in Group 4 contain concentrations of pre-FIRM properties at or above the national rate. Two of the 14 communities, Edenton Town, North Carolina, and New Smyrna Beach City, Florida, experience coastal flooding.

The 1997 NFIP participation is relatively low for the communities in Group 4, with only three communities – Vernonia City, Oregon, Hailey City, Idaho, and Phoenix City, Arizona – at or above the national participation rate of 26 percent in 1997. Four communities – Franklin

Table 10.4
Selected Community Characteristics for Group 4

Community	1998 Pre-FIRM Property Value Change	1998 Pre-FIRM Below BFE Property Value Change	Source of Flooding	1997 Population	Average Annual Change in Number of Properties1997 to 2022	Median Household Income As % of U.S.	Percent Pre-FIRM Properties	Average Single Family Property Value As % of U.S.	1997 NFIP Participation Rate	Average Local Area Employment Growth 1990-97
Garland City, TX	-0.9%	-1.7%	Inland	21,207	0.3%	124%	45%	140%	13%	2.1%
Franklin Township, PA	-0.9%	-2.5%	Inland	4,862	-0.6%	99%	89%	50%	6%	0.8%
Omaha City, NE	-0.7%	-2.0%	Inland	17,037	0.7%	90%	61%	77%	13%	1.7%
Vernonia City, OR	-0.7%	-2.4%	Inland	1,213	0.5%	77%	65%	93%	27%	0.9%
Ephrata City, WA	-0.6%	-2.2%	Inland	2,718	1.0%	82%	82%	47%	21%	3.9%
Hailey City, ID	-0.6%	-1.0%	Inland	409	1.6%	91%	48%	123%	30%	3.9%
Phoenix City, AZ	-0.4%	-1.6%	Inland	82,513	1.7%	97%	58%	65%	25%	4.1%
Bay City, AR	-0.3%	-1.7%	Inland	2,406	0.6%	61%	78%	108%	14%	2.6%
Dolores County, CO	-0.3%	-1.7%	Inland	1,010	1.6%	63%	78%	118%	16%	4.7%
Allen Parish, LA	-0.3%	-1.1%	Inland	7,222	0.8%	53%	82%	43%	7%	6.8%
Edenton Town, NC	-0.2%	-1.2%	Coastal	2,640	0.6%	57%	64%	195%	7%	1.2%
New Smyrna Beach City, FL	-0.1%	-1.2%	Coastal	19,985	1.1%	79%	57%	60%	17%	1.7%
Washington County, OK	-0.1%	-1.0%	Inland	37,385	-0.4%	96%	90%	54%	6%	-1.9%
Petal City, MS	-0.1%	-1.7%	Inland	6,941	0.6%	68%	71%	36%	10%	1.2%

Township, Pennsylvania, Allen Parish, Louisiana, Edenton Town, North Carolina, and Washington County, Oklahoma – have 1997 participation rates below ten percent. For the 14 communities, the average participation rate is only 15 percent in 1997. Since property value changes are a function of the NFIP participation, many of the communities in Group 4, as in Group 3, experience relatively small declines in property value at the community level due, in part, to the relatively low participation rates experienced by these communities throughout the 1997 to 2022 period.

For most of the 14 communities in Group 4, relatively modest numbers of flood insurance policies would be cancelled as a result of large premium changes associated with subsidy elimination. In Scenario 1 for example, the immediate shift from subsidized to actuarial rates would cause, on average, a 15 percent reduction in flood insurance policies from 1997 to

1998. For the 14 communities individually, the 1997 to 1998 reduction in policies for Scenario 1 ranges from a high of 27 percent in Franklin Township, Pennsylvania to a low of 3 percent in Phoenix City, Arizona.

Although all of the 14 communities except Garland City, Texas have median household incomes below the national average, the relative strength of local area housing markets in Group 4 varies significantly, and there is a broad range of property values across communities. For average single family properties, property values range from $235,284 in Edenton Town, North Carolina (the second highest property value among the 50 sample communities), to $43,514 in Petal City, Mississippi (the lowest among the 50 sample communities).

10.5.2 Local Area Homeowner Impacts

Overall, premium increases resulting from subsidy elimination would have a small impact on pre-FIRM residential property values in the Group 4 communities because relatively few properties are exposed to high flood risk. For all of the Group 4 communities except Franklin Township, Pennsylvania and Omaha City, Nebraska, less than two percent of residential pre-FIRM properties are six feet or more below the BFE, and no more than 25 percent of residential pre-FIRM properties are more than three feet below the BFE. In Franklin Township, Pennsylvania and Omaha City, Nebraska, however, more than 25 percent of residential pre-FIRM properties are six feet or more below the BFE, distinguishing these two communities as two areas with relatively high concentrations of high flood risk residential properties.

With the relatively low concentration of properties six feet or more below the BFE for 12 of the 14 communities in Group 4, average premium increases for residential pre-FIRM structures below BFE would be considerably smaller than those for communities in Groups 1, 2, and 3 but would still be significant. For these residential properties, average premiums are estimated to increase from $544 to $1,443, an increase of $899 as a result of subsidy elimination. In Franklin Township, Pennsylvania and Omaha City, Nebraska, premiums for residential pre-FIRM structures below the BFE are estimated to increase by $2,277 and $1,737, respectively.

In addition to relatively low concentrations of properties six feet or more below the BFE, all of the communities in Group 4 contain one-third or more of their residential pre-FIRM properties at or above the BFE. On average, for these 14 communities, premiums for residential structures at or above the BFE would decrease from $522 to $226, a decrease of $296. Average residential property premium decreases for pre-FIRM properties at or above the BFE range from an estimated $430 decrease in Hailey City, Idaho to an estimated $200 decrease in Allen Parish, Louisiana.

For those properties below the BFE, given the relatively modest premium increases for residential pre-FIRM properties below the BFE, premium increases would constitute a moderate share of income for these communities, equivalent to an estimated three percent of median household income, on average, for the 14 communities. In Franklin Township, Pennsylvania and Omaha City, Nebraska, premium increases for residential pre-FIRM structures below BFE would equal six percent and five percent, respectively, of median household income.

The relatively low concentrations of high risk structures and relatively low participation rates limit the effects of residential premium changes for communities in Group 4, despite relatively large premium increases for selected residential properties in these communities. Of all the 14 communities, homeowners in Franklin Township, Pennsylvania, with its substantial concentration high flood risk structures, relatively low average property values, and projected declines in the number of properties over the 1997 to 2022 period, would be the most significantly affected by subsidy elimination.

10.5.3 Local Area Business and Fiscal Impacts

Among the communities in Group 4, the proportion of non-residential properties to total properties averages nine percent, ranging from 12 percent in Allen Parish, Louisiana to five percent in Omaha City, Nebraska. As with residential properties, most non-residential properties in these communities are not exposed to substantial flood risk, limiting the magnitude and effect of premium increases in these communities. For those non-residential pre-FIRM properties below the BFE, premiums are estimated to increase, on average, from $1,222 to $3,490, an increase of $2,268. For properties in Franklin Township, Pennsylvania, premiums are estimated to increase by $12,367, an increase which is particularly large due to the relatively large average size of non-residential properties in this community.

In addition to the communities in Group 4 containing relatively low concentrations of non-residential structures with substantial flood risk, these communities all contain one-third or more of their non-residential pre-FIRM properties at or above the BFE which would experience premium decreases as a result of subsidy elimination. On average, for the 14 communities in Group 4, premiums for non-residential pre-FIRM structures at or above the BFE would decrease from $1,416 to $393, a decrease of $1,023. Average decreases for non-residential pre-FIRM properties at or above the BFE range from an estimated $1,495 decrease in Hailey City, Idaho, to an estimated $619 decrease in Garland City, Texas.

Overall, subsidy elimination would moderately affect local business conditions and employment in six of the 14 communities in Group 4. Although premium increases are large for selected non-residential properties, there is a relatively low concentration of high flood risk, non-residential, pre-FIRM properties in these communities. Consequently, only a small number of businesses located in these communities would experience sizeable premium changes as a result of subsidy elimination. Even for relatively small commercial establishments, premium increases for below BFE pre-FIRM properties would likely account for less than three percent of total business expenses in these communities. The community most affected by potential impacts on employment would be Franklin Township, Pennsylvania where premium increases could significantly impact some small establishments and local area economic growth is relatively weak as highlighted by the fact that employment growth from 1990 to 1997 has been significantly less than the 1.5 percent experienced by the nation for the same period.

Reflecting the combined net effects of property value changes for both above BFE as well as below BFE SFHA structures, the subsidy elimination results in decreases in local property tax revenues which would be relatively small for the 14 communities in Group 4. For all of the 14 communities, the reduction in property values for SFHA structures from subsidy elimination would lower tax revenues by an average of less than 0.5 percent in 1998. Given the relatively small magnitude of the declines, the lower property tax revenues would not have a significant effect in these communities.

10.6 Community Group 5

Table 10.5 presents the selected community characteristics for the 14 communities classified in Group 5.

Table 10.5
Selected Community Characteristics for Group 5

Community	1998 Pre-FIRM Property Value Change	1998 Pre-FIRM Below BFE Property Value Change	Source of Flooding	1997 Popu-lation	Average Annual Change in Number of Properties1997 to 2022	Median House-hold Income As % of U.S.	Percent Pre-FIRM Properties	Average Single Family Property Value As % of U.S.	1997 NFIP Partici-pation Rate	Average Local Area Employ-ment Growth 1990-97
Otero County, CO	0.0%	-1.1%	Inland	11,402	-0.4%	60%	82%	47%	10%	1.8%
Scott County, MO	0.0%	-0.4%	Inland	28,167	-0.3%	69%	80%	54%	9%	0.7%
Augusta City, KY	0.0%	-1.0%	Inland	1,132	0.3%	60%	84%	98%	21%	1.6%
Lewisport City, KY	0.1%	-0.4%	Inland	1,108	1.3%	79%	83%	55%	16%	0.6%
Woodstock Town, NH	0.1%	-1.1%	Inland	719	1.4%	70%	80%	52%	20%	1.6%
Carteret County, NC	0.2%	-1.4%	Coastal	27,015	2.5%	86%	47%	98%	13%	2.8%
Blooming-dale Borough, NJ	0.2%	-0.8%	Inland	1,351	-1.3%	164%	81%	126%	24%	1.0%
Fort Lauderdale City, FL	0.2%	-1.7%	Coastal	176,033	1.5%	91%	65%	158%	33%	2.8%
Jefferson Parish, LA	0.4%	-3.1%	Coastal	240,498	0.9%	93%	72%	88%	49%	2.0%
Vassar City, MI	0.4%	-0.6%	Inland	1,188	0.6%	73%	70%	53%	15%	2.9%
Lane County, OR	0.4%	-1.3%	Inland	24,454	0.2%	84%	81%	95%	12%	2.0%
Lawrence County, SD	0.5%	-0.4%	Inland	766	0.9%	83%	87%	62%	14%	2.5%
New Miami Village, OH	0.8%	0.1%	Inland	7,729	0.4%	83%	74%	105%	7%	2.9%
Sacramento County, CA	1.1%	-2.0%	Inland	74,374	0.2%	107%	56%	58%	14%	0.9%

10.6.1 Community Characteristics

The 14 communities presented in Table 10.5 are those among the 50 sample communities that are estimated to experience no change or overall property value increases as a result of subsidy elimination. Since overall property value changes for a community reflect the net effect of property value decreases for structures experiencing premium increases (the case for most structures below the BFE) and of property value increases for structures experiencing premium decreases (the case for most structures at or above the BFE), the communities in Group 5 reflect those areas in which the positive economic effects of premium decreases have more than offset the negative economic effects of premium increases within a community.

Of the 14 communities in Group 5, all but two – Carteret County, North Carolina and Sacramento County, California – contain concentrations of pre-FIRM properties above the national proportion of 65 percent. Three of the 14 communities, including Carteret County, North Carolina, Fort Lauderdale City, Florida, and Jefferson Parish, Louisiana, experience coastal flooding.

The 1997 NFIP participation rates for Group 5 communities are relatively low, with only two communities, Fort Lauderdale City, Florida, and Jefferson Parish, Louisiana, participating at a rate above the national average. For all of the communities in Group 5, the average participation rate is 17 percent.

For most of the 14 communities in Group 5, relatively few flood insurance policies would be cancelled as a result of large premium changes associated with subsidy elimination. In Scenario 1 for example, the immediate shift from subsidized to actuarial rates would cause, on average, a four percent reduction in flood insurance policies from 1997 to 1998. For the 14 communities individually, the 1997 to 1998 reduction in policies for Scenario 1 ranges from a high of 18 percent in Otero County, Colorado to a low of less than one percent in Sacramento County, California.

Although all but two communities of the 14 (Bloomingdale Borough, New Jersey and Sacramento County, California) contain median household incomes below the national average, the communities in Group 5 reflect considerable differences in local area housing markets, with a wide range of property values. For average single family properties, property values range from $190,358 in Fort Lauderdale City, Florida to $56,373 in Otero County, Colorado.

10.6.2 Local Area Homeowner Impacts

Overall, premium increases for the 14 communities in Group 5 resulting from subsidy elimination would not have a significant impact on pre-FIRM residential property values because relatively few residential properties in these communities are exposed to substantial flood risk. For all of the communities in Group 5, less than two percent of residential pre-FIRM properties are six feet or more below the BFE, and no more than 20 percent of residential pre-FIRM properties are three feet or more below the BFE.

With the relatively low concentration of pre-FIRM properties three feet or more below the BFE for the 14 communities in Group 4, average premium increases for residential pre-FIRM structures below the BFE would be relatively small. For these residential properties, average premiums are estimated to increase from $565 to $912, an increase of $347, as a result of subsidy elimination. The premium increases within the 14 communities range from $725 in Ft. Lauderdale City, Florida, to $86 in Scott County, Missouri. Given these relatively small premium increases, for residential pre-FIRM properties below the BFE, premium increases would be equal to a relatively small share of income for these communities, equal to less than one percent of median household income on average, for the 14 communities. Even in Ft. Lauderdale City, Florida, with the relatively highest premium changes among the communities in Group 5, average premium increases would equal less than one percent of median household income.

In addition to a relatively low concentration of properties six feet or more below the BFE, all of these communities contain forty percent or more of their residential properties at or above the BFE. On average, for these 14 communities, premiums for residential pre-FIRM structures at or above the BFE would decrease from $533 to $243, a decrease of $290. Average premium decreases for pre-FIRM residential properties at or above the BFE range from an estimated $448 decrease in Bloomingdale Borough, New Jersey to an estimated $196 decrease in Carteret County, North Carolina.

Given the relatively low concentrations of high risk residential structures and relatively high concentration of properties at or above the BFE , residential premium increases would not significantly affect the communities in Group 5. Even in communities such as Scott County, Missouri with relatively low median incomes, low residential property values, and projected declines in the number of structures over time, premium increases from subsidy elimination would not be large enough to significantly impact homeowners located in these communities.

10.6.3 Local Area Business and Fiscal Impacts

In Group 5, the proportion of non-residential to total properties averages eight percent, ranging from 13 percent in Carteret County, North Carolina to five percent in Vassar City, Michigan. As with residential properties, most non-residential properties in these communities are not characterized as having substantial flood risk, thus limiting the magnitude of premium increases in these communities. For non-residential pre-FIRM properties below the BFE, premiums for these communities are estimated to increase, on average, from $1,181 to $2,121, an increase of $940.

In addition to the communities in Group 5 containing relatively few non-residential structures with substantial flood risk, these communities all contain forty percent or more of their non-residential properties at or above the BFE which would experience premium decreases as a result of subsidy elimination. On average, for the 14 communities in Group 5, premiums for non-residential pre-FIRM structures at or above the BFE would decrease from $1,327 to $383, a decrease of $944. Average premium decreases for non-residential pre-FIRM properties at or above the BFE range from an estimated $1,257 decrease in Lane County, Oregon, to an estimated $464 decrease in Ft. Lauderdale City, Florida.

Given the high concentrations of non-residential properties at or above the BFE and the relatively small premium increases for those non-residential structures below the BFE, subsidy elimination would not significantly affect local business conditions and employment in the 14 communities in Group 5. For businesses, including small commercial establishments located in the area, premium increases for non-residential properties would likely account for less than one percent of the cost of doing business in these communities. Even in communities with relatively weak employment growth such as Scott County, Missouri, and Lewisport City, Kentucky, potential premium increases would not represent a significant enough share of business expenses to significantly affect business conditions.

Reflecting the combined net effects of property value changes for both above BFE SFHA and below BFE SFHA structures, the fiscal impacts of subsidy elimination would reflect a small net increase in local property tax revenues. For the 14 communities, on average, however, this net property tax increase would average less than 0.2 percent in 1998. Given this slight local property tax revenue increase for SFHA structures, local tax revenue changes due to subsidy elimination would not adversely affect businesses and homeowners located in these communities.

11. The Impacts of Subsidy Elimination on Disaster Assistance Programs

This section describes the economic effects of eliminating the premium subsidy on disaster assistance programs sponsored by FEMA and the Small Business Administration (SBA). The section is organized as follows:

11.1 Introduction

Several programs offered by FEMA and the Small Business Administration (SBA) provide assistance to property owners and communities for relief from flood-related damages as well as for flood hazard mitigation. In this study, the focus was the extent to which utilization of seven specific FEMA and SBA programs might change over the next 25 years, particularly in light of the potential removal of subsidies for NFIP flood insurance premiums.

In general, this discussion does not project the level of use of disaster assistance programs over time. There are many factors which may influence the use of these programs, and many of these factors offset one another.

11.2 Factors Impacting the Use of FEMA and SBA Programs

Estimating the use of the seven programs over the next quarter century is difficult. Numerous factors are likely to impact the use of the programs, including participation rates for NFIP flood insurance; flood mitigation measures taken to prevent flood damage; and the number and composition of properties in the special flood hazard areas (SFHAs). While each of these factors can be projected into the future, the interaction among factors in influencing their impact on the use of FEMA and SBA programs is uncertain. Below is a discussion of these factors in greater detail. The section concludes with a discussion of the potential overall impact these factors may have on the FEMA and SBA programs.

For the purposes of this analysis, it was assumed that the magnitude and frequency of floods, on average, will be equivalent to historical experience, and that the characteristics and administration of the seven programs themselves will not change over the 1997 to 2022 period. The influence that other Federal programs may have on SBA and FEMA programs is outside the scope of this analysis and is not discussed. However, there are likely to be effects on SBA and FEMA programs in the event new forms of disaster assistance are offered, existing programs offering flood relief are changed, or the use of existing programs differs from current levels.

11.2.1 Increase in NFIP Flood Insurance Premiums for Pre-FIRM Properties

Participation rates for pre-FIRM structures drop significantly under the various policy scenarios simulated in this study, because these structures are directly affected by the subsidy elimination scenarios. (Post-FIRM structures are not subsidized; thus, there is no change in their participation rates between the Baseline and any of the subsidy elimination scenarios.)

Participation rates drop because the impacts related to premium increases outweigh the impact of the increased participation among structures at or above the BFE.

The overall impact of the introduction of actuarially based premiums will be affected by the schedule and method with which the new premiums are implemented. For example, the new premiums might be phased in over a number of years or changed all at once; these and other options for implementation would affect the timing of property owners' decisions about federal flood insurance.

In this study, in simulated policy Scenario 1, the participation rates register the largest decline relative to the other scenarios. (In Scenario 1, the premium subsidy is eliminated in full in 1998.) This is because the subsidy change is the most sudden and widespread in this scenario relative to other scenarios.

In Scenario 1, the participation rate for pre-FIRM structures in the SFHA increases from 25.7 percent in 1997 to 29.1 percent in 2022. This is significantly less than the Baseline rate of 37.9 percent reached in 2022. This change in participation reflects the fact that approximately 280,000 flood insurance policy contracts which would have been purchased in the Baseline in 2022 would not be purchased under the Scenario 1 subsidy elimination. In the shorter term, there is a considerably larger divergence between Scenario 1 and the Baseline Scenario. In 2002, for example, approximately 406,000 flood insurance policy contracts which would have been purchased in the Baseline would not be purchased under the Scenario 1 subsidy elimination.

The participation rates for Scenarios 2 through 7 show that the downward impact in participation is less than that of the Scenario 1. The estimates do show, however, that all of the participation rates for Scenarios 1 through 7 converge to similar levels in 2022. For all of the seven policy scenarios, between 250,000 and 280,000 flood insurance policy contracts which would have been purchased in the Baseline in 2022 would not be purchased.

Over the 1997 to 2022 period in Scenario 1, on average, about 359,000 insurance policy contracts per year which would have been purchased in the Baseline would not be purchased. For Scenarios 2 through 7, about 275,000, 225,000, 296,000, 344,000, 344,000, and 331,000 insurance policy contracts which would have been purchased in the Baseline in 2022 would not be purchased, respectively. In general, the relatively large number of policy contracts that would be purchased in the Baseline but not purchased under the various policy scenarios suggest potentially large increases in exposed flood losses as a result of subsidy elimination.

The structures affected by these contracts reflect those which would not apply for disaster assistance in the Baseline if they were flooded because of their adequate flood insurance. Uninsured property owners, however, who incur flood damage are far more likely to use disaster relief programs than those who maintain flood insurance. Given the potentially large exposed losses for structures dropping out of the NFIP as a result of increasing premiums, particularly for those properties with substantial flood risk, it is clear that subsidy elimination would have substantial consequences on SBA and FEMA non-insurance programs offering flood assistance.

11.2.2 Factors and Trends Leading to Reduced Usage of SBA and FEMA Programs

A number of factors are likely to reduce reliance on FEMA and SBA programs. The factors are of two types: those leading to a greater percentage of property owners obtaining insurance and those that would lessen the risk of flood damage, either through better floodplain development decisions and construction or improved community preparation for floods. These variables are considered separately below, although they will be likely to interact.

Increase in number of homes and businesses with NFIP flood insurance

Since those who are insured against floods are likely to need far less, if any, disaster assistance than those without NFIP insurance, an increase in the percentage of property owners with NFIP insurance among the properties at risk of suffering flood damages could decrease reliance on FEMA and SBA relief programs. An increase in the percentage insured could stem from advertising of flood insurance and improved compliance.

All else being equal, awareness of the benefits of and requirements for NFIP flood insurance could increase the numbers of those insured. Initial results from FEMA's recent campaign suggest that advertising similar in scope and message to the recent effort is likely to have a positive but very small impact on the numbers of insured. As yet, no data is available on the retention rate of new purchasers gained through the campaign.

The National Flood Insurance Reform Act contains provisions intended to encourage compliance with flood insurance regulations. Among other requirements, it imposes new obligations on mortgage originators and servicers, including mandatory escrow requirements for flood insurance and mandatory provisions for "forced placements" of flood insurance, and requires that lenders deny loan applications or exercise sanctions if the applicant or borrower refuses to obtain coverage. The 1994 legislation also requires flood victims seeking assistance from SBA to obtain flood insurance and to continue to purchase it for the life of their SBA loan; if property owners drop the insurance and suffer flood damage again, they will be ineligible for another SBA loan. However, the law does not prevent property owners from accessing any of the many other relief programs available to flood victims. Furthermore, the past percentage of those that have purchased NFIP insurance in order to access other flood relief funds and then dropped out one year later is nearly 100 percent according to FEMA officials. This may be lessened somewhat by the new provision making property owners ineligible for a second SBA loan if they drop their insurance, but the historical ratio suggests that ongoing maintenance of flood insurance will likely not occur among all borrowers in SBA's flood relief programs. Overall, increased compliance is unlikely to have a significant impact on the use of SBA and FEMA programs in the short term (five years) but will have a gradual impact in the long term (25 years).

Decrease in likely property damage

SBA and most FEMA flood relief programs are accessed only in the event that a flood has occurred and caused damage to a building, home, or community. If the risk of damage to structures and communities is reduced, it follows that fewer property owners and communities will turn to flood relief programs. Two related trends, improved construction and floodplain management, and improved preventative measures, suggest property damages will decrease in the future.

While the development of new homes and businesses in flood prone areas continues, particularly in coastal areas, stronger regulations are in place governing the construction of new properties and location of properties with respect to flood risk. Construction in coastal areas is much improved. In inland areas, location decisions regarding new structures have improved as well. As post-FIRM properties begin to comprise a larger percentage of all properties in the SFHA, it is likely that fewer uninsured home and business owners will need to rely on FEMA and SBA relief programs.

Furthermore, since the majority of properties experiencing severe flood damage each year are pre-FIRM, a decrease in the numbers of pre-FIRM properties will likely lead to fewer losses and, therefore, less reliance on SBA and FEMA relief programs. As pre-FIRM properties are demolished, moved, or upgraded to become post-FIRM properties, the percentage of pre-FIRM properties will diminish.

However, two issues reduce the effect of improved construction and the loss of pre-FIRM properties. First, the removal of pre-FIRM properties from flood hazard areas is expected to occur very slowly, at about 1.1 percent of remaining stock per year. Second, while standards may have increased, it is also true that there are simply more properties, particularly in coastal areas, and the considerable growth rate of development could potentially offset the effect of better construction.

Increases in the levels of planning and activities to mitigate flood risk will also reduce the potential for property damage and the resulting use of SBA and FEMA relief programs. These efforts may be carried out in response to a flood to prevent future losses, or may be performed more proactively before flooding ever occurs. The availability of FEMA's Flood Mitigation Assistance (FMA) and Hazard Mitigation Grant Program (HMGP), programs that encourage activities to reduce the risk of damage from future floods, might serve to encourage these measures at greater rates in the future. However, the FMA is a relatively small program, offering only $20 million per year to a number of communities, and flood mitigation expenses per property are relatively high. Therefore, a small number of properties are actually affected each year even if all available funds are utilized, and the overall impact is limited.

11.3 Impact on SBA and FEMA Programs

The seven SBA and FEMA programs considered in this analysis differ significantly in their purposes and characteristics, as well as the ways in which they are used in practice by individuals and communities. However, the programs can be grouped into categories of programs sharing similar characteristics:

- SBA loans to home and business owners
- FEMA programs to assist local governments in recovering and carrying out basic functions in the wake of a flood
- FEMA programs for reduction of flood hazards

Potential changes in the use of these three types of programs are described below.

11.3.1 SBA Home and Business Loans

SBA's Home Disaster Loan Program and Business Disaster Loan Program are likely to face increased use given an increase in the NFIP flood insurance premium. Using the assumption that those covered by flood insurance will not be in need of these programs in the event of flood damage, it follows that if fewer properties (particularly those at greatest flood risk) do not have insurance, the use of alternative forms of assistance, such as SBA's disaster loan programs, will rise.

However, this effect is likely to be at least partially offset by several of the other variables described above. FEMA's awareness campaign and increased compliance should lead to higher rates of insurance, and subsequently, less need for SBA's programs. Improved construction and floodplain development decisions, as well as the gradual reduction in the number of pre-FIRM properties, should have an initially small effect but result in a moderate long-term trend away from the use of the programs. The impact of the availability of the HMGP and FMA programs on the use of SBA's loan programs is more difficult to estimate. The use of the FMA program could help some communities prepare to avoid future losses from flood damage, as could the use of HMGP funds to strengthen, elevate, or move properties after a flood. However, the magnitude of these effects is difficult to assess given that the number of communities receiving assistance is small, the monetary amount is relatively small, and the extent to which it will help uninsured property owners avoid future damage and the consequent use of SBA home and business disaster loans is uncertain.

The future use of SBA's Economic Injury Disaster Business Loan program is even more difficult to assess. The program aids businesses with no other sources of credit in maintaining reasonable working capital during the period affected by a flood. NFIP insurance does not provide such coverage, and business owners may attempt to secure an SBA loan even if they are insured against flood damage. Therefore, participation in NFIP flood insurance is likely to have a minimal impact on this program. Improved floodplain development decisions, construction, and any previous non-structural mitigation performed with HMGP funds probably will not lead to a significant reduction in the use of the SBA's economic injury program since the injury may not be preventable by an individual business; if a surrounding community suffers significant damage, a business could suffer disruption of its business without actually incurring physical damage. It is therefore likely that the economic injury program will experience the least change in use of the three SBA programs.

11.3.2 FEMA Public Assistance and Community Disaster Loan Programs

FEMA's Public Assistance Program provides grants to help state and local governments, as well as some nonprofit organizations, respond to floods through the removal of debris, implementation of emergency protective measures, restoration of public facilities and infrastructure, and mitigation of the impact of future floods. FEMA's Community Disaster Loan Program helps local governments suffering loss of taxes and other revenues as a result of disasters. There is little evidence to suggest that the usage of these programs will change markedly over the next 25 years given the variables described earlier. The rate at which property owners obtain and retain NFIP flood insurance does not effect the ability of governments to operate or the fact that clean-up and repairs or rebuilding of public property may be necessary. Improved construction standards are likely to have minimal impacts as well, since most government buildings benefit from stronger construction and are likely not placed in the most flood prone areas (such as on a shoreline) at the same rate as private property. However, the use of HMGP and FMA funds to protect public property or take measures to mitigate risks to either public property or the community at large could decrease the need of state and local governments to access Public Assistance and Community Disaster Loans. The magnitude of the effect depends on the rate at which the HMGP and FMA program allocations are utilized to protect public property and the number of communities able to access their benefits.

11.3.3 The Hazard Mitigation Grant Program and Flood Mitigation Assistance

The HMGP and FMA programs encourage activities that lessen the risk from future floods. HMGP grants are given in response to specific floods and are received by states, which then distribute funds to communities that apply through the state; FMA grants are received by states and distributed to communities. The HMGP program was authorized in 1988 by the

Robert T. Stafford Disaster Relief and Emergency Assistance Act, and the FMA was authorized in the 1994 National Flood Insurance Reform Act; their short histories make their future use difficult to estimate. If, however, the programs are initially used in response to a specific flood to mitigate future damage, or simply to undertake action to prevent future damage from a flood, the use of the programs could increase in the short-term due to the potential of increased uninsured losses under a subsidy elimination scenario. However, if the programs are used to successfully mitigate future flood losses, the use of HMGP funds to respond to future floods could gradually lessen over time. The same could be true of the FMA program, although it need not be used in response to a specific flood and its use might therefore experience less variation over time.

11.3.4 Other Considerations

The scope of this analysis did not include an investigation into the use of the seven programs by specific populations of property owners or specific communities. However, each program has specific eligibility guidelines that will impact *who* will use the program over the next 25 years and how the distribution of those accessing funds may change over the years. For example, FMA and HMGP are only available to NFIP communities, and SBA loans are restricted to those meeting credit requirements (and, in the case of economic injury loans, to those who have no alternative sources of credit). The "user-friendliness" of each program is also a consideration; the ease and speed with which individuals and communities can access funds will impact their use of various programs.

Appendix A: The Premium Calculator

This appendix provides a detailed description of the Premium Calculator. The appendix is structured as follows:

Introduction and Overview presents a general description of the Premium Calculator and its purpose in the study.
Modeling Approach describes the overall design of the Premium Calculator.
Subsidy Elimination Scenarios reviews the seven scenarios for elimination of the premium subsidy.
Cell Structure describes the attributes and assumptions used to categorize premium estimates.
Replacement Cost Calculations details the methods for calculating replacement costs for both surveyed and non-surveyed communities.
Premium Calculations describes the methodology used to determine subsidized and actuarial flood insurance premiums for surveyed and non-surveyed communities.

11.4 Introduction and Overview

The purpose of the Premium Calculator is to calculate the replacement cost, the subsidized flood insurance premiums, and the actuarial flood insurance premiums for various classes of structures in the 50 sample NFIP communities. These outputs are then provided to the Property Valuation Model (PVM) and Insurance Demand Model (IDM). The PVM uses the outputs to model the effect changes from subsidized to actuarial premiums have on property values in the 50 sample communities. The IDM uses the outputs to capture the effect changes in premiums have on the demand for flood insurance.

To accomplish this goal, the Premium Calculator uses detailed structural data collected during the elevation surveys, housing cost information, and flood insurance premium rates. The calculator computes the replacement cost, subsidized annual premium, and actuarial annual premium for each of the surveyed structures. Using the results at the structure level, the replacement costs and premiums for all types of structures are imputed for each of the 50 sample communities.

The Premium Calculator is not a predictive model. Its function is limited to calculating subsidized and actuarial premiums based on current flood insurance rate assumptions and the structural data collected by the survey teams. The PVM and IDM use the current subsidized and actuarial premiums to model the seven premium subsidy elimination scenarios over a 25-year model period. At FEMA's instruction, no calculations to test the actuarial soundness of the premium changes were performed for the seven scenarios.

11.5 Modeling Approach

The Premium Calculator operates at the cell level. Instead of modeling the change in premium at the individual structure level, one cell represents categories of structures that share common attributes. The cell categories include the critical structural and flood risk attributes necessary to calculate premiums. The structure level data collected from the 23 surveyed communities are used to define assumptions and estimate premium rates for categories of structures in each of the 50 communities. These results are then tested by comparing estimated cell results to actual results at the structure level.

A cell structure is necessary in the Premium Calculator because the three primary models in this study (the IDM, PVM, and Property Simulation Model (PSM)) operate at the cell level. In addition, since the Premium Calculator provides outputs to two of these models, it is important that the cell categories be consistent with the overall structure of these models.

The Premium Calculator requires inputs from several sources. Survey data provide detailed structural characteristics needed to compute both replacement cost and premiums. The Premium Calculator also uses the Marshall & Swift *Residential Cost Handbook* to determine housing costs (Marshall & Swift, 1997). Subsidized and actuarial premium rates, as well as coverage and rate assumptions, were furnished by FEMA for the calculation of premiums.

11.6 Subsidy Elimination Scenarios

The PVM and IDM use the outputs from the Premium Calculator to model the seven premium subsidy elimination scenarios. The Premium Calculator provides the subsidized premium, actuarial premium, and replacement cost for each cell in 1997, and the two models simulate movements from subsidized to actuarial premiums over time through the seven scenarios.

If the subsidy elimination results in a lower insurance premium, the participant will begin paying the lower premium immediately in 1998, under all seven scenarios. This is applicable to some structures with low risk and low expected losses, whose subsidized premiums are higher than the actuarial premiums. Currently, these structures are only eligible for actuarial premiums if an elevation certificate is obtained. In this case, the overall study approach assumes that all pre-FIRM structures will obtain elevation certificates under the seven scenarios; thus, these structures will observe a premium decrease. (See Section 1.4)

If the subsidy elimination results in a higher premium, the increase is phased in according to the specific scenario. Following are brief descriptions of the seven scenarios used to capture the options for eliminating the flood insurance premium subsidy for these pre-FIRM structures. The scenarios do not necessarily represent policies the NFIP is considering implementing.

Baseline

This scenario serves as a point of comparison for the seven subsidy elimination scenarios. All participating structures continue paying the current premium and have the same insurance coverage for the entire period from 1997 to 2022. Pre-FIRM structures that are not elevation rated pay the subsidized premium for all 25 years. Pre-FIRM structures that are elevation rated and post-FIRM structures pay the actuarial premium for all 25 years.

Scenario 1

This scenario eliminates the premium subsidy through an immediate premium change in 1998. For structures with a lower actuarial premium, the premium will decrease to the actuarial premium in 1998. For structures with a higher actuarial premium, the premium will increase to the actuarial premium in 1998.

Scenario 2

This scenario eliminates the premium subsidy gradually over a period of 10 years. For structures with a lower actuarial premium, the premium will decrease to the actuarial premium in 1998. For structures with a higher actuarial premium, the premium will increase steadily with an equal annual percentage growth rate for each of the 10 years from 1998 to 2007. At the end of this 10-year period, the premium will reach and remain at the actuarial rate.

The equation for the premium in any model year t from 1998 to 2007 is:

$$PREMIUM_t = SUB.\ PREM \times [(ACT.\ PREM / SUB.\ PREM)^{(1/10)}]^{(t-1997)}$$

where SUB. PREM is the subsidized premium and ACT. PREM is the actuarial premium.

Scenario 3

This scenario eliminates the premium subsidy gradually over a period of 20 years. For structures with a lower actuarial premium, the premium will decrease to the actuarial premium in 1998. For structures with a higher actuarial premium, the premium will increase steadily with an equal annual percentage growth rate for each of the 20 years from 1998 to 2017. At the end of this 20-year period, the premium will reach and remain at the actuarial rate.

The equation for the premium in any model year t from 1998 to 2017 is:

$$PREMIUM_t = SUB.\ PREM \times [(ACT.PREM / SUB.\ PREM)^{(1/20)}]^{(t-1997)}$$

Scenario 4

This scenario eliminates the premium subsidy when ownership of the structure changes or the structure is refinanced. For structures with a lower actuarial premium, the premium will decrease to the actuarial premium in 1998. For structures with a higher actuarial premium, the premium will increase to the actuarial premium when the structure is sold or refinanced.

Scenario 5

This scenario eliminates the premium subsidy with a combination of deductible increases and premium changes. For structures with a lower actuarial premium, the premium will decrease to the actuarial premium in 1998. For structures with a higher actuarial premium, the increase in deductible takes place immediately upon renewal. The deductible increases from the current $1,500 total ($750 building and $750 contents deductibles) to 15 percent of total insurance coverage. The premium change component eliminates any subsidy remaining after the deductible increase over five years with an equal annual percentage growth rate for each of the five years from 1998 to 2002.

The effects of this scenario are determined through the following steps:

1. Estimate the deductible

Table A.1
Insurance Deductibles by Structure Type for Scenario 5

Structure type	Deductible as a percent of replacement cost
Single Family	15.24%
Multiple Family	10.80%
Hi-Rise Condominium	14.40%
Manufactured Housing	15.24%
Non-Residential	13.05%

These numbers are the result of assumptions received from FEMA concerning insurance coverage. For example, a single family structure is assumed to purchase building coverage equal to 80 percent of replacement cost and contents coverage equal to 27 percent of building coverage. Thus, total coverage is 101.6% = 80% + (80% x 27%) of replacement cost. For this example, a deductible which is 15 percent of total coverage will be 15.24% = 101.6% x 15% of replacement cost.

For each structure, the replacement cost is multiplied by the deductible as a percent of replacement cost to determine the dollar amount of the deductible.

2. Identify the correct percentage change in the premium

Using the NFIP Claims Database which contains flood insurance claims from 1979 to 1995, a loss elimination ratio (LER) table was developed. The LER table presents ranges of deductibles and their equivalent percent changes in premiums. Use of this table assumes that consumers are rational and are indifferent between a deductible increase and its corresponding premium increase. Using the value of the deductible calculated in step 1, the correct percentage change in the premium is taken from the LER table. This percentage is applied to a portion of the actuarial premium.

3. Apply the percentage change to the premium

The premium comprises two components: the premium cost and the expense fee. The expense fee is fixed in the premium calculation at $250 for hi-rise condos and $75 for all other structures (FEMA, April 1996).

The following process applies the percentage change to the premium:

Begin with the actuarial premium
Subtract the expense fee to calculate the actuarial premium cost
Multiply the percentage premium increase by the actuarial premium cost
Add the dollar amount of premium increase to the entire subsidized premium

If the increase in deductible causes an effective premium increase beyond the actuarial premium, the premium is capped at the actuarial premium.

4. Apply the remainder of the subsidy elimination

Once the premium effectively increases due to the increased deductible, the new premium will be greater than the subsidized premium. The difference between this new premium and the structure's actuarial premium will be eliminated through an actual premium change over the period from 1998 to 2002. This actual premium change will be modeled through equal percentage changes in each of the five years, in the same way as Scenarios 2 and 3.

Scenario 6

This scenario eliminates the premium subsidy with a combination of deductible increases and premium changes. For structures with a lower actuarial premium, the premium will decrease to the actuarial premium in 1998. For structures with a higher actuarial premium, the increase in deductible takes place immediately upon renewal. The deductible increases from the current $1,500 total ($750 building and $750 contents deductibles) to 3 percent of total insurance coverage. The premium change component eliminates any subsidy remaining after the deductible increase over five years with an equal annual percentage growth rate for each of the five years from 1998 to 2002.

The effects of this scenario are determined in the same way as in steps 1 to 4 of Scenario 5, with the exception of the deductible calculations used in step 1. In this scenario, the deductible calculations shown in Table A.2 are used rather than those shown previously in Table A.1.

Table A.2
Insurance Deductibles by Structure Type for Scenario 6

Structure type	Deductible as a percent of replacement cost
Single Family	3.05%
Multiple Family	2.16%
Hi-Rise Condominium	2.88%
Manufactured Housing	3.05%
Non-Residential	2.61%

Scenario 7

This scenario eliminates the premium subsidy with a combination of a coverage change and premium changes. For structures with a lower actuarial premium, the premium will decrease to the actuarial premium in 1998. For structures with a higher actuarial premium, the coverage change takes place immediately upon renewal. If a structure is damaged by a flood, the NFIP will only pay for builders grade materials and materials to make the structure habitable. This coverage change only affects above average quality structures since builders grade materials are assumed to be of average quality (Marshall & Swift, 1997). The premium change component eliminates any subsidy remaining after the coverage change over five years with an equal annual percentage growth rate for each of the five years from 1998 to 2002.

The effects of this scenario are determined through the following steps:

1. Calculate the percentage of above average structures in a community

The percentage of structures that are above average quality were determined by community and structure type.

The percent of structures in communities that are above average quality varies by income level are shown in Table A.3.

Table A.3
Percent of Above Average Structures by Type and Community Income Level

Structure Type	Low Income	Medium Income	High Income
Single Family	16%	21%	26%
Multiple Family	15%	15%	15%
Hi-Rise Condominium	0%	0%	22%
Manufactured Housing	0%	0%	2%
Non-Residential	25%	25%	25%

2. Determine the increase in deductible

The deductible increase is a function of structure type and the replacement cost. Using builders grade materials decreases the building coverage of an above average structure by 35 percent. Therefore, the deductible effectively increases by 35 percent of the building coverage.

For example, a structure with $100,000 of building coverage will now have $65,000 of building coverage, and the deductible will effectively increase by $35,000.

Table A.4
Deductible Increase as a Percent of Replacement Cost for Scenario 7

Structure type	Deductible increase as a percent of replacement cost
Single Family	28%
Multiple Family	21%
Hi-Rise Condominium	28%
Manufactured Housing	28%
Non-Residential	21%

Again, these percentages are derived from assumptions regarding insurance coverage. For example, a single family structure will have building coverage equal to 80 percent of replacement cost. If the deductible increases by 35 percent of building coverage, the deductible increase as a percent of replacement cost will be 28% = 80% x 35%.

For each above average structure, the deductible increase as a percent of replacement cost is multiplied by the replacement cost to calculate the actual deductible increase.

3. Determine the effects of the deductible increase

The final deductible a structure pays is the deductible increase from step 2 plus the current $1,500 total deductible (the sum of the $750 building and $750 contents deductibles). The effects of this increased deductible level are determined using the same method as in steps 2 to 4 of Scenario 5.

11.7 Cell Structure

As described earlier, the Premium Calculator is a "cell-based" model. The cell structure of the Premium Calculator classifies structures by seven characteristics:

Occupancy type
Number of floors
Presence or absence of a basement
Flood zone
Elevation difference
Age
FIRM classification

The following is a description of each cell characteristic and the assumptions used in the Premium Calculator to assign cell categories to specific insurance rate classifications.

Occupancy Type

The five occupancy types are consistent with the other three models in this study: single family detached, multiple family attached, hi-rise condominium, manufactured housing, and non-residential. Multiple family attached is assumed to be "Other Residential" for the purpose of assigning premium rates.

Number of Floors

The number of floors is divided into three categories: one floor (single family detached), two floors (single family detached), and other. The category "other" is used for the four remaining occupancy types (multiple family attached, high-rise condominium, manufactured housing, and non-residential). All cells that are not single family detached are not classified according to the number of floors. However, the premium rates for all structures are classified by the structure's number of floors. These rates are in two categories: one floor and two or more floors. Certain model assumptions regarding the number of floors for these structures were used to assign premium rates to the cells of the four other occupancy types. By definition, hi-rise condos are three or more floors, and manufactured housing is generally one floor. However, multiple family and non-residential structures can be either one floor or two or more floors. For these two occupancy types, the premium rates for one floor and two or more floors were averaged.

Presence of Basement

Cells are classified by the presence or absence of a basement. A structure with a basement generally has a lower actuarial premium than a structure without a basement, all other things being equal, including the elevation difference. This is because NFIP policies do not provide full coverage for a structure's basement finishings and contents.

Flood Zone

The flood zones include A or V zones. Cells for inland communities only lie in A zones, and coastal communities have a combination of the two zones. All A zones are assumed to be AE (the most common zone in the survey data), and all V zones are assumed to be VE.

Elevation Difference

The Premium Calculator recognizes four categories of elevation difference: 0 and above; -1 and -2; -3, -4, and -5; and -6 and below. However, a specific elevation difference for each cell is necessary to determine the actuarial premium rates to use for the cell. The structure data from the 23 surveyed communities were used to estimate an elevation difference for each cell. The individual surveyed structures were organized into unique groups according to three characteristics:

Basement status – presence or absence of a basement
Depth of flooding in the community – shallow, medium, or deep
Location of the community – inland or coastal

For each of these groups, the average elevation difference weighted by the number of pre-FIRM structures in the community and the community's national weight was calculated. This average elevation difference was then applied to all cells with the same characteristics in all 50 communities. For example, a cell with a basement in an inland community with medium depth of flooding was assumed to have the same elevation difference as the weighted average of all surveyed structures with these same three attributes.

For the 23 surveyed communities, the average elevation difference of all surveyed structures was calculated by the four elevation categories in each individual community. If there were three or more surveyed structures in an elevation category in a particular community, this community average was used as the elevation difference, rather than the weighted average described above. This was done in order to retain community-specific elevation characteristics and maintain accuracy in the premium calculations.

Age

There are three age categories: less than 20 years, 20 to 50 years, and more than 50 years. This characteristic is not used in the calculation of replacement cost or premiums but was retained to remain consistent with the cell structure of the PVM.

FIRM Classification

All cells are classified as either pre-FIRM or post-FIRM.

11.8 Replacement Cost Calculations

The purpose of the replacement cost calculator is to determine the replacement cost for each surveyed structure in the 23 surveyed communities and each cell within the 50 sample communities. The replacement cost data are vital to calculation of the premiums because the subsidized and actuarial premiums depend on the amount of insurance coverage chosen for the structure. This coverage level in turn depends on the replacement cost of that structure.

The specific structure data collected for the 23 elevation surveyed communities were used to estimate a replacement cost at the structure level. The communities contained between 58 and 1,236 surveyed properties. The structure level information included the property's flood zone; the approximate square footage and overall building quality of the structure; the purpose of the structure (e.g., single family home, business, etc.); and other attributes such as exterior and roofing materials, presence of a garage or fireplace, and number of floors. The replacement cost calculator uses all of these characteristics to determine the unique replacement cost for each structure. Section 4 of this report details the collection of these data.

The Marshall & Swift *Residential Cost Handbook* was referenced to calculate the replacement cost for each structure based on its characteristics (Marshall & Swift, 1997). This replacement cost derived from Marshall & Swift is the cost of replacing the structure with a new, identical structure and does not account for depreciation of the structure. The handbook contains the value of a building per square foot for various types, qualities and sizes of structures. The square foot cost of a structure depends upon:

Type of structure
Number of floors
Quality
Exterior materials
Total square footage
Type of business (if non-residential property)

The total square foot measurement was then multiplied by the appropriate cost per square foot to determine the basic value of each structure. From this basic value, the replacement cost can increase or decrease depending on other structural characteristics:

Roofing materials
Presence and size of a garage
Presence of a fireplace
Presence and size of a basement

Cell Level Replacement Costs

To calculate a subsidized and actuarial premium at the cell level, it was necessary to estimate a replacement cost at the cell level. As described above, replacement costs determine the amount of coverage. To determine the replacement cost for each cell in each of the 50 sample communities, values were imputed using the replacement cost estimates at the structure level. The procedures used to estimate replacement cost rely on the technique used to estimate property values in the PVM. As described in Appendix D, the property value is a function of land value, structure value, and community-specific attributes. The replacement cost information is closely tied to structure value. An econometric relationship between replacement costs and property values was estimated using structure level property values provided by Experian and local tax assessor offices.

Property Values = f(median property value, population growth, construction index, replacement costs)

Estimates at the county level for median property value, population growth, and a construction index from the U.S. Bureau of Economic Analysis Regional Economic Measurement Division were used (U.S. Department of Commerce, June 1998). The construction index used as a dependent variable is the average wage per job for the construction industry for that county. This equation was estimated for each structure type including single family detached homes, multiple family attached homes, hi-rise condominiums, manufactured homes, and non-residential structures.

The relationship between property values and replacement costs allowed for estimating property values for all of the 7,628 structures that were surveyed and for imputing property values at the cell level. Once the property values for each cell in the 50 sample communities were estimated, the relationship among property values, replacements costs, and the other dependent variables defined above was used to estimate a replacement cost for each cell.

11.9 Premium Calculations

Inputs

The Premium Calculator was designed to calculate the subsidized and actuarial premiums at both the structure and cell level. The results of the replacement cost calculator were used in addition to the survey data. The subsidized and actuarial premiums are a function of:

Replacement cost
Type of structure
Flood zone
Number of floors
Presence of a basement
Elevation difference of the structure's lowest floor

The last five characteristics determine the appropriate premium rates for each structure or cell. These rates are then applied to the insurance coverage, which is a portion of the replacement cost.

Assumptions

FEMA provided several assumptions regarding flood insurance coverage levels and subsidized and actuarial premium rates, which are shown in Table A.5. In terms of actual insurance coverage, the coverage levels depend on the type of structure and the replacement cost for the individual structure.

Table A.5
Insurance Coverage Assumptions

Occupancy Type	Building Coverage as Percent of Replacement Cost	Contents Coverage as Percent of Building Coverage
Single Family	80%	27%
Multiple Family	60%	20%
Hi-Rise Condominium	80%	20%
Manufactured Housing	80%	27%
Non-Residential	60%	45%

These coverage amounts are subject to standard NFIP program limits on coverage.

For the insurance rates appropriate to each class of structure, FEMA specified the subsidized and actuarial rates for all types of structures in both A and V zones. These subsidized rates depend upon:

Type of structure
Number of floors
Presence of a basement
Flood zone

The actuarial rates depend upon all of the above factors as well as elevation difference of the building's lowest floor relative to the BFE. All of these characteristics were contained in the structure level survey data. To generalize to the cell level, certain assumptions were made, which are described in the cell structure discussion in Section A.4.

The rates provided by FEMA for estimating the actuarial premiums for pre-FIRM structures were a combination of rates computed specifically for this study using the NFIP's current actuarial rate methodology and rates culled from existing rate tables in the NFIP agents' manual and in the underwriting guidelines used to rate post-FIRM buildings below the BFE. It was intended that the actuarial rates be accurate enough so that the economic effects of the premium changes could be reasonably assessed. In order to facilitate the model development, simplifying assumptions were necessary in selecting the rates to be used in the study. If the decision were made to charge all pre-FIRM structures actuarial premiums, it is anticipated that a more refined set of rate tables would be applied.

Calculations

Using the replacement cost, coverage level, and premium rates for each surveyed structure, the annual subsidized and actuarial insurance premiums were calculated for every surveyed property. The building and contents rates differ so these two premiums were calculated separately. The final subsidized and actuarial premiums were obtained by summing the building premium, contents premium, expense constant, and federal policy fee. (The expense constant and federal policy fee are flat fees applied to every NFIP policy, regardless of FIRM status. FEMA specified the assumption that these costs remain constant for the next 25 years.)

The Premium Calculator calculates both a subsidized and actuarial premium for each type of structure (defined by the cell properties) for all cells in the 50 sample communities. These premiums are then provided to the PVM and the IDM. The process for calculating premiums at the cell level is the same as the process at the structure level once specific assumptions about the cells are made.

Both subsidized and actuarial insurance premium rates need to be assigned to each of the cells. The actuarial rates provided by FEMA primarily depend on the elevation difference, which is given in whole numbers. Since the assumed elevation difference for the cells was an average and generally not a whole number, intermediate actuarial rates were calculated for each cell. For a given cell, this intermediate rate was interpolated using the rates of the two closest elevations for the class of structure described by that cell. For example, the rate for a cell with an average elevation difference of -6.4 would be 40 percent of the rate for a -7 elevation difference plus 60 percent of the rate for a -6 elevation difference.

Once the appropriate subsidized and actuarial premium rates for each cell were determined, the cells' replacement costs and the same insurance coverage assumptions discussed above were used to calculate the amount of coverage for each cell. The premium rates were then applied to this coverage amount to establish the annual premiums on the building and contents of each structure type under both subsidized and actuarial conditions. To estimate the final annual subsidized and actuarial premiums, each cell's building premium, contents premium, federal policy fee, and expense constant were summed. These finalized premiums were then passed to both the PVM and the IDM.

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Appendix B: The Insurance Demand Model

This appendix provides a detailed description of the flood insurance demand model. It includes a discussion of the model assumptions, the data sources used to estimate model parameters, and how the policy scenarios were modeled. This appendix is structured as follows:

- Introduction and Overview presents a general description of the Insurance Demand Model and its purpose in the study.
- Modeling Approach reviews the methodology and modeling framework in the model.
- Model Assumptions and Data Sources identifies the assumptions used in the model and data limitations and discusses the data sources and how they were used.
- Modeling of Policy Scenarios discusses how the seven scenarios for elimination of the premium subsidy were modeled.

B.1 Introduction and Overview

The flood insurance demand model (IDM) estimates the percentage of structures in the Special Flood Hazard Area (SFHA) that have flood insurance. Structures are defined as buildings (as opposed to properties). The flood insurance policies are counted as one policy per structure, which is consistent with a policy contract definition. These participation rates are estimated for each year of the study (1997 to 2022) and for each NFIP community in the study sample and are used in the Property Valuation Model (PVM). The participation rates are sensitive to changes in the flood insurance premium; thus, the model outputs vary for the different premium subsidy policy scenarios.

The demand for flood insurance is a function of several different factors. These include:

- The price of flood insurance (i.e., the premium)
- Federal regulations and their effectiveness
- The elevation difference of a structure (the difference between the lowest floor and the base flood elevation)
- Historical trends in policy purchases
- The marketing of flood insurance
- Risk perception

The IDM captures many of these concepts, with much of the emphasis on historical trends in policy purchases and the price of flood insurance premiums. Historically, structures in the SFHA have been underinsured relative to risks for floods. However, federal legislation on mandatory flood insurance purchase requirements (MPR) passed in 1973 and 1994 has aimed to clarify the responsibilities of lenders and broaden coverage to certain mortgage servicers or mortgage guarantors. The legislation applies to loans for improved real property in the SFHA either made by federally-regulated lenders; loans purchased by the government-sponsored entities (GSEs) Fannie Mae or Freddie Mac; or loans insured or guaranteed by the Federal Housing Administration (FHA), the Veteran's Administration (VA), or the Small Business Administration (SBA). SFHA structures whose loans are owned by federally-regulated lenders or backed by GSEs or federal guarantors must be adequately insured for flood risks. The legislation also requires that, for loans originated after October 1994, federally-regulated lenders and GSEs must escrow flood insurance payments if the loan has an escrow account for other purposes. To simulate when and how the MPR apply to structures, the model includes detail on the percent of structures that have loans, information on whether or not the loans are owned by a federally regulated lender or backed by a GSE, and escrow status (FEMA, 1997).

B.2 Modeling Approach

This section describes the modeling approach for different categories of structures, the impacts of flood insurance premium changes, and the effects of flooding on insurance demand. The structures are divided into different categories in the model, because they are affected by different flood insurance purchase drivers. Since loan status is a significant determinant in estimating flood insurance purchases, the structure population for a model year is divided into three categories: (1) structures with new loans; (2) structures with existing loans; (3) and structures without loans. The section is organized as follows:

General Description of Model Flows
Loan Status of Structures
Modeling the Effects of a Change in Flood Insurance Premiums
Modeling the Effects of Flooding on Insurance Demand
Calculating Participation Rates
Model Outputs Used in the Next Model Year

1.1.1 General Description of Model Flows

The IDM employs a decision tree structure based on the flood insurance demand drivers and estimates the number of structures at the community level that are affected by these drivers. Figure B.1 provides a high level display of the types of flood insurance purchases among structures considering purchasing flood insurance for the first time (as opposed to renewing). A significant trigger for the application of the MPR is a structure's loan status. In Figure B.1, structures are divided into three categories to reflect their loan status— structures with loans from a federally-regulated lender or guaranteed by a GSE or federal guarantor, structures with loans from non-federally-regulated lenders, and structures without loans. Structures with new loans that are federally-regulated or backed by a GSE or a federal guarantor are subject to the MPR. These types of structures are the most likely to purchase flood insurance, relative to other potential buyers. Structures with loans that are not federally-regulated and structures without loans are not subject to the MPR; thus, these types are less likely to buy insurance. New insurance purchases among these structures in the model are driven by a response to marketing efforts. Structures with loans that are not federally-regulated may also be forced to purchase insurance if their lenders require flood insurance.

Figure B.2 shows a detailed version of the model flows for a group of structures for a single model year. The structures are divided into different categories based on characteristics or attributes related to flood purchase decisions. Each of these characteristics or attributes is assigned a percentage reflecting the proportion of affected structures based on recent data or assumptions. As a group of structures "moves" down the tree, the population of structures is broken down into smaller groups by multiplying by the percentages.

insert figure B-1

insert figure b-2

The model uses a cell-based framework to allow for greater detail in modeling the different structure types and the impacts of the MPR. The model data are contained in cells where each cell contains a group of structures that share similar characteristics. For each community, the IDM cells categorize structures by FIRM classification, basement, elevation difference, and structure type. The structure types include: (1) single family detached; (2) multiple family attached; (3) high-rise condominium; (4) manufactured housing; and (5) non-residential structures. The data for condominiums reflect condominium structures. A single condominium structure may contain multiple condominium units.[1] These five structure types are consistent with the five structure types used in the PVM and the Property Simulation Model (PSM).

The cell definition used in the IDM is less detailed than that of the PVM and PSM. In addition to the four attributes mentioned above, the cell definition in the PVM and PSM also considers differences in the condition of structures and the age of structures. These attributes are not used in the IDM cell structure because the model assumptions used in the IDM are not differentiated among these attributes.

The model flows begin on the left of Figure B.2, where the total number of SFHA structures for the community and cell attributes are identified. The number of structures in a cell is then split into two groups— structures with loans and structures without loans. This split is based on the proportions associated with loan status. For example, 60 percent of all structures have loans, while 40 percent do not have loans. The model then calculates the number of structures with loans and the number of structures without loans. This process of generating the count of structures occurs at each branch level in the decision tree.

The model contains the same decision tree for each cell in a sample community, but some of the proportion values vary among communities. The proportions are used to estimate the participation rates for each year from 1997 to 2022.

B.2.2 Loan Status of Structures

Loan status is a key driver for NFIP participating communities in estimating flood insurance purchases that result from the MPR. First, structures with loans are separated into structures with new loans and structures with existing loans. These two sets are needed because they are driven by different factors. New loans are estimated by taking into account all new structures, a portion of existing structures that are sold, and loans that are refinanced. The new loans are then subdivided into those loans affected by the MPR and those that are not. Loans that are affected by the MPR are then broken down into those that comply with the MPR and those that are not in compliance. Historically, compliance for all loans affected by the MPR has not been high; thus, the model does not assume that all loans affected by the MPR will comply.

The model then estimates the number of SFHA structures with new loans that have escrow accounts. Different portions of these structures and structures without escrow accounts are then assumed to be flood insurance purchasers.

The model does allow for flood purchases among structures which are not in compliance. This segment includes structures in the SFHA which have been recognized incorrectly as being outside the SFHA by lenders and GSEs. These structures may purchase flood insurance in response to the National Flood Insurance Program's (NFIP) flood insurance marketing

[1] This definition is consistent with "contract-in-force" policy counts, i.e., an insurance policy for each structure. Many condominiums units may be covered by a single contract-in-force or master policy.

campaign, Cover America. The campaign consists of televised commercials, advertisements in print media and direct mailings.

Structures with existing loans are separated into those which had flood insurance in the previous year and those that were uninsured. Structures that were insured in the previous year are multiplied by a policy retention rate to identify the number of structures that renew their policies.

Structures that did not have flood insurance in the previous year are then categorized by the type of lender or mortgage servicer or mortgage guarantor to identify structures that are affected by the MPR. A portion of the structures that are subject to the MPR and are uninsured may be forced to purchase insurance by their lenders or mortgage servicers or guarantors. This is known as force placement. Other uninsured structures may purchase insurance based on the effect of flood insurance marketing efforts. Likewise, structures with existing loans that are not subject to the MPR and did not have insurance in the previous year may purchase insurance based on the effects of marketing.

Structures without loans are not subject to the MPR. Thus, these structures purchase insurance at rates based only on policy retention and marketing.

B.2.3 Modeling the Effects of a Change in Flood Insurance Premiums

One of the last steps in estimating the number of flood insurance purchases in a model year is incorporating the effects of a change in flood insurance premium rates. The model simulates a change in the demand for flood insurance in response to a change in the flood insurance premium. If there is no change in the premium, the number of flood insurance policy purchases is not altered. If certain buyers are affected by a premium change, the model applies a price elasticity factor. The price elasticity is a measure of how sensitive consumers are to a change in price. The price elasticity factor reflects the percentage decrease in demand resulting from a one percent increase in the price of a product or service. If the premium increases, the demand for flood insurance is reduced accordingly.

B.2.4 Modeling the Effects of Flooding on Insurance Demand

The IDM is designed to incorporate the effects of flood events on participation rates. During a flood year, the participation rate in a community is adjusted upward to reflect the increase in flood insurance policies that are sold in the aftermath of a flood. Flood victims applying for federal aid generally need to purchase a flood insurance policy in order to qualify for aid. The level of the adjustment is a function of the historical level of flood insurance participation in a community with respect to flood events. Also, since many policies purchased under these circumstances are not renewed, the retention rate is adjusted for the year following a flood for an affected community.

B.2.5 Calculating Participation Rates

Once all the segments of structures have been separated by various attributes related to flood insurance purchases using the percentages for different characteristics, and any price elasticity effects have been applied, the participation rates for each cell are calculated. The flood insurance purchases are summed and then divided by the original number of structures in the cell for the given model year. These data are then passed to the PVM.

B.2.6 Model Outputs Used in the Next Model Year

Prior to running the next model year, the model updates the age distribution of loans for the structures in each cell. The model tracks the age distribution of loans in order to adjust for structures which are in the 30^{th} year of their loan and converts these to structures without loans in the following model year. Structures covered by federally-regulated loans or GSEs, or federal guarantors, are not required to purchase flood insurance once their loans are paid off.

B.3 Model Assumptions and Data Sources

The model relies on various assumptions and inputs from the PSM and the Premium Calculator. The discussion of the model assumptions and data sources includes the following topics:

Model Inputs
1996 Starting Position Data
Loan Data
Mobility Rates
MPR Compliance
Escrow Account
Flood Insurance Marketing
Flood Adjustment Factors
Elevation Ratings
Price Elasticities
National Participation Rate Constraints

B.3.1 Model Inputs

The IDM inputs include structure counts from the PSM, premiums from the Premium Calculator, and certain 1996 data for some lagged variables in the model. The PSM provides annual structure counts for each community with detail for FIRM classification, structure type, and elevation difference. These data are also broken down into new and existing structures.

The IDM also uses the premium data estimated by the Premium Calculator. The premium data are assigned to cells based on FIRM classification, presence of basement, and elevation differences. Since basement data attributes were not included in the attributes for the PSM structure counts, the basement data were estimated using the data from the 7,628 surveyed SFHA structures. This methodology is discussed in Appendix D.

B.3.2 1996 Starting Position Data

The IDM uses some 1996 data to capture the effects of lagged data on the first model year, 1997. The model relies on lagged data to estimate the number of policies that are renewed. The 1996 participation rates were estimated using policy and structure data. SFHA policies for 1996 were taken from FEMA policy data. Policies for structures in A and V flood zones were considered to be SFHA policies. The SFHA structure counts were estimated using Q3 data and survey data from the engineering firm Dewberry & Davis, FEMA's Community Information System data, and U.S. Department of Commerce census data. (See Section 3, The Sample of Structures, for more information.) Table B.1 shows the participation rate data based on the SFHA policy and structure data.

Table B.1 on the following page shows the 1996 participation rates for pre-FIRM and post-FIRM structures in the SFHA for the 50 sample communities included in this study. This table show that the 1996 participation rates for the 50 sample NFIP communities are distributed across a broad range, with a low of 0.0 percent to a high of 98.5 percent. The data were tested for correlation between the 1996 participation rates and the seven characteristics used to design the NFIP sample. The seven characteristics include: percent of community land area in the floodplain; urban/rural status; population growth rate between 1990 to 1995; per capita income; source of flooding; depth of flooding; and percent of total structures in SFHA that are pre-FIRM. This analysis showed that the combination of the depth of flooding and source of flooding showed significant correlation with 1996 participation rate levels. Coastal communities with deep or medium depth of flooding tended to have above average participation rates. The analysis did not show any other statistically significant relationships.

The policy data for the community level were reviewed for 1994 to 1996 to see if the 1996 policy totals varied significantly from data for 1994 and 1995. Two communities—Vernonia City, Oregon and Marlinton Town, West Virginia— had policy totals in 1996 that were significantly higher than those in the previous years, suggesting that the 1996 totals had increased because of flood activity. Interviews with floodplain management personnel in the communities confirmed this hypothesis. Because of these flooding events, the 1997 participation rates for these communities were adjusted in the model. Because many of the flood victims in these communities were not expected to renew their policies, a lower retention rate was applied to these communities in 1997.

Using the national weights (described in Section 9), these community participation rate data were extrapolated to a national participation rate of 28 percent for all SFHA structures and a participation rate of 25 percent for pre-FIRM SFHA structures for 1996.

Data for 1996 are also used for the age distribution of loans. Loan data from FHA for 1996 were used to estimate the number of loans for each year of origination. These data are used to estimate the age distribution of loans in the model year 1997 by aging the 1996 distribution. Thus, for example, 30 year loans which were 29 years old in 1996 become 30 years old in the model year 1997. In the model year 1998, these structures are assumed to have paid their loans off and are classified as structures without loans.

B.3.3 Loan Data

Loans are assumed to have a 30 year term. The model assumes that structure owners with loans can refinance their loans. The rate of refinancing is sensitive to interest rates; however, since the model does not forecast interest rates, the rate of refinancing was estimated by taking an average across interest rate cycles and professional judgment by PricewaterhouseCoopers' Housing Finance Group. The model assumes that 4.5 percent of all loans (excluding new loans in a model year) are refinanced each year.

The model also uses assumptions regarding the breakdown between mortgaged structures and structures without loans. For structures that are sold in a model year, 80 percent of the structures are assumed to have loans. This is based on information from the Census Bureau's American Housing Survey's Components of Inventory Change for 1980 to 1993 (U.S. Department of Commerce, 1996). The other structures are separated into mortgaged structures and structures

Table B.1
1996 Participation Rates for Pre-FIRM and Post-FIRM Structures in the SFHA

Community	State	1996 Participation Rate for Pre-FIRM Structures in the SFHA	1996 Participation Rate for Post-FIRM Structures in the SFHA
All NFIP Study Communities		28.2%	25.2%
Phoenix City	AZ	24.3%	3.4%
Bay City	AR	11.5%	7.4%
Sacramento County	CA	10.7%	5.5%
Santa Cruz City	CA	19.0%	13.3%
Dolores Town	CO	14.3%	3.3%
Otero County	CO	7.2%	0.0%
Fort Lauderdale City	FL	36.7%	21.5%
New Smyrna Beach City	FL	16.2%	48.0%
St. Petersburg Beach City	FL	86.5%	64.6%
Hailey City	ID	32.4%	52.1%
Grundy County	IL	7.6%	5.1%
Council Bluffs City	IA	19.2%	7.3%
Augusta City	KY	20.2%	2.8%
Lewisport City	KY	14.0%	11.2%
Louisville City	KY	20.0%	3.6%
Allen Parish	LA	4.3%	1.8%
Jefferson Parish	LA	50.3%	70.1%
Shreveport City	LA	98.5%	52.1%
Cohasset Town	MA	11.9%	3.3%
Vassar City	MI	12.6%	1.4%
Petal City	MS	7.2%	1.0%
Scott County	MO	5.9%	8.9%
Omaha City	NE	9.6%	2.9%
Pender Village	NE	10.9%	9.1%
Woodstock Town	NH	18.0%	0.0%
Bloomingdale Borough	NJ	22.5%	10.8%
Lincoln Park Borough	NJ	28.0%	2.3%
Niagara Town	NY	10.3%	1.3%
Waterford Village	NY	14.4%	2.5%
Carteret County	NC	10.5%	9.5%
Edenton Town	NC	4.1%	6.9%
New Miami Village	OH	2.0%	0.1%
Washington County	OK	1.8%	0.0%
Lane County	OR	9.4%	9.5%
Vernonia City*	OR	26.6%	20.2%
Franklin Township	PA	2.9%	1.4%
Glen Rock Borough	PA	83.6%	21.3%
Lower Mount Bethel Township	PA	82.3%	8.1%
New Cumberland Borough	PA	26.8%	4.3%

Myrtle Beach City	SC	55.1%	20.7%

Table B.1 (continued)
1996 Participation Rates for Pre-FIRM and Post-FIRM Structures in the SFHA

Community	State	1996 Participation Rate for Pre-FIRM Structures in the SFHA	1996 Participation Rate for Post-FIRM Structures in the SFHA
Lawrence County	SD	12.3%	5.1%
Brookside Village	TX	19.8%	9.8%
Garland City	TX	8.8%	2.1%
League City	TX	9.8%	47.9%
Grundy Town	VA	41.4%	1.5%
Ephrata City	WA	19.5%	7.5%
Leavenworth City	WA	14.4%	7.3%
Marlinton Town*	WV	32.9%	4.5%
Philippi City	WV	35.6%	8.8%
Wheeling City	WV	28.5%	2.1%

* Communities that experienced flooding in 1996.

without loans by using percentages based on data taken from the 1990 Census at the county level. The Census data provide the number of mortgaged housing units and total housing units. The percent of all structures with loans for each sample NFIP community is shown in Table B.2. Note that the rates presented in Tables B.1 and B.2 for all NFIP study communities, developed using the community level statistical weights, were not used in the study and are for comparison purposes only.

In the model, the loans are further subdivided into loans that are subject to the MPR and those which are not. Loans subject to the MPR include: loans from federally-regulated lenders; loans purchased by government-sponsored entities such as Fannie Mae and Freddie Mac; and loans guaranteed by FHA, the SBA, or the VA. About 99 percent of all structure loans are through federally-regulated lenders. Only home purchases through contracts for deeds (e.g., a builder offers a loan to a buyer) are not federally-regulated, as well as structures without loans. As of 1996 loans held by GSEs accounted for about 61 percent of all loans. These percentages were obtained from interviews with staff at the Mortgage Bankers Association, Fannie Mae, and Freddie Mac, and were reviewed by members of the Housing Finance Group at PricewaterhouseCoopers.

Structure loans that are not from federally-regulated lenders or backed by GSEs or federal guarantors are estimated to be about one percent. (This is based on subtracting out loans that are subject to the MPR from all loans.) Non-federally-regulated lenders may also require borrowers to purchase flood insurance in order to reduce the default risks.

B.3.4 Mobility Rates

The model assumes that a certain portion of structures are sold each year. This percentage is based on county level data from the 1980 and 1990 Census and is referred to as the mobility rate (U.S. Department of Commerce, 1982; U.S. Department of Commerce, 1992). The model calculates the number of structures sold by multiplying the mobility rate by the total number of structures. These percentages are constant throughout the period 1997 to 2022. Table B.3 shows the mobility rates used in the model. Note that the mobility rate presented in this table for all NFIP study communities, developed using the community level statistical weights, was not used in the study and is for comparison purposes only.

Table B.2
Percent of Structures with Loans in 1990 in the SFHA

Community	State	% with Loan	% without Loan
All NFIP Study Communities		62%	38%
Phoenix City	AZ	79%	21%
Bay City	AR	63%	37%
Sacramento County	CA	80%	20%
Santa Cruz City	CA	75%	25%
Dolores Town	CO	61%	39%
Otero County	CO	51%	49%
Fort Lauderdale City	FL	79%	21%
New Smyrna Beach City	FL	65%	35%
St. Petersburg Beach City	FL	63%	37%
Hailey City	ID	69%	31%
Grundy County	IL	58%	42%
Council Bluffs City	IA	61%	39%
Augusta City	KY	47%	53%
Lewisport City	KY	59%	41%
Louisville City	KY	66%	34%
Allen Parish	LA	37%	63%
Jefferson Parish	LA	70%	30%
Shreveport City	LA	71%	29%
Cohasset Town	MA	71%	29%
Vassar City	MI	58%	42%
Petal City	MS	55%	45%
Scott County	MO	59%	41%
Omaha City	NE	34%	66%
Pender Village	NE	70%	30%
Woodstock Town	NH	62%	38%
Bloomingdale Borough	NJ	76%	24%
Lincoln Park Borough	NJ	64%	36%
Niagara Town	NY	57%	43%
Waterford Village	NY	72%	28%
Carteret County	NC	54%	46%
Edenton Town	NC	50%	50%
New Miami Village	OH	71%	29%
Washington County	OK	58%	42%
Lane County	OR	71%	29%
Vernonia City	OR	65%	35%
Franklin Township	PA	60%	40%
Glen Rock Borough	PA	57%	43%

Table B.2 (continued)
Percent of Structures with Loans in 1990

Community	State	% With Loan	% Without Loan
Lower Mount Bethel Township	PA	63%	37%
New Cumberland Borough	PA	47%	53%
Myrtle Beach City	SC	60%	40%
Lawrence County	SD	53%	47%
Brookside Village	TX	65%	35%
Garland City	TX	73%	27%
League City	TX	58%	42%
Grundy Town	VA	33%	67%
Ephrata City	WA	61%	39%
Leavenworth City	WA	62%	38%
Marlinton Town	WV	39%	61%
Philippi City	WV	41%	59%
Wheeling City	WV	46%	54%

Table B.3
Mobility Rates By NFIP Sample Community

Community	State	Mobility Rate
All NFIP Study Communities		8%
Phoenix City	AZ	10%
Bay City	AR	9%
Sacramento County	CA	11%
Santa Cruz City	CA	9%
Dolores Town	CO	9%
Otero County	CO	6%
Fort Lauderdale City	FL	9%
New Smyrna Beach City	FL	10%
St. Petersburg Beach City	FL	8%
Hailey City	ID	17%
Grundy County	IL	7%
Council Bluffs City	IA	6%
Augusta City	KY	8%
Lewisport City	KY	8%
Louisville City	KY	6%
Allen Parish	LA	6%
Jefferson Parish	LA	5%
Shreveport City	LA	7%
Cohasset Town	MA	5%
Vassar City	MI	6%

Table B.3 (continued)
Mobility Rates By NFIP Sample Community

Community	State	Mobility Rate
Petal City	MS	6%
Scott County	MO	7%
Omaha City	NE	7%
Pender Village	NE	4%
Woodstock Town	NH	7%
Bloomingdale Borough	NJ	5%
Lincoln Park Borough	NJ	6%
Niagara Town	NY	6%
Waterford Village	NY	8%
Carteret County	NC	9%
Edenton Town	NC	5%
New Miami Village	OH	9%
Washington County	OK	8%
Lane County	OR	10%
Vernonia City	OR	7%
Franklin Township	PA	4%
Glen Rock Borough	PA	7%
Lower Mount Bethel Township	PA	5%
New Cumberland Borough	PA	7%
Myrtle Beach City	SC	10%
Lawrence County	SD	10%
Brookside Village	TX	8%
Garland City	TX	8%
League City	TX	7%
Grundy Town	VA	5%
Ephrata City	WA	8%
Leavenworth City	WA	8%
Marlinton Town	WV	6%
Philippi City	WV	4%
Wheeling City	WV	5%

B.3.5 MPR Compliance

The model uses assumptions for the level of expected compliance with the MPR. The compliance assumptions consist of two parts— (1) MPR compliance among loans that are newly issued and (2) the annual rate at which existing non-compliant loans are forced to purchase insurance, a practice known as force placement. New loans subject to the MPR are expected to have high levels of compliance relative to existing loans because it is easier for banks to integrate compliance checks and collect relevant flood risk information on a structure during the procedures for issuing new loans versus revisiting loans which are already on the books. Also, some banks originally believed that the MPR only applied to new loans and have been delayed or slower in addressing compliance among existing loans.

Future compliance with MPR is expected to increase relative to historical levels, reflecting the stiffer penalties included in the 1994 Reform Act, but it is difficult to estimate how much compliance will increase. Given the newness of the Act, the data capturing policy sales trends in the post-1994 era are limited. Also, some banks are still in the process of starting or stepping up their compliance measures, and there is some uncertainty as to how well these measures will reduce all non-compliance. These factors have contributed to difficulty in estimating the future trends for MPR compliance.

Data on MPR compliance was limited to an interim report to Congress summarizing compliance with the 1994 Reform Act. The report, entitled "Compliance with the National Flood Insurance Program," was the only source based on reported data as opposed to professional judgment. The 1994 Reform Act requires the Federal Reserve Board and other federal banking regulatory agencies to report to Congress biennially for the four years following enactment of the Act. The September 1997 report reflecting activity between September 1, 1996 and June 30, 1997, summarized the findings of Federal Reserve examiners. The summary included the total number of state member banks cited for violating the MPR but did not indicate the number of loans found in violation. Since the violations were reported at the bank level and not at the loan level, the data cannot be used to assess the extent of violations throughout the industry, which is needed for the IDM.

Various sources were considered in developing the compliance rate assumptions including: regulators, banking industry members and management at flood zone determination companies. The three groups provided very different ranges for future compliance levels. The federal regulators indicated that compliance would be high within the next few years, after lenders and GSEs have become more familiar with the MPR and adopted procedures that address checking for adequate flood insurance coverage for structures in the SFHA. The perspective from banking industry members was that compliance is not very high under current market conditions and that lenders are under competitive pressures in their markets. This competition makes it difficult for lenders in compliance to compete with lenders who are not complying.

Representatives from flood zone determination companies were interviewed because these companies provide services to verify if a structure is in or out of the SFHA. These companies are hired by lenders (and sometimes by regulators) to check the SFHA status of structures financed by federally-regulated loans. Interviews with management at flood zone determination companies suggested that compliance will not increase over time. Members in this industry felt that the current MPR are not strong enough to drive compliance rates upward.

Based on these interviews and professional judgment from FEMA, 50 percent of new loans subject to the MPR for SFHA structures are assumed to purchase flood insurance in the year the loans are issued. In the following years, renewals occur at a rate equal to the retention rate generally used in the model. SFHA structures that are not covered by flood insurance in the origination year of the loan are then subject to being force placed in subsequent years. The weighted average of new loan compliance is 50 percent. However, compliance is higher among SFHA structures significantly below the BFE and lower among SFHA structures close to the BFE level. SFHA areas with structures with "deep" depth of flooding are believed to have greater risk perception, which is known to and understood by lenders, and thus these structures are assumed to have higher compliance rates relative to other structures.

The model assumes that a portion of existing loans that are not in compliance are force placed each year. In each model year, the loans that are non-compliant (excluding those that originated in the model year) are identified, and 20 percent of the loans in this category are force placed. This 20 percent figure is an average based on interviews with regulators, FEMA staff, and members of the flood zone determination companies. This rate is high, reflecting the need for the lending industry to "catch-up" and have their existing loans checked for SFHA status. Force placement is expected to occur in response to stepped up efforts by federal banking regulatory agencies including MPR components in their bank examinations. Policies purchased under force placement conditions are retained in the following year at rates consistent with retention rates in the model.

B.3.6 Escrow Accounts

The percentage of escrowed accounts was based on information from the Housing and Urban Development Agency (HUD) and the PricewaterhouseCoopers Housing Finance Group. A report by HUD's Policy Development and Research office, using statistically sound survey methods, found that 78 percent of single family owner-occupied homes had escrow accounts (U.S. Department of Housing and Urban Agency, 1992). This percentage, reported in a 1992 study entitled "Escrow Management for Single Family Residential Properties: Phase II Report on Servicers," was based on a survey conducted in 1990. Interviews with various housing experts, including staff of the PricewaterhouseCoopers Housing Finance Group, regarding potential sources for this assumption indicated that this study was the best available source.

B.3.7 Retention Rates

The average weighted retention rate in the model is assumed to be 90 percent. Policyholder data from FEMA suggested that 95 percent of purchasers were renewing their policies for a two year period from 1994 to 1996. The data were aggregated to the national level. Given the data limitations and the fact that the detailed data were limited to two years, the 95 percentage was considered to be high by FEMA staff. The adjusted retention rate of 90 percent was based on a compromise between the 95 percentage and other retention data based on FEMA policyholder data from 1993 to 1996 for individual communities. FEMA staff agreed that a level of 90 percent was reasonable for use in the model. The retention rates were differentiated across the different elevation categories to allow for increased retention rates among structures with higher flood risks, where the weighted average for all structures was 90 percent.

B.3.8 Flood Insurance Marketing

The Federal Insurance Administration (FIA) launched an education and awareness marketing program to increase awareness of flood risks and the availability of flood insurance among consumers, small business owners, and insurance industry members. A significant component of this program is the marketing campaign, Cover America. Cover America helps facilitate flood insurance purchases through direct marketing mechanisms by providing information on *how* to buy insurance but does not conduct direct flood insurance sales via the response mechanisms. FIA's marketing program targets consumers, lenders, agents, Write-Your-Own (WYO) insurance companies[2], and other NFIP stakeholders using four general methods:

Training
Publications and technology
Relationships, conferences and speaking engagements
Special projects, research and reports

FIA offers seminars and workbooks on recent policy changes for lenders. To target WYO companies, FIA also sponsors workshops and seminars for insurance agents highlighting new legislation and program changes.

To target consumers and small business owners, FIA supports Cover America, which began in October 1995. The Cover America campaign sponsors television commercials and print advertisements across the U.S. (and is not limited to or focused on the SFHA). The campaign has also sent direct mailings to 675,000 households. Cover America aims to increase awareness of flood insurance and flood risk and generate leads for insurance agents. All advertisements direct viewers to contact their insurance agent or call a toll-free number to get more information. Insurance companies have reported an increase in phone calls about flood insurance since Cover America's started in October 1995. Over 670 insurance companies and agents have participated in the advertising co-op program, under which the company and FIA co-sponsor ads, and have experienced an increase in flood insurance policy sales.

The model assumptions for FIA's marketing of flood insurance were based on data from the NFIP Marketing Division and the policy retention data received from FEMA. The Marketing Division provided summary data on Cover America based on a survey measuring the impact of the campaign. Since the campaign was distributed evenly across the U.S. without any differences related to SFHA status, many of the percentages from the summary data were taken from the population at large. Where possible, data were restricted to SFHA structures. Most of the detailed information focused on respondents who had seen the commercials.

The summary data for the first two years concluded that approximately 15 percent of consumers and 18 percent of business decision makers indicated they had seen the televised commercials and print advertisements. Of the individuals who had seen the commercials and advertisements, five percent of consumers and three percent of business decision makers took action to get more information about flood insurance. Of the persons who called the NFIP toll-free number to inquire about more information, 6.84 percent were identified as actually purchasing flood insurance and living in the SFHA. This 6.84 percent was derived by FEMA by matching addresses of callers who dialed the phone number advertised to the addresses of individuals who purchased flood insurance. The summary data did not include the same level of detail for the insurance purchase rate among the print media respondents or consumers contacting their insurance agents directly, so the model assumes that this rate of purchase would be comparable to those calling the toll-free number.

Since the model requires more detail than that observed in the summary data provided by the marketing division, the percentages provided by the Marketing Division reflecting the population at large are assumed to be an accurate reflection of sampling restricted to SFHA structures. It is possible that some of these percentages related to responses might be higher

[2] Write-Your-Own insurance companies are licensed property and casualty insurance companies that sell national flood insurance under an arrangement with the federal government. The federal government retains all risks associated with these policies.

in the SFHA areas (relative to the entire U.S.), because these individuals may realize their risks are higher relative to those persons outside of the SFHA. Using percentages from the general population to reflect SFHA populations may result in underestimating the impact of marketing in the SFHA; however, the percentages from the general population reflect the most detail available.

To estimate the total number of residential structures and non-residential structures which purchase flood insurance as a direct result of the Cover America campaign, these different percentages were multiplied as follows:

Residential structures 0.051% = 15% x 5% x 6.84%

Non-residential structures 0.037% = 18% x 3% x 6.84%

Thus, only 0.051 percent of the total number of consumers in the SFHA and 0.037 percent of non-residential structures in the SFHA purchased flood insurance as a direct result of the Cover America campaign. This means that about 5 out of 10,000 residential structures in the SFHA will inquire about more information and purchase insurance because of the advertising campaign.

Since the Cover America campaign will be funded for the next five years and will probably be funded thereafter, its impact is expected to increase in the next few years. Information on how these parameters of 0.051 percent and 0.037 percent might change over time was not available. In the model, the marketing penetration is assumed to improve by 20 percent within five years, and then stay constant for the remainder of the modeling period. This would result in an increase to 0.061 and 0.044 percent, respectively, by 2001.

An independent evaluation of the Cover America campaign, conducted by Gallup and Robinson (an advertising and market research firm), completed in February 1999, indicates that "almost certainly, increased media spending would result in improved results in attitudes and outcomes." Gallup and Robinson looked at data covering the period October 1995 through June 1998, and these data show that the campaign has had a more significant impact. According to Gallup and Robinson, "The results show that the Cover America campaign has achieved its stated objectives. Awareness and attitudes have been influenced. Additionally, flood insurance policies increased 22.3 percent during the campaign period evaluated, which was 8.2 percent higher than expected growth."

The model also captures the effects of the marketing program (Cover America and the other education and flood risk awareness programs) through the policy retention rate. The retention rate has increased since steadily since 1994, reflecting both the MPR and increased awareness of flood risks. Because the retention data are not detailed, the significance of the marketing program on retention could not be measured; however, FEMA staff have indicated that the marketing program has been a significant contributor to sustaining and increasing the policy retention rate in recent years.

B.3.9 Flood Adjustment Factors

The flood adjustment factors are used to increase the participation rates in communities which are hit by floods. The participation rate increase in a flood year reflects additional policies sold to individuals applying for federal relief. These factors were estimated using FEMA policy-in-force retention data for Hurricane Hugo, the March 1993 floods in Florida, and the 1993 Midwest floods. Since the data for the 1993 Midwest floods are significantly different from the other two datasets, the data were not averaged.

This retention data from FEMA were used to analyze an increase in the percentage of policies purchased in months where floods hit (relative to months preceding the flood event) and a decrease in the renewal rate 12 months after a flood event. The decrease in the renewal rate in a year following a flood indicates that policyholders who purchased insurance to qualify for federal relief requirements did not renew their policies even though they may be required to do so under federal law. The magnitude of these percentage increases and decreases varies significantly between (1) the Hurricane Hugo and March 1993 Florida floods and (2) the 1993 Midwest floods. Table B.4 compares the annual growth rates for policy sales prior to and after a flood event for areas affected by Hurricane Hugo, the March 1993 floods in Florida, and the 1993 Midwest floods.

Communities struck by Hurricane Hugo and the March 1993 Florida floods did not show significant changes in policy sales between the pre-flood period and the post-flood period. Policy sales increased after the events by a few percentage points. But data for the 1993 Midwest floods show that the annualized growth in policy sales increased from 7.8 percent to 269 percent. The moderate growth in policy sales following Hurricane Hugo and the March 1993 floods is most likely related to the fact that many of these communities probably had high participation rates prior to the flood events. Many communities in Florida and in the southeastern region of the U.S. in the NFIP sample had high participation rates in 1996 which probably have not changed much since the early 1990s.

Table B.4
Changes in Trends in Policy Growth Following a Flood

	Hurricane Hugo (Sept. 1989)	March 1993 Florida	1993 Midwest Floods*
Average rate of growth in pre-flood policy sales	9.0%	7.4%	7.8%
Average rate of growth in post-flood policy sales	14.8%	7.7%	269.1%

* 1993 Midwest flood data exclude anniversary data for April. Although the data from April precede the July/August floods and could be considered "pre-flood data," it appears there was a large increase in policies in April 1993, which might be related to a flood event.

The large growth in policy sales related to the Midwest floods probably is a result of low participation rates in the year prior to the flood event, followed by many individuals purchasing policies in anticipation of the flood event or after the flood to qualify for federal aid. Many Midwest communities in the NFIP sample had low participation rates based on 1996 data, and this trend is probably representative of other communities in the Midwest.

In the demand model, two flood adjustment factors are used—one set of ratios is used for communities with low participation rates and another set of ratios is used for communities with high participation rates. Communities with low participation rates are likely to exhibit a large percentage increase in policies in a flood year because the communities are relatively underinsured, whereas communities with high participation rates would exhibit a smaller percentage increase in policies.

This approach required assuming a threshold level in participation rates to categorize communities hit by floods as relatively underinsured. The limited amount of available insurance data did not allow for conducting a rigorous analysis of what threshold level should be used. Based on professional judgment, a participation rate of 40 percent was used for this threshold, where about 20 percent of the communities have either a 1996 pre-FIRM participation rate or a 1996 post-FIRM participation rate above 40 percent. Based on the 1996 participation rates for the NFIP sample communities, many communities in Florida and Louisiana would be adjusted by the factor for high participation rates. Many of the NFIP sample communities in the Midwest have 1996 participation rates which are significantly lower than 40 percent. Thus, these communities would use the low participation rate flood adjustment factor.

The flood adjustment factors were estimated using the flood event policy data by dividing the average growth rate of post-flood policy sales by the average growth rate of pre-flood policy sales. The flood event policy data were assumed to reflect the 100 year flood. The flood adjustment factors used in the model were adjusted to reflect more frequent flooding. The model assumes that in a flood year the participation rate is multiplied by 10 for communities with low participation rates or multiplied by 1.09 for communities with high participation rates.

The model assumes that some of the policies purchased in the year of a flood will not be renewed in the following year even though renewal may be required by federal law. This is based on the flood policy data which show policy sales in a year after a flood year dropping by an amount almost equal to the sales increase in a flood year. Using retention data from FEMA related to Hurricane Opal (October 1995), the retention rate for flood-induced purchases was estimated at 75 percent. This retention rate is higher than historical levels, most likely on account of the mandatory purchase requirements for flood insurance, which were in effect at the time of the disaster.

B.3.10 Elevation Ratings

Pre-FIRM structures that are above the base flood elevation can obtain elevation certificates verifying their base flood elevation, and, thus, become eligible for actuarial premiums, which are lower than the subsidized premiums. Structures that have obtained these elevation certificates are said to be “elevation rated.” Since these structures will not be affected by premium changes in the policy scenarios, these structures need to be identified in the IDM and treated in a manner similar to that of the post-FIRM structures.

Elevation rate data for insured pre-FIRM structures from FEMA policy data were used to derive an estimate of the percentage of elevation rated structures among all structures above the base flood elevation in each community. These percentages are shown in Table B.5. Some of the percentages are very high (above 90 percent), reflecting communities with low counts of structures. In these communities, the percentages are driven by a small number of structures. Note that the elevation rated percentage presented in this table for all NFIP study communities, developed using the community level statistical weights, was not used in the study and is for comparison purposes only.

The model assumes that these minimum percentages are constant over time.

Table B.5
Percentage of Elevation Rated Structures Among Insured Pre-FIRM Structures Above the Base Flood Elevation

Community	State	Percentage of Elevation Rated Structures
All NFIP Study Communities		15.3%
Phoenix City	AZ	2.6%
Bay City	AR	5.9%
Sacramento County	CA	15.0%
Santa Cruz City	CA	9.3%
Dolores Town	CO	0.0%
Otero County	CO	0.0%
Fort Lauderdale City	FL	67.5%
New Smyrna Beach City	FL	75.9%
St. Petersburg Beach City	FL	29.1%
Hailey City	ID	95.0%
Grundy County	IL	37.8%
Council Bluffs City	IA	6.0%
Augusta City	KY	0.0%
Lewisport City	KY	34.5%
Louisville City	KY	2.1%
Allen Parish	LA	24.5%
Jefferson Parish	LA	64.3%
Shreveport City	LA	70.6%
Cohasset Town	MA	5.1%
Vassar City	MI	0.0%
Petal City	MS	0.0%
Scott County	MO	94.2%
Omaha City	NE	5.8%
Pender Village	NE	0.0%
Woodstock Town	NH	0.0%
Bloomingdale Borough	NJ	14.5%
Lincoln Park Borough	NJ	26.9%
Niagara Town	NY	0.0%
Waterford Village	NY	0.0%
Carteret County	NC	44.1%
Edenton Town	NC	60.1%
New Miami Village	OH	0.0%
Washington County	OK	92.5%
Lane County	OR	6.0%
Vernonia City	OR	15.4%
Franklin Township	PA	0.0%
Glen Rock Borough	PA	3.2%
Lower Mount Bethel Township	PA	2.7%

Table B.5 (continued)
Percentage of Elevation Rated Structures Among Insured Pre-FIRM Structures Above the Base Flood Elevation

Community	State	Percentage of Elevation Rated

		Structures
New Cumberland Borough	PA	0.0%
Myrtle Beach City	SC	29.0%
Lawrence County	SD	3.8%
Brookside Village	TX	33.7%
Garland City	TX	38.6%
League City	TX	67.5%
Grundy Town	VA	0.0%
Ephrata City	WA	5.0%
Leavenworth City	WA	29.3%
Marlinton Town	WV	12.0%
Philippi City	WV	1.3%
Wheeling City	WV	0.0%

B.3.11 Price Elasticities

The changes in participation rates in the NFIP under premium subsidy elimination are driven by the price elasticity assumptions, which capture the change in flood insurance demand related to a change in the premium. The price elasticities used in the study are based on data cited in a General Accounting Office (GAO) study. Despite various efforts to obtain robust and detailed price elasticities, only the GAO study was identified, and this source did not fully address price elasticities under the conditions of large premium changes. Since this assumption is critical to estimating the demand for flood insurance under potential changes in the premium subsidy, new research in estimating the price elasticity for flood insurance is recommended but was beyond the scope of this study.

The GAO report entitled "The Effect of Premium Increases on Achieving the National Flood Insurance Program's Objectives" indicated a price elasticity of 0.38 to 0.39 for average premium increases of $88, equal to an increase in the premium of 112 percent (U.S. General Accounting Office, 1983).

An extensive search for other sources of price elasticity data for insurance premiums for natural disasters was not successful. The lack of data may be attributable to the fact that this type of data is treated as proprietary. Data for other insurance products was considered not to be relevant because those markets are very different in terms of risk awareness and market penetration.

Because the changes in premiums from subsidized levels to actuarial premiums in the study are significantly larger than 112 percent, the price elasticity assumptions were altered for premium changes larger than 112 percent. The model assumes that the price elasticity is 0.38 for all changes up to 112 percent. For percent changes between 112 percent and 200 percent, the model has assumed a linear increase in the price elasticity doubling from 0.38 to 0.76. All changes
larger than 200 percent were assumed to have an elasticity of 0.76. Because of the limited data available, these adjustments to the price elasticity curve were based on professional judgment.

B.4 Modeling of Policy Scenarios

The IDM is designed to simulate seven scenarios for eliminating the current federal premium subsidy. If the subsidy elimination process causes structure owners to get elevation rated, resulting in lower insurance premiums, the owners will begin paying the lower premium immediately in 1998, under all seven scenarios. These owners are further divided into those who would have been elevation rated in the absence of any subsidy elimination processes and those who get elevation rated because of subsidy elimination processes. (See Section 1.4 on how actuarial premiums for pre-FIRM structures will be based on elevation certificates.) Owners who have been elevation rated because of the subsidy elimination processes are affected by the policy scenarios, whereas the other elevation rated owners are not.

In the IDM, changes in the flood insurance premiums impact the sales of flood insurance policy contracts. The use of price elasticities in the model allows for adjusting policy contract sales to reflect the magnitude of a premium change and whether the change is a decrease or an increase. If the subsidy elimination results in a higher premium, the increase is phased in according to the specific scenario. The scenarios do not necessarily represent policies the NFIP is considering implementing. Section A.3 of Appendix A presents a detailed description of these seven scenarios.

Baseline

This scenario serves as a point of comparison for the seven subsidy elimination scenarios. All participating structures continue paying the current premium and have the same insurance coverage for the entire period from 1997 to 2022. Pre-FIRM structures that are not elevation rated pay the subsidized premium for all 25 years. Pre-FIRM structures that are elevation rated and post-FIRM structures pay the actuarial premium for all 25 years.

Scenario 1

This scenario eliminates the premium subsidy through an immediate premium change in 1998. For structures with a higher actuarial premium, the premium will increase to the actuarial premium in 1998. For structures with a lower actuarial premium, the premium will decrease to the actuarial premium in 1998.

Scenario 2

This scenario eliminates the premium subsidy gradually over a period of 10 years. For structures with a higher actuarial premium, the premium will increase steadily with an equal annual percentage growth rate for each of the 10 years from 1998 to 2007. At the end of this 10 year period, the premium will reach and remain at the actuarial rate. For structures with a lower actuarial premium, the premium will decrease to the actuarial premium in 1998.

Scenario 3

This scenario eliminates the premium subsidy gradually over a period of 20 years. For structures with a higher actuarial premium, the premium will increase steadily with an equal annual percentage growth rate for each of the 20 years from 1998 to 2017. At the end of this 20 year period, the premium will reach and remain at the actuarial rate. For structures with a lower actuarial premium, the premium will decrease to the actuarial premium in 1998.

Scenario 4

This scenario eliminates the premium subsidy when ownership of the structure changes. For structures with a higher actuarial premium, the premium will increase to the actuarial premium when the structure is sold or refinanced. For structures with a lower actuarial premium, the premium will decrease to the actuarial premium in 1998.

Scenario 5

This scenario eliminates the premium subsidy with a combination of deductible increases and premium changes. For structures with a higher actuarial premium, the increase in deductible takes place immediately upon renewal. The deductible increases from the current $1,500 total ($750 building and $750 contents deductibles) to 15 percent of total insurance coverage. The premium change component eliminates any subsidy remaining after the deductible increase over five years with an equal annual percentage growth rate for each of the five years from 1998 to 2002. For structures with a lower actuarial premium, the premium will decrease to the actuarial premium in 1998.

Scenario 6

This scenario eliminates the premium subsidy with a combination of deductible increases and premium changes. For structures with a higher actuarial premium, the increase in deductible takes place immediately upon renewal. The deductible increases from the current $1,500 total ($750 building and $750 contents deductibles) to 3 percent of total insurance coverage. The premium change component eliminates any subsidy remaining after the deductible increase over five years with an equal annual percentage growth rate for each of the five years from 1998 to 2002. For structures with a lower actuarial premium, the premium will decrease to the actuarial premium in 1998.

Scenario 7

This scenario eliminates the premium subsidy with a combination of a coverage change and premium changes. For structures with a higher actuarial premium, the coverage change takes place immediately upon renewal. If a structure is damaged by a flood, the NFIP will only pay for builders grade materials and materials to make the structure habitable. This coverage change only affects above average quality structures since builders grade materials are assumed to be of average quality. The premium change component eliminates any subsidy remaining after the coverage change over five years with an equal annual percentage growth rate for each of the five years from 1998 to 2002. For structures with a lower actuarial premium, the premium will decrease to the actuarial premium in 1998.

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12. Appendix C: The Property Simulation Model

This appendix describes the design specifications and assumptions underlying the Property Simulation Model (PSM). The appendix is structured as follows:

Introduction and Overview provides a general description of the PSM and its main purpose in the study.
Modeling Approach describes the overall design of the PSM and highlights key features of the model.
Cell Categories describes the data sources, methods, and determining factors used to categorize each property type in the PSM.
Non-Flood Related Events details the data sources and analytical methods used to estimate changes in the characteristics and number of pre-FIRM and post-FIRM SFHA structures due to non-flood related property growth, attrition, or changes in the physical condition of structures.
Flood Related Events details the data sources and analytical methods used to estimate property damages resulting from a flood event.
Nonstructural Mitigation Events describes the data sources, methods, and underlying assumptions used to estimate the effects of nonstructural flood mitigation activities on the number of pre-FIRM SFHA structures in the PSM.
Structural Mitigation Events describes the data sources, methods, and underlying assumptions used to estimate the effects of structural flood mitigation activities on the number of pre-FIRM SFHA structures in the PSM.

12.1 Introduction and Overview

The PSM is designed to evaluate how changes in the stock of residential and non-residential structures will affect the universe of structures eligible for subsidized flood insurance. The PSM begins with the current universe of residential and non-residential structures in Special Flood Hazard Areas (SFHAs) and uses projections of future mitigation fund allocations, flood frequency rates, acquisition rates, flood damage, property removal rates, and property growth rates to project the universe of structures into the future.

To track the change in the stock of residential and commercial structures, the PSM models seven specific events which are designed to capture removals of pre-FIRM SFHA structures as well as the growth in post-FIRM SFHA structures over time. These seven events are:

1. **Natural removals** (non-flood related) which reduce the number of pre-FIRM SFHA structures due to any non-flood related event (abandonment due to deterioration, local area property value changes, fire, demolition for land redevelopment, or other non-flood related events).

2. **Natural growth**, which adds new post-FIRM SFHA structures to the stock of structures based on local community growth.

3. **Normal improvements** (non-flood related) which are made to some structures as part of regular maintenance. Some pre-FIRM SFHA structures are substantially upgraded to become post-FIRM SFHA structures.

4. **Natural deterioration** (non-flood related) which occurs for some structures as normal wear and tear. Some pre-FIRM SFHA structures that deteriorate are substantially improved to become post-FIRM SFHA structures.

5. **Post-disaster flood mitigation** which results from a flood event and reduces the number of pre-FIRM SFHA structures in a given community SFHA due to destruction; the substantial improvement of substantially damaged buildings; or post-disaster mitigation programs targeted to acquire, relocate, elevate, or dry flood proof at-risk pre-FIRM SFHA structures.

6. **Pre-disaster flood mitigation** which does not occur in response to a specific flood event and reduces the number of pre-FIRM SFHA structures due to individual action or pre-disaster mitigation programs targeted to acquire, relocate, elevate, or dry flood proof at-risk pre-FIRM SFHA structures.

7. **Structural mitigation**, such as drainage improvements or the construction of dams and levees, which effectively re-maps selected pre-FIRM SFHA structures out of the community's SFHA and effectively elevates other selected structures from below the BFE to at or above the BFE.

Conceptually, the PSM is a cell-based simulation model in which housing is treated as a standard capital good, subject to depreciation, maintenance, and replacement. The model is "cell-based" in the sense that rather than modeling events for individual structures, the PSM groups structures into mutually exclusive categories or "cells" which are defined by specific structural attributes such as type of unit, age of structure, and flood zone where the structure is located. The cells are detailed enough to recognize the diversity of structural characteristics across the sampled NFIP communities and throughout the nation's SFHAs, while general enough to facilitate efficient development of the model.

The PSM is designed to project annually, for the universe of structures within the SFHAs of the 50 sampled NFIP communities, changes in the stock of residential and non-residential structures over the 25-year period from 1997 to 2022. Each of the 50 sampled NFIP communities will be modeled individually to track changes in the stock and composition of pre-FIRM and post-FIRM SFHA structures.

The life cycle of structures will directly influence estimates of current and future structures eligible for subsidized insurance, since the starting point for the PSM will be the current universe of pre-FIRM and post-FIRM SFHA structures. As these structures age, depreciation will occur, and an increasing number of structures will be voluntarily removed, reconstructed, or damaged/destroyed by natural events. The rate of deterioration and removal from the stock of structures will be influenced by annual changes in property values as determined by the Property Valuation Model (PVM). By direct linkage to the PVM, the PSM will capture changes in property values in determining natural removal rates for structures. In the PSM, these removal rates are estimated separately for each type of event in each of the sampled NFIP community SFHAs. In this way, through the PSM, the analysis of structures eligible for subsidized flood insurance will directly incorporate the life cycle of structures.

12.2 Modeling Approach

In the PSM, the sequence of events tracks all possible outcomes for a particular type of structure as categorized by the cell categories. The cell categories, which classify each structure according to its structural type, age, condition, flood zone, FIRM classification, and structure elevation difference, define the base year (1996) inventory of all structures in each of the 50 sampled community SFHAs. The PSM tracks the stock of post-FIRM as well as pre-FIRM SFHA structures since both types of structures are used in the PVM to develop property value changes which are then used in turn by the PSM to adjust pre-FIRM removal rates for each community.

In every year of the model simulation, the sequence of events affects the count of structures in a particular structure category. In any given year an individual structure may either (1) remain in the same category, (2) be relocated to a different category, or (3) be removed entirely from the stock of structures in that SFHA.

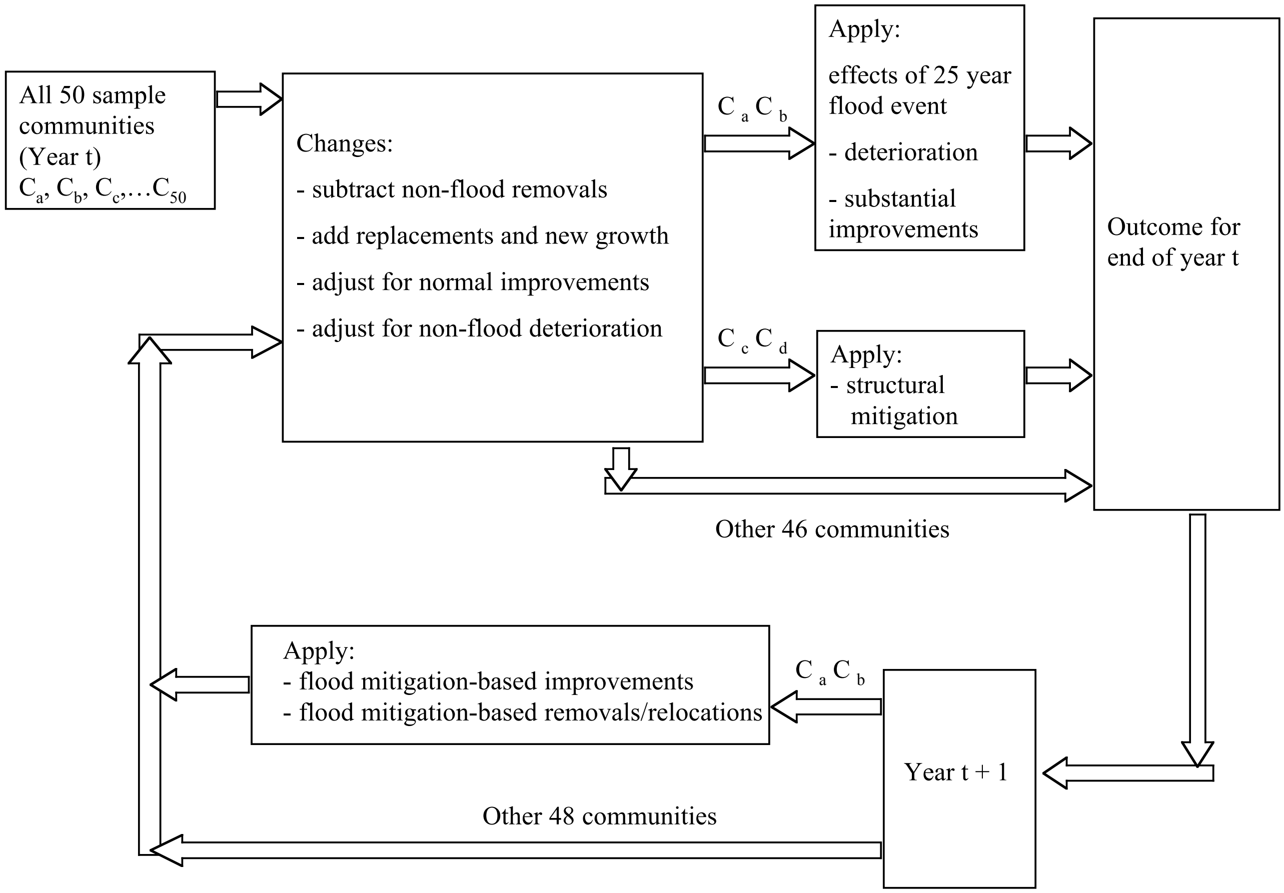
The following example illustrates how a specific PSM model event can affect the stock of structures. A given cell within a particular community and of a particular structural type, age, condition, flood zone, FIRM classification, and structure elevation difference contains 50 structures in 1997. Suppose that in 1998, a structural mitigation project was modeled to occur in that community, with an estimated parameter of a 10 percent removal rate of structures out of the SFHA for the structures in that particular cell. In 1998, this 10 percent parameter would be applied to the 50 structures in that cell, yielding a removal of 50*(0.1) = 5 structures from that cell. As a result of this structural mitigation event, the 1998 count of structures for this cell would be updated to 50 - 5 = 45.

Since the timing of flood events is unpredictable for a given SFHA, the model simulates flood events to occur randomly for a particular community. In any given year, several randomly selected communities may experience a flood event, and in the following year, a community flooded in the previous year will experience the effects of nonstructural flood mitigation. In addition, two communities were randomly selected every year to undergo a one-time structural mitigation project. The model was designed so that all 50 selected communities randomly experienced one structural flood mitigation project over the 25-year simulation period.

To test the sensitivity of the PSM with respect to flooding severity, three different scenarios were run. As the base case scenario, the model was run with a 25-year flood scenario such that, in each year, two randomly selected communities experienced one 25-year flood over the 1997 to 2022 simulation period. The first alternative scenario was the 10-year flood scenario such that in each year, five randomly selected communities experienced one 10-year flood over the 1997 to 2022 simulation period. The second alternative scenario was the 100-year flood scenario such that, over a two-year period, one randomly selected community experienced one 100-year flood over the simulation period. From the depth damage data provided by FEMA (Leikin, 1982), damage estimates for the 25-year, 10-year, and 100-year flood were developed and used in the model to simulate each of the three types of flood events to evaluate the effects of each of type of flood on the stock of pre-FIRM SFHA structures. Finally, since the order in which communities experience a flood event can influence the overall stock of pre-FIRM and post-FIRM SFHA structures for all communities over time, the base case, 10-year, and 100-year flood scenarios were run multiple times so that averages for each scenario's outcome could be determined.

Figure C.1 depicts the sequence of events in the PSM for the base case scenario. The depiction of a two-year simulation period is for presentation purposes only; a two-year period allows the stock of structures to complete the full cycle of all possible events in the model. The model will, of course, be simulated over the full 25-year period. Note that communities C_a and C_b experience a flood in year t and therefore nonstructural mitigation in year t+1, and note that communities C_c and C_d experience structural mitigation in year t.

Figure C.1
Property Simulation Model



12.3 Cell Categories

This section describes the criteria, data sources, and methods used to categorize each property type in the PSM. The section includes two tables which present estimates for the number of total and pre-FIRM structures, by property type, in the SFHA's of each of the 50 sampled communities.

~~C.1.1~~12.3.1 Cell Category Criteria

Several criteria were used to determine the cell categories in the PSM. These criteria are:

The cell categories must incorporate structural characteristics to facilitate the modeling of a range of possible outcomes from the effects of flood events and flood mitigation
The cell categories must take advantage of available data to develop the most accurate estimates possible
The PSM must identify characteristics important in the PVM and the Insurance Demand Model (IDM)

The total number of potential cells must be limited so that the majority of cells do not contain too few observations

Some of these criteria were conflicting, and the final cell categories selected for the model reflected the balancing of multiple objectives. In identifying needs among the PSM, PVM, and IDM for example, each of the three models focused on different structural characteristics. Including the maximum possible structural characteristic detail for each of the three models would have increased the number of potential cells to an unmanageable total which would have compromised the PSM's ability to accurately track the stock of structures over time. The reasoning behind the objectives of each of the above criteria used to define the cell categories in the PSM is presented below.

Criteria 1 – Inclusion of characteristics to recognize the diversity of structural characteristics and responses to the effects of flood events and flood mitigation.

Since the effects of a flood as well as the type of flood mitigation associated with a particular structure depend on a structure's location and physical characteristics, several physical and locational attributes were recognized as critical in the construction of the PSM. Since residential and non-residential structures are generally constructed differently and require different types of nonstructural flood mitigation for example (Baldini, 1997, FEMA, 1997, FEMA 1993, FEMA 1991) non-residential structures were differentiated from residential structures. Similarly, since there are different types of structures which carry different levels of flood risk, single family detached, multiple family attached units, and manufactured housing were differentiated in the PSM to capture this variation. With respect to locational attributes, the flood zone in which a structure is located (inland or coastal) and the base flood elevation difference of a structure were recognized as important structural characteristics in the PSM (Leikin, 1982) and were attributes which were differentiated in the cell categories of the model.

Although for the nation's floodplains as a whole, single family detached housing comprises about 67 percent of all residential structures, (U.S. Department of Commerce, October 1992) there are communities with compositions of structures which significantly differ from the average. Of the 50 communities sampled for this study for example, the SFHA of St. Petersburg Beach City, Florida was estimated to contain a large number of multiple family attached and high-rise condominium units— nearly half of all structures. Similarly, while manufactured housing comprises only about eight percent of all structures estimated in the nation's floodplains, (*ibid.*) there are NFIP communities such as Niagara Town, New York, where manufactured housing comprises the majority of structures in the SFHA.

<u>Criteria 2</u> *– Utilizing available data to develop the most accurate structure counts possible.*

To a considerable extent, the type of unit classifications in the PSM's cell categories reflect the decennial Census data categories for residential housing units (*ibid*.). The use of Census categories facilitated accurate and detailed estimates of structure counts for the 50 sampled NFIP communities. Using detailed data disaggregated to the Census block group level allowed an accurate and cost-effective categorization of the structures in each community. While there were other possible structural characteristics (such as number of floors) that would have been desirable to distinguish in the PSM, the lack of Census data or other data on those characteristics at necessary levels of detail made them difficult to determine, and they were therefore not included in the model's cell categories.

<u>Criteria 3</u> *– Identification of characteristics important in the PVM and the IDM.*

This consideration was important since the PSM is part of the larger modeling system which includes the PVM and IDM to measure the economic effects of changes in premium rates. Since much of the analysis focuses on the change in the stock of pre-FIRM SFHA structures, a critical structural characteristic to include in the PSM was whether or not the structure was pre-FIRM or post-FIRM, since FIRM classification would determine a property's eligibility for subsidized flood insurance rates. In addition to FIRM classification, a structure's physical condition is an important characteristic for property valuation in the PVM (Arnott *et al*., 1980) and was therefore included in the cell categories of the PSM.

<u>Criteria 4</u> *- Limiting the total number of potential cells.*

From a large range of possible structural attributes, a number of potential structural categories were consolidated to avoid having too many cells with too few observations. Since preliminary counts of total structures in the 50 sample communities indicated an average count of about 6,500 structures per community, with 20 communities containing less than 1,000 structures, care was taken to avoid having more cells than structures. Since the number of cells increases geometrically as more structural characteristics are included, a cell structure can rapidly grow to include thousands of cells. One early draft of the PSM cell structure, for example, contained 12 categories for unit type, five categories for age of structure, three categories for size of structure, four categories for structure condition, four categories for flood zone type, two categories for FIRM classification, and two categories for elevation difference. Mathematically, this translates into a possible 12 x 5 x 3 x 4 x 4 x 2 x 2 = 11,520 combinations. Had the PSM cell structure actually contained this number of cells, many cells would have contained no structures, and many, if not most, would have contained a very small (less than ten) number of structures — an outcome which would have severely limited the PSM's ability to simulate properly. The final cell categories of the PSM were limited to a maximum of 480 different possible cell combinations.

The cell categories selected for the PSM are shown below. Note that all of the pre-FIRM and post-FIRM SFHA structures in the PSM will fall within one of the following mutually exclusive categories:

A. Structure Type
   - I. Single family detached
   - II. Single-unit or multiple-unit attached
   - III. High-rise condominium
   - IV. Manufactured home
   - V. Non-residential

B. Structure Age
   I. Less than 21 years
   II. 21 to 50 years
   III. Over 50 years

C. Structure Condition
   I. At or above average
   II. Below average

D. Flood Zone
   I. AO/AH /AE/A/A1-A30 zones (includes high velocity AO zones)
   II. VE/V zones

E. FIRM Classification
   I. Pre-FIRM
   II. Post-FIRM

F. Structure Elevation Difference
   I. At or above the BFE
   II. 1 or 2 feet below the BFE
   III. 3, 4, or 5 feet below the BFE
   IV. 6 feet or more below the BFE

In the cell categories included here, the Census Bureau's definition for single-unit attached structures is used which defines these structures as one-unit structures that have one or more walls extending from ground to roof separating it from adjoining structures (U.S. Department of Commerce, May 1997). In row houses (sometimes called town houses), double houses, or houses attached to non-residential structures, each house in the Census classification is a separate, attached structure if the dividing or common walls extend from ground to roof (*ibid*.).

12.3.2 Community Structure Count Estimation

The discussion below details the data sources and methods used to estimate the number of structures represented in each cell characteristic included in the cell categories.

Structure Type

To construct the inventory of structures by structure type the following steps were used:

1. A count of the number of housing units for the 50 sample communities from the 1990 decennial Census was developed.

2. The 1990 count of housing units was converted to a count of residential structures.

3. The number of non-residential structures was estimated for each sample community.

4. The count of 1990 residential and non-residential structures was adjusted to reflect a count for 1996, the base year in the PSM.

Housing Units

The first step was a mapping of the SFHAs from Q3 Flood Data onto block groups based on land area for all 50 sampled communities. This procedure determined which block groups or portions of block groups were located in a particular SFHA. Using the 1990 decennial Census (U.S. Department of Commerce, October 1992), data on the number of housing units was extracted by single family detached, or multiple-family attached, high-rise condominium, or manufactured housing unit type for all block groups contained within each of the 50 sample community SFHAs. Using the Census housing unit data (*ibid*.), a distribution was completed of the total number of housing units within each block group based on the estimated proportion of each block group's land area contained within the SFHA. The block groups, or block group portions, were then summed to SFHA totals to estimate the total number of housing units for each of the 50 sample SFHAs.

Residential Structures

In the second step of developing structure counts, housing units were converted to residential structures by estimating the number of housing units per residential structure for all multiple-unit housing units. Using both the Census Residential Finance Survey and the American Housing Survey, (U.S. Department of Commerce, July 1997, *op. cit*., August 1996) which report the number of units per building for multi-unit residential structures, the average number of residential units per building was estimated for each multi-unit housing group. The total number of multi-unit residential structures was estimated by dividing multiple housing units by the average number of housing units per residential structure. For the 50 sample communities as a whole, these multi-unit structures represent about 25 percent of all housing units but only about five percent of all residential structures.

Non-residential Structures

Because counts of non-residential structures by detailed geographic area do not exist, a count of non-residential structures was estimated for each of the 50 sample communities using data on the number of commercial buildings and workers by Census region and urban or rural status from the 1989 Commercial Building Energy Consumption Survey (CBECS) conducted by the U.S. Department of Energy (U.S. Department of Energy, 1991). Rather than using a later CBECS, the 1989 CBECS survey was used for consistency since it was the CBECS which coincided most closely with the 1990 decennial Census.

As a first step in estimating non-residential structures, the ratio of commercial workers to commercial buildings was estimated by Census region and by urban and rural status, the most detailed geographic levels identified in the CBECS. Next, this ratio was applied to an estimate of the number of commercial employees in each community in 1989. The estimate of the number of commercial employees in each community was derived by using county level tabulations of commercial workers obtained from the 1989 County Business Patterns (U.S. Department of Commerce, 1991) adjusted to the population of the sample community SFHA:

Number of commercial workers in SFHA =

$$\frac{\text{Number of commercial workers in associated county}}{\text{Total population of associated county}} \times \text{Total population in SFHA}$$

The number of commercial structures for each SFHA was estimated by dividing the estimate of the number of commercial workers in each SFHA by the CBECS-derived estimate of the number of commercial workers per commercial building:

Number of commercial buildings = Number of commercial workers in SFHA / Number of commercial workers per commercial building

In the elevation certificate surveys of 7,628 SFHA structures in the 23 surveyed communities completed for this study, some non-commercial, non-residential structures were identified, mostly those classified as industrial establishments and places of worship. In the survey of 7,628 SFHA structures, industrial establishments were differentiated from commercial establishments. Commercial structures were identified as those establishments designed for the purpose of selling final goods and services to customers. Industrial structures were identified as those establishments designed for manufacturing purposes (Office of Management and Budget, 1995).

In the survey of 7,628 SFHA structures, the number of non-commercial, non-residential structures equaled about 10 percent of the number of commercial structures. To account for non-commercial, non-residential structures in the PSM, the estimates of commercial structures derived above were therefore adjusted upward by 11.1 percent. On average for the 50 sample communities, non-residential structures are estimated to account for about six percent of total structures.

Estimated Counts for 1996

Since the data used to initially estimate the count of structures in each sample community were for 1990, the 1990 stock of structures had to be adjusted to reflect the PSM base year 1996 stock of structures. To accomplish this adjustment, an estimate was used of the 1990 to 1996 net growth of structures based on the 1990 to 1996 growth in local area age 21 to 65 population (U.S. Department of Commerce, 1998) applied to the historic relationship between net growth in structures and the growth in age 21 to 65 population. This adjustment was accomplished in two steps as detailed below.

First, the ratio of the growth in housing units to the growth in the age 21 to 65 population was estimated using 1980 and 1990 decennial Census data (U.S. Department of Commerce, 1992, *op. cit*. 1982) for the county or Census tracts which corresponded to the sample community:

Housing unit growth to growth in age 21 to 65 population = (1990 housing units / 1980 housing units) / (1990 age 21 to 65 population / 1980 age 21 to 65 population)

Next, this ratio was multiplied by the 1990 to 1996 change in the age 21 to 65 population for the corresponding county or Census tract to estimate the growth in structures from 1990 to 1996. The source for the 1990 to 1996 population change was data from the Census Bureau's small area population program (U.S. Department of Commerce, 1997).

1990-96 growth in structures =

1996 population - 1990 population x Housing unit growth to growth in age 21 to 65 population

1990 population

For the 21 of the 50 sample communities which were covered by one or two Census tracts, the tract level was used to estimate the above relationships. Where a community contained two Census tracts, results were obtained for each tract and averaged. For the remaining 29 sample communities which contained multiple Census tracts, county level data were used in estimating the above relationships.

Table C.1 shows the 1996 count of total structures in the SFHA by property type for the 50 sample communities included in this study. Note that the community level structure counts presented in the table are estimates based on 1990 decennial Census data and a GIS-based determination of the land area within each NFIP Community's SFHA. While considerable effort was undertaken to assure the reliability and accuracy of these structure count estimates, they are subject to measurement error. A precise inventory of SFHA structures would have been possible only through conducting elevation surveys for every structure in each NFIP community to determine its exact location relative to the community's SFHA, an approach that would have been prohibitively expensive and beyond the scope of this study.

Table C.1
1996 Count of All SFHA Structures by Property Type

Community	State	Total Structures	Single Family Detached	Single or Multiple Attached	Condo Unit	Manu-factured Housing	Non Residential Unit
ALL NFIP STUDY COMMUNITIES		6,465,335	4,583,306	605,569	256,330	587,529	432,602
PHOENIX CITY	AZ	28,885	20,300	3,642	1,189	2,251	1,503
BAY CITY	AR	1,089	771	24	0	182	112
SACRAMENTO COUNTY	CA	22,327	16,051	2,733	334	2,052	1,158
SANTA CRUZ CITY	CA	3,498	1,712	991	203	398	193
DOLORES TOWN	CO	484	325	11	0	96	52
OTERO COUNTY	CO	1,469	1,096	58	0	165	150
FORT LAUDERDALE CITY	FL	59,932	30,140	6,344	16,345	3,829	3,273
NEW SMYRNA BEACH CITY	FL	6,884	4,512	1,334	296	330	412
ST. PETERSBURG BEACH CITY	FL	4,567	2,711	452	887	269	248
HAILEY CITY	ID	263	193	18	0	26	26
GRUNDY COUNTY	IL	1,624	1,268	166	0	99	91
COUNCIL BLUFFS CITY	IA	5,563	4,225	456	12	552	318
AUGUSTA CITY	KY	516	323	24	0	104	66
LEWISPORT CITY	KY	427	329	20	0	35	44
LOUISVILLE CITY	KY	4,164	3,201	550	105	108	200

Table C.1 (Continued)
1996 Count of All SFHA Structures by Property Type

Community	State	Total Structures	Single Family Detached	Single or Multiple Attached	Condo Unit	Manu-factured Housing	Non Residential Unit

ALLEN PARISH	LA	3,171	2,226	46	0	525	373
JEFFERSON PARISH	LA	82,639	64,352	8,644	1,186	3,821	4,445
SHREVEPORT CITY	LA	4,155	3,046	498	49	331	231
COHASSET TOWN	MA	558	467	42	0	20	29
VASSAR CITY	MI	493	367	19	0	49	58
PETAL CITY	MS	2,908	2,198	118	0	443	149
SCOTT COUNTY	MO	3,308	2,309	63	0	596	341
OMAHA CITY	NE	5,839	4,667	403	36	461	271
PENDER VILLAGE	NE	413	328	20	0	20	46
WOODSTOCK TOWN	NH	277	155	47	12	35	28
BLOOMINGDALE BOROUGH	NJ	398	327	38	0	11	22
LINCOLN PARK BOROUGH	NJ	4,223	3,123	728	76	85	210
NIAGARA TOWN	NY	348	125	22	0	181	20
WATERFORD VILLAGE	NY	844	442	325	11	13	53
CARTERET COUNTY	NC	19,278	10,007	1,143	128	5,892	2,109
EDENTON TOWN	NC	1,244	880	75	0	156	133
NEW MIAMI VILLAGE	OH	3,118	2,743	57	0	130	187
WASHINGTON COUNTY	OK	2,563	1,761	50	3	507	241
LANE COUNTY	OR	10,105	6,765	470	15	2,309	546
VERNONIA CITY	OR	487	378	13	0	61	35
FRANKLIN TOWNSHIP	PA	2,185	1,801	47	0	198	140
GLEN ROCK BOROUGH	PA	64	45	14	0	2	3
LOWER MOUNT BETHEL TOWNSHIP	PA	90	69	7	0	9	5
NEW CUMBERLAND BOROUGH	PA	358	196	136	0	8	18
MYRTLE BEACH CITY	SC	1,476	794	280	151	176	75
LAWRENCE COUNTY	SD	356	272	18	0	29	36
BROOKSIDE VILLAGE CITY	TX	517	401	4	0	82	31
GARLAND CITY	TX	7,135	5,929	655	176	38	337
LEAGUE CITY CITY	TX	2,418	1,925	165	18	171	139
GRUNDY TOWN	VA	239	141	10	0	62	26
EPHRATA CITY	WA	1,062	802	59	0	90	112
LEAVENWORTH CITY	WA	62	45	3	0	7	6
MARLINTON TOWN	WV	1,107	753	19	0	218	117
PHILIPPI CITY	WV	377	272	25	0	35	45
WHEELING CITY	WV	4,934	3,195	1,094	59	342	244

Table C.2 presents the 1996 count of pre-FIRM SFHA structures by property type for the 50 sample communities included in this study.

To assure the reasonableness, completeness, and consistency of the estimates of total and pre-FIRM SFHA structures presented in the above tables, several methods of validation were used:

1. *Review of Data Sources and Estimation Methods*

In determining the reliability and accuracy of the estimates of the stock of structures in the 50 sample communities, a comprehensive review of all source data and estimation methods was undertaken. This review included a review of the Census household tabulations for each Census block group or block group portion within each NFIP community, analysis of the distribution of housing unit tabulations by housing unit type, and a thorough examination of the criteria for classifying structures as in or out of the SFHA according to the flood zone determination within each Census block group.

Table C.2
1996 Count of Pre-FIRM SFHA Structures by Property Type

Community	State	Pre-FIRM Structures	Single Family Detached	Single or Multiple Attached	Condo Unit	Manu-factured Housing	Non Residential Unit
ALL NFIP STUDY COMMUNITIES		4,330,884	3,192,701	394,887	148,824	285,046	309,513
PHOENIX CITY	AZ	17,282	12,598	2,284	745	721	934
BAY CITY	AR	869	647	17	0	111	94
SACRAMENTO COUNTY	CA	12,496	9,441	1,624	198	552	681
SANTA CRUZ CITY	CA	2,929	1,479	866	176	242	166
DOLORES TOWN	CO	387	273	4	0	67	43
OTERO COUNTY	CO	1,228	949	51	0	98	130
FORT LAUDERDALE CITY	FL	40,072	20,929	4,449	11,464	958	2,272
NEW SMYRNA BEACH CITY	FL	3,961	2,674	796	175	73	243
ST. PETERSBURG BEACH CITY	FL	3,802	2,287	379	747	184	205
HAILEY CITY	ID	125	101	7	0	5	12
GRUNDY COUNTY	IL	1,290	1,026	135	0	54	75
COUNCIL BLUFFS CITY	IA	4,457	3,575	390	7	216	269
AUGUSTA CITY	KY	438	289	17	0	73	59
LEWISPORT CITY	KY	357	287	13	0	22	35
LOUISVILLE CITY	KY	3,409	2,658	463	86	39	163
ALLEN PARISH	LA	2,656	1,918	39	0	378	321
JEFFERSON PARISH	LA	56,597	45,470	6,151	845	996	3,135
SHREVEPORT CITY	LA	3,077	2,312	380	35	174	176
COHASSET TOWN	MA	482	418	32	0	10	22
VASSAR CITY	MI	343	276	12	0	13	42
PETAL CITY	MS	2,124	1,724	94	0	190	116
SCOTT COUNTY	MO	2,682	1,961	54	0	378	289
OMAHA CITY	NE	3,640	3,064	267	22	110	177
PENDER VILLAGE	NE	340	282	15	0	5	38
WOODSTOCK TOWN	NH	218	128	39	5	25	21
BLOOMINGDALE BOROUGH	NJ	322	272	31	0	2	17
LINCOLN PARK BOROUGH	NJ	2,478	1,853	436	46	19	124
NIAGARA TOWN	NY	265	112	15	0	123	15
WATERFORD VILLAGE	NY	675	360	267	5	1	42
CARTERET COUNTY	NC	9,426	5,652	648	70	1,870	1,186
EDENTON TOWN	NC	794	614	48	0	46	86
NEW MIAMI VILLAGE	OH	2,352	2,110	42	0	55	145
WASHINGTON COUNTY	OK	2,326	1,640	47	3	412	225

Table C.2 (Continued)
1996 Count of Pre-FIRM SFHA Structures by Property Type

			Single	Single or		Manu-	Non

Community	State	Pre-FIRM Structures	Family Detached	Multiple Attached	Condo Unit	factured Housing	Residential Unit
LANE COUNTY	OR	8,315	5,920	416	10	1,490	479
VERNONIA CITY	OR	317	270	7	0	15	25
FRANKLIN TOWNSHIP	PA	1,971	1,659	42	0	142	128
GLEN ROCK BOROUGH	PA	48	37	11	0	0	0
LOWER MOUNT BETHEL TOWNSHIP	PA	52	52	0	0	0	0
NEW CUMBERLAND BOROUGH	PA	280	157	110	0	0	13
MYRTLE BEACH CITY	SC	542	317	107	57	37	24
LAWRENCE COUNTY	SD	308	245	13	0	19	31
BROOKSIDE VILLAGE CITY	TX	369	304	0	0	43	22
GARLAND CITY	TX	3,240	2,698	301	80	8	153
LEAGUE CITY CITY	TX	1,577	1,288	109	10	77	93
GRUNDY TOWN	VA	167	111	6	0	33	17
EPHRATA CITY	WA	897	694	50	0	57	96
LEAVENWORTH CITY	WA	25	25	0	0	0	0
MARLINTON TOWN	WV	906	640	13	0	153	100
PHILIPPI CITY	WV	306	228	19	0	21	38
WHEELING CITY	WV	4,178	2,784	964	50	166	214

2. *Consistency Checks*

To assure the completeness and overall consistency of the estimates, several different checks were used. As one check, the count of households in each community SFHA was compared with an independently developed count of households for each Census Place which mapped to the corresponding sample NFIP community. Another set of checks compared the estimated percentage of structures in the SFHA for each community with an independently derived percentage estimate developed from the Q3 data. Finally, the structure estimates developed for each community were compared with an independently developed set of population estimates to assure reasonableness in the implied number of persons per structure.

3. *Analysis of Age Distribution of Community Structures*

As a way of assuring that the estimation of pre-FIRM SFHA structures was accurate, reliable, and consistent with each community's effective FIRM date, the age distribution of housing units in each corresponding Census block group was analyzed and matched to each community's effective FIRM date. In addition, an independently developed set of community population growth rate estimates was analyzed to track the consistency between the rate of growth in households over time and the concentration of pre-FIRM SFHA structures in a given community.

12.3.3 Structure Age, Condition, Flood Zone, and FIRM Classification

Structure Age

The classification of structures by age was developed using the Census data, which provides an aggregated count of structures built within specific time intervals for all structures within a given area. (U.S. Department of Commerce, 1992). The Census data were analyzed to determine which age categories displayed the most significant differences with respect to rates of removal, improvement, and deterioration. Three age categories were ultimately selected: less than 20 years old, 20 to 50 years old, and over 50 years old. In the base year, these categories represent structures built from 1976 to 1996, 1946 to 1975, and pre-1946. While other, more detailed age classification categories were considered in development of the model, the three age categories selected yielded the most robust and reliable results — an important modeling concern given the small number of structures represented in some of the 50 sample communities.

To estimate the number of structures built in each age group, the age distribution of housing units from the 1990 Census data (*ibid*.) were applied to the total number of structures by structure type. To reflect the age distribution of structures in the base year, removal rates for each age group (described in section C.4.1) were applied, and the estimate of 1990 to 1996 growth was added as new growth to the less than 20 year age category.

In the base year, about 22 percent of all structures for the 50 sample communities as a whole are in the 1976 to 1996 year built category, about 57 percent are in the 1946 to 1975 year built category, and about 21 percent are in the pre-1946 year built category. Among the 50 sample communities, however, there was considerable variation in the proportion of structures in each age category. For example, Myrtle Beach City, South Carolina had the largest proportion of structures built since 1976 (57 percent), and Wheeling City, West Virginia had the smallest proportion of structures built since 1976 (about 5 percent).

Structure Condition

The classification of structures by condition was primarily included in the PSM to reflect a change in a structure's physical status, allowing the PVM to adjust the current values of structures in the community. Based on the proportion of structures with selected structural deficiencies identified in the Census Bureau's American Housing Survey, (U.S. Department of Commerce, 1996) housing structure types by age were categorized as "below average" if they contained more than the median number of structural deficiencies for all structures in that community. Other structures were classified as "at or above average" if they contained the median or less than the median number of structural deficiencies for all structures in that community.

Flood Zone

The classification of structures according to flood zone was determined using the Q3 data for each SFHA to classify each Census block group within an SFHA portion according to flood zone. This distribution of flood zones was used to differentiate structures in coastal zones from those in inland zones. Ten of the 50 sample communities included in this study contained structures located in coastal zones (zones delineated as V, VO, V1-V30, VE, M or E), with the highest proportion of such structures in Myrtle Beach City, South Carolina, where an estimated 20 percent of structures lie in areas mapped as coastal zones. The remaining 40 communities contained structures located entirely in inland zones (zones delineated as A, AO, A1-A30, AE, AR, or AH).

FIRM Classification

The classification of SFHA structures as pre-FIRM or post-FIRM was determined using Census data, which provides an aggregated count of structures built within specific time intervals for all structures within a given area (U.S. Department of Commerce, 1992). Assuming a uniform distribution of structures built within each time period--a standard statistical procedure for developing estimates for small geographic areas for which annual observations are not
available--(Murdock, 1989), the effective date of the initial FIRM was used to estimate the percentage of pre-FIRM and post-FIRM SFHA structures in each group. On an unweighted basis for the 50 sample communities as a whole, about 70 percent of SFHA structures were estimated to be pre-FIRM SFHA structures in 1996. Among the 50 sample communities, the proportion of all SFHA structures determined to be pre-FIRM ranged considerably from a high of 93 percent of all SFHA structures classified as pre-FIRM in Washington County, Oklahoma, to a low of 38 percent of all SFHA structures classified as pre-FIRM in Myrtle Beach City, South Carolina. Based on results of extrapolating the 50 sample communities to national totals using the pre-FIRM structure weights developed for this study, the results imply that about 65 percent of SFHA structures were estimated to be pre-FIRM SFHA structures in 1996.

12.3.4 Structure Elevation Difference Classification

Structure Elevation Difference

The PSM classifies structures as being (1) at or above the BFE, (2) 1 or 2 feet below the BFE, (3) 3, 4, or 5 feet below the BFE, or (4) 6 feet or more below the BFE. Since NFIP actuarial premium rates vary considerably by elevation difference, the elevation differences were divided into the same categories in the PVM and IDM.

Several steps were used to estimate the number of pre-FIRM SFHA structures in the three categories below the BFE in each of the 50 communities. In general, the procedures involved the development of a set of community-level survey-based BFE results from the 23 surveyed communities, the development of a set of pooled survey-based results, and the assignment of elevation distributions to the 27 non-surveyed communities.

1. Community-Level Survey-Based BFE Results

As a first step, each of the 23 elevation certificate survey communities was grouped according to flood source (inland or coastal). Next, for each of the 23 surveyed communities, the percent of structures in each elevation category was calculated. These results were computed directly from the elevation certificate surveys (rounded to the nearest integer) and were used to classify the specific elevation distributions for the 23 surveyed communities.

2. Pooled Survey-Based BFE Results

First, the 23 surveyed communities, grouped by flood source, were ordered according to the percentage of structures in each elevation category. For example, all inland communities with high percentages of structures in the "6 feet or more below the BFE" category were classified together and all inland communities with high percentages of structures in the "at or above the BFE" category were classified together. After the elevation percentages were ordered, communities with similar elevation percentages were divided into four sub-groups. The weighted average of the elevation percentages in each of the four sub-groups was calculated using the individual communities' elevation percentage and the community weights developed for the 23 surveyed communities. These weights allow for estimation of the number of pre-FIRM SFHA structures at the national level based on estimates of pre-FIRM SFHA structures for the 23 communities.

3. Assignment of Elevation Distributions to 27 Non-Surveyed Communities

First, the average number of NFIP pre-FIRM claims in the 1979 to 1995 period was calculated as a percent of pre-FIRM SFHA structures. Next, these average claim percentages were adjusted by the pre-FIRM policy participation for each of the 27 non-surveyed communities. The 27 non-surveyed communities were divided into four groups ordered by the adjusted average claim percentages. The 27 non-surveyed communities with the highest adjusted average claim percentages were assigned the elevation percentages with the largest percent of structures in the "6 feet or more below the BFE" category. Likewise, those communities with the lowest adjusted average claim percentages were assigned elevation percentages with the largest percentage of structures in the "at or above the BFE" category. Since all 27 non-surveyed communities were classified with inland flooding, only the 12 surveyed communities with inland flooding were used in this process.

Among the 50 sample communities there was wide variation in the proportion of structures in the various elevation difference categories. The proportion of structures in the 6 feet or more below BFE elevation difference category was highest in Wheeling City, West Virginia where 80.4 percent of structures were classified in the -6 and below elevation difference category, 7.9 percent of structures were classified in the -3, -4 and -5 elevation difference category, 5.9 percent of structures were classified in the -1 and -2 elevation difference category, and 5.8 percent of structures were classified in the zero and above elevation difference category. At the other extreme, the proportion of structures in the zero and above BFE category was highest in Fort Lauderdale City, Florida where 96.6 percent of structures were classified in the zero and above elevation difference category and the remaining 3.4 percent of structures were classified in the -1 and -2 elevation difference category.

For the 50 sample communities extrapolated to the national level using the pre-FIRM structure weights, 29.9 percent of pre-FIRM structures were classified with an elevation difference of 1 or 2 feet below the BFE; 12.2 percent of pre-FIRM structures were classified with an elevation difference of 3, 4, or 5 feet below the BFE; 12.6 percent of pre-FIRM structures were classified with an elevation difference of 6 or more feet below the BFE.

Weighted to the national level, 45.4 percent of the pre-FIRM structures were classified at or above the BFE. Nationally, among the 54.6 percent of pre-FIRM structures below the BFE, 29.7 percent were classified with an elevation difference of 1 or 2 feet below the BFE; 12.1 percent of pre-FIRM structures were classified with an elevation difference of 3, 4, or 5 feet below the BFE; 12.8 percent of pre-FIRM structures were classified with an elevation difference of 6 or more feet below the BFE.

12.4 Non-Flood Related Events

In the PSM, several non-flood events affect the stock of pre-FIRM and post-FIRM SFHA structures in a given community. The non-flood related events described in this section include:

A natural rate of removals from the stock due to any non-flood related event

A natural rate of growth which adds new structures to the stock based on community growth
Normal improvements which are made to some structures as part of regular maintenance
A natural rate of deterioration which occurs for some structures

~~C.1.1~~12.4.1 Removals and Growth

Natural Rate of Removals

In the PSM, non-flood related removals from the stock of structures can occur for a number reasons, such as abandonment due to deterioration, changes in property values, fire, other non-flood natural events, or demolition for land redevelopment. To estimate an average annual rate of natural removals, the 1980 and 1990 Census data (U.S. Department of Commerce, 1992, *ibid*., 1982) were used at the corresponding county or Census tract level, by structure age:

$$\text{Average annual rate of removals} = \left(\frac{\text{1990 Number of structures}}{\text{1980 Number of structures}}\right)^{1/10}$$

For each community, for structures in the 0 to 20 years, 21 to 50 years, and 50 years and older categories, the above equation was used to estimate non-flood removals. To eliminate flood removals in the Census data and avoid double counting, average annual removals from flood events (the estimation of which is detailed below) were subtracted from the total removals to estimate non-flood removals. Overall non-flood removal rates for the 50 sample communities averaged 1.2 percent, 0.9 percent, and 1.8 percent for structures in the 0 to 20 years old, 21 to 50 year old, and over 50 year old age categories, respectively. The somewhat higher rates of removals in the 0 to 20 years old than in the 21 to 50 year old age category reflect the relatively rapid attrition of newer structures in fast growing areas where redevelopment often targets newer structures due to their location on the land which tends to be appreciating most rapidly. Of the sampled communities included in this study, Bay City, Arkansas, exhibited the highest overall rate of removals with rates of 1.5 percent, 1.4 percent, and 3.7 percent for structures in the 0 to 20 years old, 21 to 50 years old, and over 50 years old age category, respectively. Conversely, New Smyrna Beach City, Florida exhibited the lowest overall rate of removals, with rates of 0.6 percent, 0.4 percent, and 0.7 percent for structures in the 0 to 20 years old, 21 to 50 years old, and over 50 years old age category, respectively.

Natural Rate of Growth

The PSM is designed to track the stock of post-FIRM as well as pre-FIRM SFHA structures since both types of structures are used in the PVM to develop property value changes which are then used in turn by the PSM to adjust pre-FIRM removal rates for each community. To perform the required tracking of the stock of post-FIRM SFHA structures, the natural rate of growth of these structures is modeled.

The natural rate of growth of structures in each sample community was estimated in three steps. First, (as described above) the relationship between the growth in the age 21 to 65 population and the number of new structures was estimated for each community at the county or Census tract level which corresponded to the SFHA in each of the 50 sampled communities. Next, the growth in population for the county or Census tracts which corresponded to the SFHA was estimated annually using the Census Bureau's most recent annual population projections (U.S. Department of Commerce, 1996). Next, the Census-based population projections were applied to the estimated relationship between the growth in population and the growth in new structures to project the annual growth in new structures for each of the 50 sample communities.

The natural rate of growth in structures will be affected by property value changes as well as by population changes. Using econometric modeling, the effect of changes in property values on the growth of new structures was estimated for each sampled community using Census data for 1980 and 1990. In the PSM, these estimated parameters were applied to changes in property values estimated in the PVM for each projection year and affected the growth in new structures over the 1997 to 2022 simulation period.

Based on the PSM property growth estimates which reflect changes in property values as determined in the PVM, the average rate of growth in structures for all 50 sample communities over the 1997 to 2022 period is about 1.6 percent, with growth rates ranging from a high of about 5.2 percent in Myrtle Beach City, South Carolina, to a low of about -0.5 percent in Grundy Town, Virginia.

C.1.212.4.2 Improvements and Deterioration

Normal Improvements

In the PSM, two types of normal improvements are recognized: (1) improvements which reflect structural upgrades valued at less than 50 percent of a property's value, and (2) improvements which reflect structural upgrades which are valued at 50 percent or more of a property's value. The latter are, by definition, substantial improvements. Although NFIP regulations require that all substantially improved pre-FIRM SFHA structures be upgraded to become post-FIRM SFHA structures, the PSM assumes less than full compliance. Specifically, in the PSM, 25 percent of all (non-flood related) substantial improvements are assumed to convert a pre-FIRM property to a post-FIRM property in 1997, with this proportion increasing at the rate of one percent a year until reaching a maximum of 50 percent in 2022, the final projection year. These increasing post-FIRM conversion rates reflect the assumption that compliance with NFIP rules for substantial improvements is gradually increasing over time.

For non-substantial improvements, data from both the Census Survey of Residential Finance and the American Housing Survey (U.S. Department of Commerce, July 1997, *ibid*. August 1996) was used to estimate the proportion of structures by age and type of structure which undergo improvements of ten to 50 percent of a structure's total value. The ten percent amount was set as the lower bound for improvements which upgrade a property from "below" to "at or above" average condition based on the assumption that improvements less than this are not large enough to significantly upgrade a property. For all pre-FIRM and post-FIRM SFHA structures, annual non-substantial improvement rates averaged about 4.0 percent of structures, with rates averaging about 2.0 percent, 4.0 percent, and 6.0 percent for structures in the 0 to 20 years old, 21 to 50 years old, and over 50 years old age categories, respectively.

For substantial improvements, both the Census American Housing and the Residential Finance Survey data (*op. cit*., July 1997, *op. cit*. August 1996) were used to estimate the proportion of structures by age and type of structure that undergo improvements valued at 50 percent or more of a structure's total value. For all pre-FIRM and post-FIRM SFHA structures, annual substantial improvement rates averaged about 0.2 percent of structures, with rates averaging about 0.1 percent, 0.2 percent, and 0.3 percent for structures in the 0 to 20 years old, 21 to 50 years old, and over 50 years old age categories, respectively.

Natural Deterioration

In the PSM, two types of natural deterioration are recognized: (1) deteriorations which involve less than 50 percent of a property's value, and (2) deteriorations which involve 50 percent or more of a property's value. The latter are, by definition, (FEMA, 1991) substantial damages, and reflect damages of 50 percent or more to a structure from any single non-flood event such as fire or wind damage. Although NFIP regulations require that all pre-FIRM SFHA structures which suffer substantial damage be upgraded with proper flood mitigation to become post-FIRM SFHA structures, (*ibid*.) the PSM assumes only partial compliance with NFIP rules for substantial damage. Specifically, 25 percent of all non-flood related substantial damages are assumed to convert a pre-FIRM property to a post-FIRM property in 1997, with this proportion increasing at a rate of one percentage point a year until reaching a maximum of 50 percent in 2022, the final projection year. These increasing post-FIRM conversion rates reflect the assumption that compliance with NFIP rules for substantial damage will gradually improve over time.

Rates of non-substantial deterioration and substantial damage are estimated using data from the Census Survey of Residential Finance and the American Housing Survey (U.S. Department of Commerce, July 1997, *op. cit*. August 1996); the 1980 study by Sheaffer & Roland, Inc., *Alternatives for Implementing Substantial Improvement Definitions (*FEMA, 1980*)*, and data collected from the Red Cross, (American Red Cross, 1997) the National Fire Prevention Association, and the National Safety Council, (National Safety Council, 1997). The Census data were used to estimate average annual rates of deterioration resulting from normal wear and tear, while data from the Red Cross, the National Fire Prevention Association, the National Safety Council, and the Sheaffer & Roland study were used to estimate the proportion of structures affected by specific non-flood events such as fires or earthquakes. While rates of deterioration were estimated by structure type and age using Census data on average annual structural failures, substantial damage rates were estimated at a more aggregated level by residential and non-residential units (U.S. Department of Commerce, 1996). The more aggregated estimate of substantial damages was necessitated by the fact that damage rates were not available by structural characteristic.

~~C.1.3~~12.4.3 Total Pre-FIRM Attrition

Combining the impacts of natural deterioration, substantial improvements, and non-flood related removals, the total attrition of pre-FIRM SFHA structures can be estimated. Over the 1997 to 2022 modeling period, the PSM simulation estimates an average of 1,222 non-flood pre-FIRM removals per year for the 50 sample communities. These removals are shown on line 1 of Table C.3 which presents unweighted estimates of components of change to pre-FIRM SFHA structures for the 50 sample communities over the 1997 to 2022 period.

Based on results of extrapolating the 50 sample communities to national totals with the pre-FIRM structure weights which reflect an estimated 4,294,673 pre-FIRM SFHA structures in the 15,461 NFIP communities included in this study, the PSM estimates an average of 29,073 non-flood pre-FIRM removals per year for the universe of study communities. These removals are shown on line 1 of Table C.4, which presents estimates of the 1997 to 2022 components of change to pre-FIRM SFHA structures for the universe of 15,461 study communities.

To arrive at the estimated 29,073 non-flood pre-FIRM removals per year for the universe of study communities, the following steps were used:

Table C.3
Components of Change to Pre-FIRM SFHA Structures, 1997-2022
50 Sample NFIP Communities

Line	Property Simulation Model Event	1997-2022 Total Change	1997-2022 Average Annual Change	1997-2022 % Removal of pre-FIRM Structures
1	Non-flood removals	30,555	1,222	14.8
2	+ Structural Mitigation	13,500	540	6.5
3	+ Post-disaster non-structural mitigation	3,795	152	1.8
4	+ Pre-disaster non-structural mitigation	1,363	55	0.7
5	= Total pre-FIRM removals	49,213	1,969	23.8
6	1997 Pre-FIRM SFHA structures	206,478		
7	- Total pre-FIRM removals	49,213		
8	= 2022 pre-FIRM SFHA structures	157,265		

Table C.4
Components of Change to Pre-FIRM SFHA Structures, 1997-2022
Universe of 15,461 NFIP Study Communities

Line	Property Simulation Model Event	1997-2022 Total Change	1997-2022 Average Annual Change	1997-2022 % Removal of pre-FIRM Structures
1	Non-flood removals	726,833	29,073	16.8
2	+ Structural Mitigation	303,241	12,130	7.0
3	+ Post-disaster non-structural mitigation	78,975	3,159	1.8
4	+ Pre-disaster non-structural mitigation	27,519	1,101	0.6
5	= Total pre-FIRM removals	1,136,568	44,463	26.3
6	1997 Pre-FIRM SFHA structures	4,294,673		
7	- Total pre-FIRM removals	1,136,568		
8	= 2022 pre-FIRM SFHA structures	3,158,105		

1. *Applying Community Weights with Pre-FIRM Natural Attrition Estimates*

In the methodology used to select the sample of communities and structures included in this study, a set of pre-FIRM SFHA structure weights was developed for the 50 sample communities. These structure weights reflect each community's relative share of all pre-FIRM SFHA structures in the 15,461 study communities. After refinement of the estimation of the number of pre-FIRM SFHA structures for 1996 in the study communities, these pre-FIRM SFHA structure weights were finalized to reflect an estimated 4,330,884 pre-FIRM SFHA structures for 1996 in the study communities. By multiplying each community's pre-FIRM structure count weight by that community's estimate of total pre-FIRM natural attrition, a set of community weighted pre-FIRM natural attrition estimates resulted.

2. *Aggregating Weighted Pre-FIRM Natural Attrition Estimates to Universe Totals*

By aggregating the community weighted pre-FIRM property attrition estimates over all of the 50 communities, an estimate of total natural attrition for all 4.3 million pre-FIRM SFHA structures for 1996 in the 15,461 study communities was obtained. This aggregation of community weighted natural attrition resulted in the estimate of a natural attrition of 29,073 pre-FIRM SFHA structures per year for the universe of study communities.

12.5 Flood-Related Events

As depicted in the flow chart presented in the introduction(Figure C.1), flood events immediately affect the stock of structures through deterioration or substantial damage in the PSM. Flood damages by magnitude of flood event by structure type for each of the 50 sample communities were developed using the steps summarized below and detailed in the following sections:

1. Based on community-specific flood zone information, each of the 50 communities was assigned to one of the flood recurrence interval/elevation functions provided by FEMA.

2. A community-specific average elevation difference for structures in each elevation difference category was estimated based on the elevation differences obtained from the 7,628 elevation surveyed SFHA structures.

3. The community-specific average elevation differences for structures by elevation difference category were applied to the flood recurrence interval/elevation functions provided by FEMA to determine the depth of water in a structure resulting from the 10-year, 25-year, and 100-year flood events.

4. Community-specific damage estimates by type of structure and magnitude of flood event were estimated for each sample community using the estimated water depths in a structure and water depth/percent damage tables provided by FEMA.

5. Substantial damage rates were estimated as a proportion of total damage rates by structure and magnitude of flood event for each sample community.

6. Damage rates were applied to selected structures in each sample community to simulate deterioration or substantial damages resulting from a flood event.

~~C.1.1~~12.5.1 Community Recurrence Interval/Elevation Function Assignments

To assign each of the 50 sample communities a flood recurrence interval/elevation function provided by FEMA, the flood zone that best characterized the overall community was determined. To characterize an overall community's flood zone, an estimate of the average depth of flooding was calculated for each community. This average depth of flooding measure was the same concept used to classify structures by depth of flooding in the sampling phase of the study. To estimate this average depth of flooding for each of the 50 sample communities, two primary sources were used. For the 23 communities in which the 7,628 elevation surveys on individual structures in the SFHA were completed, average depths of flooding were estimated as the simple mean of the depths of flooding reported for all of the surveyed structures in that community. For the remaining 27 communities, average depths of flooding were estimated using the Q3 data, which provided a breakdown of the proportion of SFHA land by flood zone. The average depth of flooding was estimated as a land-area weighted average of all of the flood zones in each SFHA using the average depth of flooding measure associated with each flood zone.

Next, each community was characterized by the flood zone which most closely corresponded to one of the zones included in the 1982 FEMA report *Simulation Model of Annual Flood Losses for the National Flood Insurance Program* (Leikin, 1982). Since this study reported average water depth by flood zones grouped as inland zones A1-A5, A6-A10, A11-A14, A15-A17, A18-A22, A23-A30, and coastal zones V1-V3, V4-7, V8-V11, V12-V17, V18-V23, V24-V30, each inland community was assigned one of the A zones based on its average flood depth. Since they contain both A zones and V zones, coastal communities were assigned both an A zone and a V zone based on the community's average flood depth. In the 1982 FEMA report, each of these A and V zones is characterized by a flood recurrence interval/elevation function which provides the elevation of a flood relative to the base flood (100-year) elevation. It is these flood recurrence interval/elevation functions which formed the basis for estimating the differential effects of 10-year, 25-year, and 100-year floods in each community.

In rating insurance policies, the NFIP uses the standard term "elevation difference" to mean the difference between the elevation of a building's lowest floor and the Base Flood Elevation

(BFE) (FEMA, 1982). An elevation difference of -2 feet would indicate that the lowest floor is two feet below the BFE. This difference between the lowest floor and the BFE was provided by the 7,628 elevation surveys of individual SFHA structures undertaken for this study.

In the 1982 FEMA report, (Leikin, 1982) the recurrence interval/elevation functions provide the elevation of a flood relative to the Base Flood (100-year) elevation. For example, for zones A6-A10, the 20-year flood event may be three feet below the 100-year flood event elevation.

If, for example, a building's elevation relative to the BFE (its "elevation difference) is -4 feet in zones A6-A10, then the 20-year flood event would produce a depth of water in the building of one foot. The depth-percent damage table provided in the 1982 FEMA report can then be used to determine the damage produced by one foot of water in the building.

12.5.2 Average Elevation Difference Estimation

The PSM recognizes four categories of elevation difference for structures: 0 and above; -1 and -2; -3, -4, and -5; and -6 and below. However, a specific elevation difference for each cell is necessary to estimate damage rates for structures in that cell. The structure data from the 23 surveyed communities was used to estimate an elevation difference for each cell. The individual surveyed structures were organized into unique groups according to three characteristics:

Basement status— presence or absence of a basement
Depth of flooding in the community— shallow, medium, or deep
Location of the community— inland or coastal

For each of these groups, an average elevation difference was calculated, weighted by the number of pre-FIRM SFHA structures in the community and the community's national weight. This average elevation difference was then applied to all cells with the same characteristics in all 50 communities. For example, a cell with a basement in an inland community with medium depth of flooding was assumed to have the same elevation difference as the weighted average of all surveyed structures in all communities with these same three attributes.

For each of the 23 surveyed communities, the average elevation difference of all surveyed structures in the four elevation categories in that community was calculated. If there were three or more surveyed structures in an elevation category in a particular community, this community average was used as the elevation difference, rather than the weighted average described above. This was done to retain community-specific elevation characteristics and maintain accuracy in the estimates.

For the 50 communities as a whole, elevation differences in the 0 and above category averaged, on an unweighted basis, 1.6 feet; in the -1 and -2 category, -1.3 feet; in the -3, -4, and -5 category, -3.8 feet; and in the -6 and below category, -10.3 feet. The elevation differences ranged from 20.2 feet below the BFE in Louisville City, Kentucky, to 4.1 feet above the BFE in Sacramento County, California.

12.5.3 Estimating the Depth of Water in a Structure

To estimate the depths of water in a structure as a result of 10-year, 25-year, and 100-year flood events, the community-specific average elevation differences for structures were applied to that community's flood recurrence interval/elevation function. Suppose, for example, that Lewisport City, Kentucky was categorized as an A6-A10 community based on an average depth of 3.5 feet of water. Further, suppose that for zones A6-A10, the 25-year event is 2.5 feet below the 100-year flood and the 10-year flood is 4.5 feet below the 100-year flood as given by FEMA's zone A6-A10 recurrence interval/elevation function. Suppose further that the estimated average elevation difference for a group of structures in the -3, -4 and -5 elevation difference category was -4. In this case, while the 100-year flood would produce four feet of water in these structures, the 25-year flood would produce 1.5 feet of water in these structures, and the 10-year flood would produce -0.5 feet of water in these structures

Since the terms "10-year," "25-year," and "100-year" flood refer to floods that have a ten percent, four percent, and one percent probability of being equaled or exceeded in any year, respectively, (Leikin, 1982) estimated water depths from each of the three types of floods will include a range of all floods of equal or greater magnitude for each type of flood. Thus, in calculating average water depths for the 10-year flood for a given flood zone, the probability-weighted averages of all floods ranging from the 10-year to the 500-year flood were estimated by interpolating the water depths for each flood zone as reported by the NFIP and multiplying these interpolated water depths by the probability of each particular flood's occurrence. Similarly, estimation of average water depths from the 25-year flood events involved calculating the probability-weighted average depths of 25-year to 500-year floods. Finally, the estimation of average water depths from 100-year flood events involved calculating the probability-weighted average depths of 100-year to 500-year floods.

12.5.4 Damage Rate Estimation

In the estimation of damage rates at various flood depths by type of structure, four types of structures were identified: (1) one floor residential structures, (2) two floor residential structures, (3) manufactured housing units, and (4) non-residential structures. Since the PSM cell categories do not classify structures by number of floors, it was assumed, based on analysis of the 7,628 structures surveyed in the SFHA for this study, that single family detached dwellings could be reasonably modeled as single story structures, while all attached dwelling units could reasonably be modeled as two floor units. For non-residential units, analysis of the NFIP flood insurance claims data over the 1979 to 1995 period was used to estimate a non-residential damage rate of about 1.2 times that of the one floor residential unit damage rates in coastal areas and a non-residential damage rate equal to those of the one floor residential unit damage rates in inland areas.

To estimate flood damage rates by type of structure and flood magnitude for each of the 50 communities, flood damage rates provided by FEMA and reported by water depths in single foot increments were used to develop probability-weighted flood event exceedence rates interpolated to estimate damages from the estimated water depths from the 10-year, 25-year, and 100-year floods for each community. The FEMA flood damage rates, based on NFIP claims data, (FEMA, August 1996) reflect averages of the percent of damage (valued in dollar terms) to particular types of structures experiencing a given depth of water. Suppose, for example, that flood damage rates for two story structures were estimated at 15.5 percent at a water depth of two feet and 17.5 percent at a water depth of three feet and that the estimated 25-year flood water depth for that community was 2.33 feet. Then the flood damage for multiple unit structures for the 25-year flood for that community would be estimated by interpolating two thirds of the two foot water depth damage rate and one third of the water depth damage at three feet:

(0.67) x (15.5) + (0.33) x (17.5) = 16.16

Based on these damage rate computations, damage rates for the 50 communities varied widely depending upon the flood magnitude, community, elevation difference category, and type of structure. In general, flood damage rates were highest for 100-year flood events; damage rates were larger for structures increasingly below the BFE, and damage rates were highest for manufactured housing. Table C.5 presents unweighted average damage rates for all of the 50 sample communities by flood event, elevation difference category, and type of structure:

Since flood damage rates were estimated for each individual community, the results presented in Table C.5 are 50-community average damage rates for presentation purposes and are not the actual flood damage rates used in the model. The rates presented in the table are, however, indicative of the relative flood damage rate patterns for individual communities. In general, flood damage patterns show increasingly higher damage rates for the 10-year, 25-year, and 100-year flood events, respectively, although this pattern is insignificant for structures at or above the BFE. In general, the NFIP claims data-based damage functions as reported in the 1982 FEMA study (Leikin, 1982) indicate that increasingly higher magnitude floods have only a very small effect on damage rates for structures already at or above the BFE.

Within the averages presented in Table C.5, there was considerable variation among communities. For the 100-year flood, damages were highest in League City, Texas, where damage rates for structures at -6 feet or below elevation difference averaged 77.2 percent for single family residential structures, 54.2 percent for multiple family residential structures, 87.9 percent for manufactured housing, and 81.1 percent for non-residential structures. Damages for the 100-year flood were lowest in Omaha City, Nebraska, where damage rates for structures at -6 feet or below elevation difference averaged 39.0 percent for single family residential structures, 25.2 percent for multiple family residential structures, 59.1 percent for manufactured housing, and 39.0 percent for non-residential structures.

For the 25-year flood, damage rates for structures at -6 feet or below elevation difference in League City, Texas averaged 42.8 percent for single family residential structures, 30.1 percent for multiple family residential structures, 53.7 percent for manufactured housing, and 51.4 percent of non-residential structures. For the 25-year flood, damage rates for structures at -6 feet or below elevation difference in Omaha City, Nebraska averaged 32.4 percent for single family residential structures, 24.8 percent for multiple family residential structures, 53.2 percent for manufactured housing, and 32.4 percent for non-residential structures.

Table C.5
Damage Rates for 100, 25, and 10-Year Flood Events
Unweighted Averages for 50 Sample NFIP Communities

100-Year Flood				
Elevation			Manu-	Non-

Difference Category	Single Family	Multiple Family	factured Housing	Residential Unit
0 and above	17.50%	13.92%	24.68%	18.38%
-1 and –2	23.18%	17.95%	32.22%	24.34%
-3, -4, and -5	40.16%	26.43%	56.54%	42.16%
-6 and below	52.96%	35.51%	73.52%	55.61%

25-Year Flood				
Elevation Difference Category	Single Family	Multiple Family	Manu-factured Housing	Non-Residential Unit
0 and above	17.38%	13.76%	23.45%	18.25%
-1 and -2	23.06%	17.78%	29.99%	24.21%
-3, -4, and -5	27.78%	21.13%	43.44%	29.17%
-6 and below	40.59%	30.21%	60.42%	42.61%

10-Year Flood				
Elevation Difference Category	Single Family	Multiple Family	Manu-factured Housing	Non-Residential Unit
0 and above	17.24%	13.51%	23.26%	18.10%
-1 and -2	22.87%	17.39%	29.75%	24.02%
-3, -4, and -5	26.78%	19.95%	41.88%	28.12%
-6 and below	38.23%	27.55%	56.92%	40.14%

For the 10-year flood, damage rates for structures at -6 feet or below elevation difference in League City, Texas averaged 36.5 percent for single family residential structures, 25.2 percent for multiple family residential structures, 46.2 percent for manufactured housing, and 43.8 percent of non-residential structures. For the 10-year flood, damage rates for structures at -6 feet or below elevation difference in Omaha City, Nebraska averaged 29.0 percent for single family residential structures, 24.3 percent for multiple family residential structures, 48.6 percent for manufactured housing, and 29.0 percent for non-residential structures.

12.5.5 Substantial Damage Rate Estimation

To estimate substantial damages resulting from flood events, 1979 to 1995 NFIP flood insurance claims data (FEMA, August 1996) were used to analyze the number of flood insurance claims at or in excess of 50 percent of the total value of the property as a percent of all claims in all NFIP communities. Although the claims data do not classify structures by detailed structure type or type of flood, an attempt was made to identify the flood magnitude as a 10-year, 25-year, or 100-year flood based on a determination of the specific event that resulted in substantial damages. Although only a small percentage of events could be assigned a magnitude, partial identification as well as discussions with flood experts provided information to estimate substantial damage proportions (the ratio of substantial damage to total damage). These substantial damage proportions are: 12.5 percent for inland and 14.5 percent for coastal flooding for the 100-year flood; 6 percent for inland and 7 percent for coastal flooding for the 25-year flood; and 4 percent for inland and 3 percent for coastal flooding for the 10-year flood. Based on analysis of NFIP flood insurance claims for smaller floods as well as discussions with floodplain management experts, the 10-year flood was the only flood event in which inland flooding substantial damage was modeled to exceed that of coastal flooding substantial damage.

As with overall damages, substantial damage rates varied by community, type of structure, magnitude of flood event, and elevation difference category for each group of structures. Table C.6 presents unweighted average substantial damage rates for all of the 50 sample communities by flood event, elevation difference category, and type of structure.

Since substantial damage rates were estimated for each individual community, the results presented in Table C.6 are 50-community average substantial damage rates for presentation purposes and are not the actual substantial damage rates used in the model. The rates presented in the table are, however, indicative of the substantial damage rate patterns for individual communities.

Within the averages presented in Table C.6, there was considerable variation among communities. For the 100-year flood, substantial damages were highest in Sacramento County, California where substantial damage rates for structures at -6 feet or below elevation difference averaged 11.9 percent for single family structures, 8.3 percent for multiple family structures, 14.4 percent for manufactured housing, and 6.2 percent for non-residential units. Damages for the 100-year flood were lowest in Washington County, Oklahoma, where damage rates for structures at -6 feet or below elevation difference averaged 5.7 percent for single family structures, 3.7 percent for multiple family structures, 8.6 percent for manufactured housing, and 4.7 percent for non-residential units.

For the 25-year flood, substantial damage rates for structures at -6 feet or below elevation difference in Sacramento County, California averaged 4.5 percent for single family structures, 3.2 percent for multiple family structures, 5.7 percent for manufactured housing, and 5.4 percent for non-residential units. For the 25-year flood, substantial damage rates for structures at -6 feet or below elevation difference in Washington County, Oklahoma averaged 3.2 percent for single family structures, 2.6 percent for multiple family structures, 5.3 percent for manufactured housing, and 3.3 percent for non-residential units.

Table C.6
Substantial Damage Rates for 100, 25, and 10-Year Flood Event
Unweighted Averages for 50 Sample NFIP Communities

100-Year Flood				
Elevation Difference Category	Detached	Attached	Manu-factured Housing	Non-Residential Unit

0 and above	3.49%	2.27%	4.87%	3.72%
-1 and -2	4.68%	3.06%	6.59%	5.07%
-3, -4, and -5	5.29%	3.50%	7.40%	5.71%
-6 and below	8.19%	5.53%	11.20%	6.12%

25-Year Flood				
Elevation Difference Category	Detached	Attached	Manu-factured Housing	Non-Residential Unit
0 and above	0.76%	0.59%	1.25%	0.79%
-1 and -2	1.45%	1.11%	2.31%	1.50%
-3, -4, and -5	2.34%	1.78%	3.67%	2.39%
-6 and below	4.28%	3.15%	6.28%	4.50%

10-Year Flood				
Elevation Difference Category	Detached	Attached	Manu-factured Housing	Non-Residential Unit
0 and above	0.53%	0.42%	0.89%	0.55%
-1 and -2	0.70%	0.54%	0.97%	0.70%
-3, -4, and -5	1.12%	0.85%	1.54%	1.12%
-6 and below	2.53%	1.89%	3.45%	2.67%

For the 10-year flood, substantial damage rates for structures at -6 feet or below elevation difference in Sacramento County, California averaged 2.8 percent for single family structures, 2.0 percent for multiple family structures, 3.5 percent for manufactured housing, and 3.3 percent for non-residential units. For the 10-year flood, substantial damage rates for structures at -6 feet or below elevation difference in Washington County, Oklahoma averaged 2.1 percent for single family structures, 1.7 percent for multiple family structures, 3.0 percent for manufactured housing, and 2.2 percent for non-residential units.

The substantial damage rates developed above were applied to pre-FIRM SFHA structures in each of the sample communities. The PSM does recognize, however, that substantial damages can affect post-FIRM SFHA structures to the extent that some post-FIRM SFHA structures, 91 percent of which were assumed to be above BFE (based on FEMA's reported elevation compliance estimates), would be affected by a flood event. Based on substantial damage rates for pre-FIRM and post-FIRM SFHA structures reported by FEMA in research undertaken in developing its Increased Cost of Compliance coverage, the PSM models post-FIRM substantial damages to be 56% of those for pre-FIRM SFHA structures for inland flooding and 62% of those for pre-FIRM SFHA structures for coastal flooding.

12.5.6 Estimating the Number of Damaged and Substantially Damaged Structures

In estimating the number of structures which deteriorate in the PSM, total damage rates are applied proportionally by structure type, flood zone, and elevation difference category to estimate the portion of structures reached by floodwater and downgraded from the "at or above average" to the "below" average condition. Although these non-substantial damage deteriorations do not affect the pre-FIRM classification of a given property, they are included to reflect a change in the structure's physical status. The non-substantial damage deteriorations are designed to reflect a range of damages from one percent to just below 50 percent. From these deteriorations, changes in physical status allow the PVM to adjust the current value of structures in the community. These PVM-based value changes are then used in turn by the PSM to adjust rates of property growth and removal in each community.

For substantial damages, the estimated substantial damage rates are applied, by structure type, flood zone, and elevation difference category, to the percentages of structures reached by floodwater in the community. As depicted in Table C.6, substantial damage rates vary by flood magnitude, elevation difference category, and type of structure, as well as by community.

In this way, damages and substantial damages are incorporated in the PSM for each of the three flood scenarios, for each property type, and in each of the 50 sample communities. Over the 1997 to 2022 modeling period, the PSM simulation for the 25-year flood estimates flood-related substantial damages to pre-FIRM SFHA structures to average about 270 per year for the 50 sample communities. Based on results of extrapolating the 50 sample communities to national totals (which include an estimated 4,294,673 pre-FIRM SFHA structures for 1996 in the 15,461 NFIP communities included in this study), the number of structures with flood-related substantial damages as a result of 25-year and greater flood events are estimated to average about 5,400 a year.

To arrive at an estimated 5,400 substantially damaged pre-FIRM SFHA structures per year for the universe of study communities, the following steps, similar to those involved in estimating the natural attrition of pre-FIRM SFHA structures, were used:

1. *Applying Community Weights with Substantial Damage Estimates*

As part of the process of sampling communities and structures for this study, a set of pre-FIRM SFHA structure weights was developed for the 50 sample communities. These structure weights reflect each community's relative share of all pre-FIRM SFHA structures in the 15,461 study communities. After refinement of the estimation of the number of pre-FIRM SFHA structures in the study communities, these pre-FIRM structure weights were finalized to reflect an estimated 4,294,673 pre-FIRM SFHA structures in the study communities. By multiplying each community's pre-FIRM structure count weight by that community's estimate of substantially damaged structures, a set of community weighted substantial damages resulted.

2. *Aggregating Weighted Substantial Damage Estimates to Universe Totals*

By aggregating the community weighted substantial damages over all of the 50 communities, an estimate of total substantial damages for all 4.3 million pre-FIRM SFHA structures in the 15,461 study communities was obtained. This aggregation of community weighted substantial damages resulted in the estimate of 5,400 substantially damage pre-FIRM SFHA structures per year for the universe of study communities.

12.6 Nonstructural Mitigation Events

Although the PSM modeling of nonstructural mitigation follows from a number of assumptions regarding available funding for various nonstructural mitigation programs, the number of structures affected by nonstructural mitigation in the PSM is consistent with the model's flood damage estimates and parameters regarding substantial improvement rates for substantially damaged structures. As presented in the previous section, for example, the PSM estimates about 270 structures per year substantially damaged as the result of a flood event in the 50 sample communities. Nationally, the PSM estimates about 5,400 substantially damaged as the result of a flood event. As will be detailed in this section, the PSM estimates about 207 structures in the 50 sample communities and about 4,260 structures nationally to be affected annually by nonstructural mitigation. On average over the 1997 to 2022 period, these annual nonstructural mitigation estimates relative to the total number of substantially damaged structures imply that about 77 percent of substantially damaged structures in the 50 communities and about 79 percent of structures nationally are substantially improved. As will be detailed in the following section, these implied substantial damage rates are internally consistent with the PSM's assumptions regarding flood related substantial damage rates over the 1997 to 2022 period.

An important objective of the NFIP is to protect structures in floodplains from flood-related damage. To support this objective, the NFIP regulations contain building design and construction measures that apply to post-FIRM construction and substantially damaged pre-FIRM SFHA structures (FEMA, 1991). According to these regulations, post-FIRM residential structures in SFHA-delineated flood zones must be constructed with their lowest floor at or above the BFE. Non-residential structures constructed in SFHA-delineated flood zones must either have their lowest floor elevated to at or above the BFE or be dry flood proofed to at or above the BFE.

For pre-FIRM structures in the SFHA, any reconstruction, rehabilitation, addition, or other improvement of a structure with a cost equaling or exceeding 50 percent of the market value of the structure before the start of the improvement qualifies as a "substantial improvement" (FEMA, 1991). By NFIP regulation, any substantially improved pre-FIRM structure automatically becomes a post-FIRM structure and is actuarially rated based on its risk of flooding. These substantial improvements must meet the criteria established for post-FIRM SFHA structures and be constructed with their lowest floor at or above the BFE. For residential structures, this generally results in property elevation, relocation, or demolition in riverine and coastal flooding areas, although elevation is frequently more common in coastal flooding areas. For non-residential structures, rules for substantial improvement generally result in dry flood proofing to make the non-residential structure watertight to at or above the BFE (FEMA, 1993). It is these pre-FIRM SFHA conversions to post-FIRM SFHA structures which this section addresses.

12.6.1 Nonstructural Mitigation, General Model Assumptions

Pre-Disaster and Post-Disaster Nonstructural Mitigation

In the PSM, nonstructural mitigation activities are modeled as either post-disaster events which occur immediately after a flood event or as pre-disaster mitigation activities which do not occur immediately after a flood event but result from flood damages occurring at some time in the past. For modeling purposes in the PSM, a distinction between post-disaster and pre-disaster nonstructural mitigation activities involves assumptions about the sources of funds for these two types of mitigation activities. For post-disaster nonstructural mitigation, funding sources are assumed to include: FEMA's Hazard Mitigation Grant Program (HMGP); the Department of Housing and Urban Development's (HUD) Community Development Block Grant (CDBG) funding; the Small Business Administration's (SBA) funding; and owner financed elevation, relocation and removal. For pre-disaster nonstructural mitigation activities, funding sources are assumed to include FEMA's Flood Mitigation Assistance (FMA) program and all state, local, and private funding.

Modeling Nonstructural Mitigation

In the PSM, after substantial damages to structures are assessed as the result of a flood event, the model assumes that a portion of the pre-FIRM SFHA structures that are substantially damaged are substantially improved and upgraded to become post-FIRM SFHA structures. Specifically, the PSM assumes that at the beginning of the 1997 to 2022 period, 70 percent of substantially damaged pre-FIRM SFHA structures are substantially improved and become post-FIRM SFHA structures. These rates, suggested by FEMA officials and consistent with the judgment of floodplain management experts (Godschalk, 1997, van Kirk, 1997, Wetmore, 1997), increase at the rate of one-half of one percentage point a year, so that by 2022, 82.5 percent of substantially damaged pre-FIRM SFHA structures are substantially improved to become post-FIRM SFHA structures. These increasing post-FIRM conversion rates incorporate the projected impact of the new Increased Cost of Compliance (ICC) coverage, increased funding for FEMA's HMGP and FMA programs, and more generally, reflect the assumption that compliance with NFIP rules for substantial improvements is gradually increasing over time.

Nonstructural mitigation occurs in the PSM as the result of elevations, dry flood proofings, or removals and relocations. The primary distinction among pre-disaster mitigation activities is that acquisitions and relocations involve relocating a pre-FIRM structure out of the floodplain, while elevations or dry flood proofings upgrade a structure from pre-FIRM to post-FIRM classification but do not relocate it out of the SFHA.

12.6.2 Estimating Annual Expenditures for Nonstructural Mitigation

Estimation of the average annual expenditure for elevations, dry flood proofings, and acquisitions and relocations first requires an estimate of total annual average expenditures for nonstructural mitigation. To estimate annual average nonstructural mitigation totals, a variety of sources were used. Based on analysis of expenditure data reported by FEMA, the Department of Housing and Urban Development (HUD), the Small Business Administration (SBA), the U.S. Department of Agriculture (USDA), and Federal and state and local funding sources reported in the 1996 University of North Carolina study *Assessing Planning and Implementation of Hazard Mitigation Under the Stafford Act,* (Bohl *et al*. 1996) annual expenditures of post-disaster nonstructural mitigation from all sources were estimated to average about $78 million per year in 1996 dollars between 1986 and 1995.

While this $78 million average expenditure was representative of pre-1993 expenditures, funding levels have increased dramatically during the 1990's. Reasons for these funding increases include: the 1993 Volkmer Amendment that increased funding levels through the Hazard Mitigation Grant Program (HMGP); FEMA's new Increased Cost of Compliance (ICC) coverage program; the creation of FEMA's new Flood Mitigation Assistance Program (FMA); increased commitments from HUD's Community Development Block Grant (CDBG) program; increased funding available through SBA's Home Disaster Loan and Business

Physical Loan program; and increased funding commitments from USDA's Housing and Repair Programs.

Based on data for 1996, it is estimated that about $68 million was obligated for the HMGP for nonstructural flood mitigation. In addition to HMGP funding, about $17 million was available through FEMA's FMA program. This amount is expected to reach its statutory limit of $20 million by 1998, for a total of about $86 million available from these two programs in 1996.

Based on analysis from the 1996 University of North Carolina study, it is estimated that with the current Federal-state cost sharing arrangements, one dollar of HMGP and FMA funding will generate an additional $1.20 of spending from all other Federal, state, local, and personal sources. Assuming that the current cost sharing arrangements (which commit Federal payments at 75 percent of a project's total eligible costs) hold into the future, an average estimated mitigation expenditure of about $86 + $106 = $192 million, in 1996 dollars, is assumed for future years.

Analysis of HMGP expenditures indicate that between 1986 and 1996 about 17.5 percent of total obligated funds were not used for acquisitions, relocations or structural improvements (mainly dry flood-proofing) but were instead used for other purposes such as drainage projects, equipment purchases, and planning and research. Based on these findings, the PSM assumes that in the future only 82.5 percent of obligated funds will be used to fund acquisitions, relocations, or structural improvements. If this ratio of 0.825 is applied to $192 million, the result is an estimated $158 million, the assumed annual expenditure level for non-insured nonstructural mitigation in 1996 dollars.

In addition to the HMGP and FMA program, FEMA's new Increased Cost of Compliance (ICC) coverage program mandated under the National Flood Insurance Reform Act of 1994 is expected to be a significant source of mitigation funding in the future. Under the ICC, every property owner insured under the NFIP will, for an addition premium of up to $75, receive $15,000 coverage to help pay for elevating, flood proofing, demolishing, or relocating a structure that has been substantially or repetitively damaged by flooding. In the judgment of FEMA officials, ICC coverage-based funding is expected to average about $56 million annually for nonstructural mitigation. Adding this $56 million for insured structures to the $158 million for uninsured structures produces a total of $214 million expended annually for all nonstructural mitigation efforts.

Of the $214 million estimated to be expended annually for all nonstructural mitigation efforts, $158 million is estimated to be expended for all post-disaster mitigation programs, and the remaining $56 million is estimated to be expended for all pre-disaster mitigation programs. The $56 million in estimated annual expenditures for pre-disaster nonstructural mitigation includes $20 million from the FMA and $36 million from state, local, and private funding. State, local, and private funding expenditures are estimated through sources reported in the 1996 University of North Carolina study *Assessing Planning and Implementation of Hazard Mitigation Under the Stafford Act (*Bohl *et al*. 1996).

Based on analysis of HMGP obligated funds and discussions with state and local officials as well as the judgment of floodplain management experts, the PSM assumes that 25 percent of mitigated structures are involved in flood proofing or elevation, at an average current cost of about $30,000 per structure. Based on similar analysis, the PSM assumes that about 75 percent of mitigated structures are acquired or relocated at an average current cost of about $60,000 per structure, the estimated average cost reported by FEMA.

Using the $158 million estimated annual expenditure for post-disaster mitigation and the $56 million estimated annual expenditure for pre-disaster mitigation, the PSM assumptions regarding mitigation methods and average costs of mitigation imply about 152 post-disaster pre-FIRM conversions and about 55 pre-disaster pre-FIRM conversions per year in the 50 sample communities included in this study. These results are reported on lines 3 and 4 in Table C.3. Weighting the results to the universe of all 15,461 communities included in this study implies about 3,159 post-disaster pre-FIRM conversions and about 1,101 pre-disaster pre-FIRM conversions per year. These national results are reported on lines 3 and 4 of Table C.4.

12.6.3 Dry Flood Proofing, Elevations, and Acquisitions and Relocations

Dry Flood Proofing

In the PSM, it is assumed that nonstructural mitigation for non-residential structures involves only dry flood proofing. This assumption is based on NFIP regulations that non-residential structures are not required to be elevated or relocated to be converted to post-FIRM SFHA structures; (FEMA, 1993) in most instances, dry flood proofing is the cost-effective flood mitigation mechanism for non-residential structures.

To estimate the number of pre-FIRM non-residential structures affected by dry flood proofing, the following steps were used:

The average annual national expenditure for dry flood proofing was estimated
The average sample community expenditure for dry flood proofing was estimated
The average cost for dry flood proofing a non-residential structure was estimated
The number of non-residential dry flood proofed structures per community was estimated as the total estimated expenditure divided by the average dry flood proofing cost per structure for that community

To estimate the average annual national expenditure available for dry flood proofing, it is assumed that the percent of structures that undergo dry flood proofing is proportional to the ratio of non-residential to total structures. On average, flood proofing of a non-residential structure currently is estimated by industry experts and reported by FEMA to cost about $15,000 per structure (Wetmore, 1997). Given that non-residential structures comprise about six percent of all structures but that flood proofing is estimated to currently cost about one-half of the cost of elevation and about one-fourth of the cost of acquisition or relocation, national expenditures for dry flood proofing are estimated as:

$$0.06 \times [\$15{,}000/\{(0.25 \times \$30{,}000) + (0.75 \times \$60{,}000)\}] \times \$214 \text{ mil.} = 0.06 \times (0.28) \times \$214 \text{ mil.}$$
$$= \$3.6 \text{ million per year}$$

In the above equation, the 0.25 and 0.75 ratios reflect the estimate that, of funds used for acquisition, relocation, or elevation, about 75 percent are used for acquisition and relocation, with the remaining 25 percent used for elevation.

To estimate the number of structures affected by flood proofing for each community, it is assumed that the total amount of money available to the community equals $3.6 million times the percent of national non-residential structures represented in that community. Based on extrapolating the PSM results to the universe of all study communities, the estimates imply about 150 post-disaster-funding-based and about 53 pre-disaster-funding-based dry flood proofings per year at the national level. These national estimates of post-disaster and pre-disaster dry flood proofings are reflected in the totals reported on lines 3 and 4, respectively, of Table C.4.

Elevations

The procedures used to estimate the number of structures affected by elevation largely parallels the procedures used to estimate the number of flood proofings. One added detail is that the average cost of elevation is estimated as one-fourth of the cost of the property rather than as a constant dollar amount. This one-fourth estimate was derived by comparing an estimate of the average current cost of elevations reported by FEMA ($30,000) with the average estimated median property value of structures targeted for elevation ($121,044).

In the PSM, structural elevations are assumed to affect only residential structures, with 75 percent of these elevations occurring in coastal communities and the remaining 25 percent occurring in inland communities. This assumption is based on the judgment of FEMA officials and on discussions with state and local officials.

Through the same procedures used to estimate annual total national expenditures for flood proofing, total average annual expenditures for elevations are estimated to be $33.5 million per year. Based on extrapolating the PSM results to the universe of all study communities, the estimates imply about 705 post-disaster-funding-based and about 246 pre-disaster-funding-based dry elevations per year at the national level. These national estimates of post-disaster and pre-disaster elevations are reflected in the totals reported on lines 3 and 4, respectively, of Table C.4.

Acquisitions and Relocations

Estimates of the number of structures affected by acquisition and relocation follow the methods used to estimate structures affected by flood proofing and elevation. Based on the judgment of FEMA officials, 75 percent of acquisitions and relocations are assumed to affect inland residential structures and the remaining 25 percent are assumed to affect coastal residential structures. For both inland and coastal communities, the average acquisition and relocation cost is estimated at 75 percent of the reported median property value for that community. This 75 percent ratio is based on the estimated average current cost of $60,000 for acquisition and relocation as a percent of the estimated median value of SFHA structures, which is $79,950.

Of the total of $214 million available for pre-disaster nonstructural mitigation, subtracting $3.6 million for flood proofings and $33.5 million for elevations leaves about $176 million for acquisitions and relocations. Based on extrapolating the PSM results to the universe of all study communities, the estimates imply about 2,304 post-disaster-funding-based and about 802 pre-disaster-funding-based acquisition and relocations per year at the national level. These national estimates of post-disaster and pre-disaster acquisitions and relocations are reflected in the totals reported on lines 3 and 4, respectively, of Table C.4.

12.7 Structural Mitigation Events

As depicted in Figure C.1, the PSM models structural mitigation activities, such as those involving drainage improvements or the construction of levees and reservoirs. These affect the stock of pre-FIRM SFHA structures by effectively removing some pre-FIRM SFHA structures from the community's SFHA while effectively elevating other pre-FIRM SFHA structures to at or above the BFE. While a wide range of actions can influence an individual structure's level of risk from flooding, only structural mitigation projects which affect multiple structures were considered in the model.

Because the size, scope, and timing of structural mitigation projects varies considerably, the approach used to model the effects of structural mitigation involved the averaging of a range of projects recently completed or underway in the 50 sample communities. In general, the estimation of the effects of structural mitigation in the PSM was accomplished using three steps:

1. Interviews with flood mitigation or other knowledgeable community officials were conducted in each of the 50 communities to identify any structural mitigation projects recently completed or currently in progress in that community.

2. The information collected from the community interviews was assembled to develop structural mitigation parameters to estimate the number of structures affected by structural mitigation projects.

3. The estimated structural mitigation parameters were applied to each community to simulate the effects of a structural mitigation project.

12.7.1 Community Interviews

From August to October 1997, interviews were conducted with flood mitigation officials in each of the 50 sample communities to identify any structural mitigation projects recently completed or in progress.

Using point of contact information provided in FEMA's Community Information System (CIS) database, contact was made with knowledgeable individuals in all 50 sample communities. In the larger communities, the point of contact was typically a designated floodplain manager, city engineer, or building inspector. In the smaller communities, the town supervisor or city administrator was the typical point of contact. While information was solicited for all types of flood control projects underway in the community, structural mitigation projects were included for estimation of the effects of structural mitigation only if the projects met the following criteria:

> The project had to be primarily a flood control project which involved flood protection for residential or commercial structures. (Environmental, power generation, or navigation projects were not considered unless they involved flood protection for some structures.)
>
> The project had to include specific information regarding the cost of the project, the time period over which the project was finished or would be completed, and the number of structures potentially affected by the project.
>
> If not yet begun, the project had to include a firm financial commitment for completion. Proposed future projects that had no definite Federal, state, or local funding commitment were not considered.

In conducting the interviews, community officials were asked about flood control projects completed in the last few years, those currently underway, or those about to begin in their community. Community officials were asked to provide specific information regarding the type of project, the source and amount of funding for the project, the number and type of structures affected by the project, the level of flood protection afforded by the project, and the month and year in which the project was completed or was expected to be completed.

Of the 50 communities, 16 reported recently completed or ongoing structural mitigation projects. These projects are listed in Table C.7 by community, including project type, number of structures affected, and estimated completion year. Of the 16 communities reporting structural mitigation projects, six are in coastal communities, and the remaining ten are in inland communities. The type of projects included eight drainage improvements and eight assorted other projects such as a berm widening and a dam construction. In terms of the estimated number of structures affected, the largest project, drainage improvements in Jefferson Parish, Louisiana, was estimated to affect about 7,500 structures. The smallest projects, canal and drainage improvements in Fort Lauderdale City, Florida, and drainage improvements in Cohasset Town, Massachusetts, were estimated to affect ten structures. Because virtually all of the estimated structures affected were identified as residential structures, the structural mitigation estimates were applied only for residential structures. Of the 16 reported projects, 15 were state or locally funded, and one (the bridge widening in Omaha City, Nebraska) was funded through the U.S. Army Corps of Engineers (USACE).

Table C.7
Completed or Ongoing Structural Mitigation Projects, 1996-2002
Sample NFIP Communities

Community	State	Project Type	Estimated Number of Structures Affected	Estimated Completion Year
PHOENIX CITY	AZ	Detention basin construction	6,500	2002
SACRAMENTO COUNTY	CA	Drainage improvements	300	1997
SANTA CRUZ CITY	CA	Levee raising	65	1996
DOLORES TOWN	CO	Widening berm	25	1997
OTERO COUNTY	CO	Pump installation	20	1998
FORT LAUDERDALE CITY	FL	Canal & drainage improvements	10	1996
NEW SMYRNA BEACH CITY	FL	Drainage improvements	50	1998
GRUNDY COUNTY	IL	Drainage improvements	20	1996
SHREVEPORT CITY	LA	Drainage improvements	150	1999
JEFFERSON PARISH	LA	Drainage improvements	7,500	2002
COHASSET TOWN	MA	Drainage improvements	10	1997
OMAHA CITY	NE	Bridge widening	130	1999
WASHINGTON COUNTY	OK	Dam construction	12	1998
GARLAND CITY	TX	Channel widening	200	1999
LEAGUE CITY	TX	Drainage improvements	20	1997
GRUNDY TOWN	VA	Drainage improvements	25	1998

12.7.2 Parameter Estimates

From the data collected in the community interviews, the structural mitigation projects were classified into two types: (1) those that would involve re-mapping structures out of the 100-year floodplain (SFHA) as a result of the project, and (2) those that would not re-map structures out of the SFHA but would involve effectively elevating structures initially below the BFE to at or above the BFE as a result of the project. For the first type of mitigation projects, it was estimated that of the 15,037 structures estimated to be affected by structural mitigation in these 16 communities, 4,125 structures would be mapped out of the SFHA as a result of the project. The estimate of 4,125 mapped out of the SFHA was based on the judgment of officials in Phoenix City and Jefferson Parish, who estimated that about one-quarter and one-third of the structures, respectively, would potentially involve protection from a 100-year flood event. For the remaining 10,912 structures estimated to be affected by structural mitigation projects, the level of mitigation was judged by local officials to be within the 50-year flood level of protection, and these structures were characterized as being effectively elevated while remaining within the SFHA.

From the 4,125 estimated effective structure re-mappings out of the SFHA and the 10,912 estimated effective elevation increases, structural mitigation parameters were developed. (Re-mappings and elevation increases are referred to as "effective" in the remainder of this section since they are not officially recognized until the issuance of an updated community FIRM map.) Using the 50 community total average of 203,422 pre-FIRM SFHA structures from 1996 to 2002 (the period covering the structural mitigation projects), SFHA effective removals were calculated as 4,125/203,422 = 2.03 percent over the six year period. Similarly, effective structure elevations were calculated as 10,912/203,422 = 5.36 percent over the six year period. On an annual basis, this implies a 0.34 percent rate for effective structure removals and a 0.89 percent rate for effective elevations. Compounded over the 25-year simulation period for this study, this implies an estimated 8.4 percent effective removal rate and an estimated 22.4 percent total effective elevation rate.

12.7.3 Structural Mitigation Simulation

Since the PSM assumes that two communities undergo structural mitigation each year over the 25-year projection period, the mitigation-based removal rates were applied to a community in the year that community is selected for a structural mitigation project. For modeling purposes, the PSM assumes that only structures at or above the BFE are removed from the SFHA and only structures below the BFE are effectively elevated but remain within the SFHA. For those structures at or above the BFE, the removal rate parameters were applied such that 8.4 percent would be removed from the SFHA as a result of a structural mitigation project. For structures in categories below the BFE, 22.4 percent would be reclassified as "at or above the BFE" from their initial below BFE category. Recognizing that structural mitigation is generally targeted to the structures most at risk from flooding, the PSM assumes that of the 22.4 percent effective rate of structure elevations as a result of structural mitigation, 60 percent of structural elevations will occur to structures in the -6 and below elevation difference category, 30 percent of elevations will occur to structures in the -3, -4 and -5 elevation difference category, and the remaining 10 percent of elevations will occur to structures in the -1 and -2 elevation difference category.

For the 50 sample communities, the parameters for structural mitigation result in about 540 structures at or above the BFE being effectively re-mapped out of the SFHA annually over the period from 1997 to 2022, while about 1,100 structures initially below the BFE are effectively elevated to at or above the BFE over this period. Based on results of extrapolating the 50 sample communities to national totals using the pre-FIRM structure weights, the results imply that about 12,130 pre-FIRM SFHA structures at or above the BFE will be re-mapped annually out of the SFHA over the period from 1997 to 2022, while about 17,100 pre-FIRM SFHA structures initially below the BFE will be elevated annually to at or above the BFE as a result of structural mitigation projects over this period.

The assumptions, parameters, and results of the PSM structural mitigation modeling were reviewed by floodplain management experts to assure that the modeling was consistent with industry views on likely impacts of structural mitigation projects on the inventory of pre-FIRM SFHA structures. While the results of the structural mitigation module of the PSM are intended to capture, in a broad manner, the impacts of future structural mitigation projects, the estimated parameters and results do not serve as a way of evaluating the impacts or cost-effectiveness of specific structural mitigation projects. While, for example, the USACE engages in numerous large-scale structural mitigation projects (U.S. Army Corps of Engineers, 1993), only one USACE project was represented in the community surveys reflected in Table C.7. Based on the views of floodplain management experts, (Baldini 1997, Godschalk, 1997, van Kirk, 1997, Wetmore, 1997) it appears that the USACE will be engaged in fewer large-scale structural mitigation projects in the future, and that much of the future structural mitigation-based flood control will occur at the state and local level.

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13. Appendix D: The Property Valuation Model

This section describes the design specifications and assumptions underlying the Property Valuation Model (PVM). The appendix is structured as follows:

> Introduction and Overview provides a general description of the PVM and its main purpose in the study.
> Modeling Approach describes the overall design of the PVM and highlights key features of the model.
> Cell Structure describes the data sources, methods, and determining factors used to categorize each property in the PVM.
> Property Values Estimates describes the data sources and econometric approach to estimate the property values in the PVM.
> Model Simulation describes the mechanics of the PVM and its interface with the Insurance Demand Model (IDM) and Property Simulation Model (PSM).
> Property Taxes describes the data sources and methodology used to estimate the effects of property value changes on the property taxes in a community.

D.1 Introduction and Overview

The PVM is designed to assess the effect of eliminating the flood insurance subsidy on property values and property taxes for residential and non-residential structures in the Special Flood Hazard Areas (SFHAs). The PVM begins with current estimates of property values for the structures in the SFHA and uses one of the seven subsidy elimination scenarios to estimate how changes in the subsidy will effect property values and property taxes. It relies on premium rates provided by the Premium Calculator, an inventory of structures provided by the PSM, and NFIP participation rates provided by the IDM.

The PVM is a cell-based model that projects the value changes for each affected property by estimating the change in its income potential. In this "cell-based" approach, structures are aggregated into mutually exclusive categories or "cells." Each cell represents a class of similar properties, with the differences among cells representing some of the key factors determining variations in property values, such as type of structure and age of structure. The cells have been constructed to allow for sufficient variations in property values across different structure types and flood risk profiles.

The PVM is designed to project annually, for the universe of properties within the SFHAs of the 50 sampled NFIP communities, changes in property values and property taxes over the 25-year period from 1997 to 2022. Each of the 50 sampled NFIP communities will be modeled individually to track changes in the property values and property taxes.

The changes in property values for a given sample community will be directly affected by the number of structures participating in the flood insurance program, the magnitude of the premium change, and the timing with which the insurance subsidy is eliminated within a community. As the subsidy is eliminated for a particular structure, the premium may increase or decrease based on the flood risk profile for the structure. The percentage change in insurance premiums or flood insurance coverage will be capitalized in the property values of the structures participating in the flood insurance program.

D.2 Modeling Approach

The PVM is a valuation model that estimates the effects that changes in the premium rates or flood insurance coverage will have on property values and property tax revenues for each of the 50 communities. The PVM assigns properties to specific cell classifications based on structure type, age, flood zone, FIRM status, structure elevation difference, presence of a basement, and number of floors. In every year of the model simulation, the property value for a particular cell classification is updated to reflect the change in the property values for structures participating in the flood insurance program.

As the "bottom line" model in this study, the PVM uses inputs from the Premium Calculator, IDM, and PSM to estimate the change in property values and property taxes for each of the 50 communities:

> **Premium Calculator**: For each pre-FIRM cell category in the PVM the Premium Calculator estimates the change in insurance premium that results from charging actuarially based premium rates for pre-FIRM structures. The changes reflect the difference in the subsidized premium and the actuarial premium rate for each cell. Structures with a lower actuarial premium will begin paying this premium immediately in 1998, regardless of scenario. For structures with a higher actuarial premium, the premium increase will be graduated over a 25-year period based on the seven scenarios for eliminating the flood insurance premium subsidy. The baseline and seven scenarios include:
>
> <u>Baseline</u>: This scenario serves as a point of comparison for the seven subsidy elimination scenarios. All structures continue paying the current premium and have the same insurance coverage for the entire period from 1997 to 2022. Pre-FIRM structures that are not elevation rated pay the subsidized premium for all 25 years. Pre-FIRM structures that are elevation rated and post-FIRM structures pay the actuarial premium for all 25 years.
>
> <u>Scenario 1</u>: This scenario eliminates the premium subsidy through an immediate premium change in 1998. For structures with a higher actuarial premium, the premium will increase to the actuarial premium in 1998. For structures with a lower actuarial premium, the premium will decrease to the actuarial premium in 1998.
>
> <u>Scenario 2</u>: This scenario eliminates the premium subsidy gradually over a period of 10 years. For structures with a higher actuarial premium, the premium will increase steadily with an equal annual percentage growth rate for each of the 10 years from 1998 to 2007. At the end of this 10-year period, the premium will reach and remain at the actuarial rate. For structures with a lower actuarial premium, the premium will decrease to the actuarial premium in 1998.
>
> <u>Scenario 3</u>: This scenario eliminates the premium subsidy gradually over a period of 20 years. For structures with a higher actuarial premium, the premium will increase steadily with an equal annual percentage growth rate for each of the 20 years from 1998 to 2017. At the end of this 20-year period, the premium will reach and remain at the actuarial rate. For structures with a lower actuarial premium, the premium will decrease to the actuarial premium in 1998.
>
> <u>Scenario 4</u>: This scenario eliminates the premium subsidy when ownership of the structure changes. For structures with a higher actuarial premium, the premium will increase to the actuarial premium when the structure is sold or refinanced. For

structures with a lower actuarial premium, the premium will decrease to the actuarial premium in 1998.

Scenario 5: This scenario eliminates the premium subsidy with a combination of deductible increases and premium changes. For structures with a higher actuarial premium, the increase in deductible takes place immediately upon renewal. The deductible increases from the current $1,500 total ($750 building and $750 contents deductibles) to 15% of total insurance coverage. The premium change component eliminates any subsidy remaining after the deductible increase over five years with an equal annual percentage growth rate for each of the five years from 1998 to 2002. For structures with a lower actuarial premium, the premium will decrease to the actuarial premium in 1998.

Scenario 6: This scenario eliminates the premium subsidy with a combination of deductible increases and premium changes. For structures with a higher actuarial premium, the increase in deductible takes place immediately upon renewal. The deductible increases from the current $1,500 total ($750 building and $750 contents deductibles) to 3 percent of total insurance coverage. The premium change component eliminates any subsidy remaining after the deductible increase over five years with an equal annual percentage growth rate for each of the five years from 1998 to 2002. For structures with a lower actuarial premium, the premium will decrease to the actuarial premium in 1998.

Scenario 7: This scenario eliminates the premium subsidy with a combination of a coverage change and premium changes. For structures with a higher actuarial premium, the coverage change takes place immediately upon renewal. If a structure is damaged by a flood, the NFIP will only pay for builders grade materials and materials to make the structure habitable. This coverage change only affects above average quality structures since builders grade materials are assumed to be of average quality. The premium change component eliminates any subsidy remaining after the coverage change over five years with an equal annual percentage growth rate for each of the five years from 1998 to 2002. For structures with a lower actuarial premium, the premium will decrease to the actuarial premium in 1998.

Insurance Demand Model: The IDM estimates participation rates for each cell category in the PVM. Participation rates provide an estimate of the percentage of structures with flood insurance. These estimates, combined with those of the PSM, will determine the number of structures in a community whose property value will be affected by the elimination of the flood insurance premium subsidy.

Property Simulation Model: The PSM will estimate the current and future inventory of pre-FIRM and post-FIRM structures. These estimates will be used in calculating the total change in property values for all pre-FIRM structures in each sample community and the total change in property taxes for each sample community. In turn, the PVM provides the PSM with changes in the current value of structures in the community in order to adjust rates of property growth and removal in each community.

Given the inputs from the Premium Calculator, IDM, and PSM, the PVM will track property values for residential and commercial properties in the SFHAs for the 25-year period from 1997 to 2022 for a given subsidy elimination scenario.

The PVM is designed to track property values for specific flood events. Since the timing of flood events is unpredictable for a given SFHA, the PVM has been designed to track variations in property values and property taxes for a particular community and flood event. The PSM simulates flood events for a particular community. In a given year, the PSM may randomly select one or more communities (depending on the flood scenario) to experience a flood. As the base case scenario, the model will be run with a 25-year flood scenario such that two randomly selected communities will experience one 25-year flood in each year of the 1997 to 2022 simulation period. The base case scenario will be run multiple times for a random set of flood events, so that averages for each scenario's outcome can be determined.

D.3 Cell Structure

Several criteria were used to determine the cell structure in the PVM. The following section describes the criteria used to select the cell structure and how differences in cell structure between the IDM, PVM, and PSM were resolved. These criteria can be grouped into three main categories:

> The PVM must incorporate structural characteristics that account for the diversity of property values across the 50 sampled NFIP communities and the NFIP universe of communities.
>
> The PVM must incorporate flood risk characteristics which account for the range of possible premium values across the 50 sampled NFIP communities.
>
> The total number of potential cells must be limited so that the majority of cells do not contain too few observations.

The final cell classification was a compromise of the previous objectives. In particular, the final cell classification was a balance of the requirements for the IDM, Premium Calculator, and PSM. Since the PVM is highly dependent on the inputs from the IDM, PSM, and Premium Calculator, the PVM had to conform to cell classifications established by the other models while including attributes that allow the accurate estimation of property values at the community and sub-community level. The following description provides an explanation of the criteria used to classify cells within the PVM:

Criteria 1 - *Incorporating structural characteristics that account for the diversity of property values across the 50 sampled NFIP communities and the NFIP universe of communities.*

In order to reflect the range of property values in the communities, a number of significant structural characteristics were identified to be included in the cell classification. Since property values vary considerably across structure type, particularly between single family homes, residential structures like condominiums, and manufactured housing, different categories for a variety of residential and non-residential housing types were constructed, including the number of floors in a structure for detached single family homes. Similarly, housing values differ by the age of the structure, and age can provide some indication of structural condition. Finally, the structure type was divided between pre-FIRM and post-FIRM properties. This qualification is necessary for the PVM to calculate the change in property values at the community level.

Criteria 2 - *Incorporating flood risk characteristics that account for a range of possible premium values across the 50 sampled NFIP communities and the NFIP universe of communities.*

In order to capture variations in premiums, the determinant of changes in property values in the PVM, a number of flood risk related categories were included. A structure's premium is a function of several structural and risk attributes. The most important determinants include structure type, flood zone, presence of a basement, and elevation difference. To accurately account for changes in premiums and changes in property values, the PVM defines cells across each of these dimensions. The presence of a basement factors in as a primary determinant of a premium rate for a number of structures. Likewise, premium rates vary considerably depending on the elevation difference of a structure. Careful review of the premium rates resulted in the conclusion that classification of the elevation difference into four main categories could capture most of their variation. Lastly, premium rates differ by locational factors. A coastal property (in a V zone) typically has different premium rates than an inland property (in an A zone).

Criteria 3 - Limiting the total number of potential cells.

The PSM provides estimates of pre-FIRM and post-FIRM structures to the PVM in order for the PVM to calculate the total change in property values at the community level. The PSM provides these estimates at a cell level that is compatible with the PVM. Because of the interdependence of the PVM and PSM, special attention was given to the construction of the cell categories. The conceptual design for integrating the PVM and PSM addressed the need to balance the specific model requirements while limiting the number of cell categories in the models to avoid having too many cells with too few observations. This is a concern because a large number of cell categories in the model limits the number of structures in a particular cell which can limit the accuracy and flexibility of the model.

The following outline provides the specific cell categories used in the PVM. Each cell in the PVM is defined by a unique combination of these categories.

A. Structure Type
   I. Single family detached
   II. Single multiple family attached
   III. High-rise condominium

IV. Manufactured home
V. Non-residential

B. Structure Age
I. Less than 21 years
II. 21 to 50 years
III. Over 50 years

C. Flood Zone
I. AO/AH/AE/A/A1-A30 zones
II. VE/V/V1-V30 zones

D. FIRM Classification
I. Pre-FIRM
II. Post-FIRM

E. Structure Elevation Difference
I. Positive or zero (at or above BFE)
II. 1 or 2 feet below the BFE
III. 3, 4, or 5 feet below the BFE
IV. 6 feet or more below the BFE

F. Presence of Basement
I. No basement
II. Basement

G. Number of Floors (limited to single family detached structures)
I. One floor
II. More than one floor

D.4 Integrating the PVM and PSM

The PVM is part of a larger modeling system that includes the IDM, PSM, and the Premium Calculator. For integration purposes, the PVM cell classification is structured very similar to that of the PSM and the IDM. Although most of the cell categories in the PVM and PSM are identical, the PVM further disaggregates the stock of structures provided by the PSM because the PVM requires two additional structural characteristics that are critical to the premium rate:

Presence of Basement
Number of Floors

The following section describes the differences in the cell classifications between the PVM and PSM and the assumptions used to further disaggregate the inputs from the PSM. In addition, this section describes how the PVM incorporates the structure condition attribute provided by the PSM and the estimation technique used to determine the distribution of structures in each elevation category.

Floor Estimation

The PSM does not provide a cell classification for the number of floors in a structure. However, premium rates are a function of the number of floors in a structure and can vary considerably depending on the elevation difference of the structure. To account for this variation, assumptions were made regarding the number of floors for each structure type, and these were classified as either "one floor" or "more than one floor." The PVM classifies the number of floors in single family detached structures, consistent with the flood insurance rate tables, as either "one floor" or "more than one floor." By definition, hi-rise condominiums are three or more floors, and manufactured housing is generally one floor. Therefore, the PVM assumes all hi-rise condominiums have "more than one floor" and all manufactured homes have "one floor". Multiple family and non-residential structures can have either one floor or two or one or more floors. Since the premium rates for single family or multiple family attached and non-residential structures do not vary across floor classification, except for a few elevation differences, the PVM assumes all single family or multiple family attached structures are "more than one floor" and all non-residential structures are "one floor." These floor designations are consistent with the number of floors observed in the survey data for attached and non-residential structures. For those cases where rates vary considerably across floor classification, the Premium Calculator includes adjustments to account for variations in premium rates that differ by floor classifications.

The number of floors in single family detached homes varies by region within the U.S. The elevation certificate data grouped together by geographic region were used to determine the percentage of structures with one or more than one floor for each of the 50 sample communities. Each of the 50 communities was assigned to one of five regions. The regions include the Pacific and Mountain States, the New England and Middle Atlantic States, the Central States, the Southern Central States, and the Southern Atlantic States. For the 23 surveyed communities, the percentage of structures with one or more than one floors was estimated using the specific elevation data collected for each community. Using the 23 surveyed communities pooled together by region and weighted by the national weights derived for the 23 surveyed communities, the percent of structures with more than one floor in that region was calculated. Each of the 27 non-surveyed communities was assigned the percentages derived by region.

Presence of a Basement

The PSM does not provide a classification for the presence of a basement in the structure. However, the presence of a basement in a structure is a critical component in the determination of the premium rate. The elevation certificate data was used to estimate the percentage of structures with basements in a community. Based on previous surveys, the prevalence of basements by geographic region was determined (U.S. Department of Commerce, 1993). Each of the 50 communities was assigned to one of five regions. The regions include the Pacific and Mountain States, the New England and Middle Atlantic States, the Central States, the Southern Central States, and the Southern Atlantic States. For the 23 surveyed communities, the percentage of basements by structure type was estimated using specific elevation data collected for each community. Using the 23 surveyed communities pooled together by region and weighted by the national weights derived for the 23 surveyed communities, the percent of structures with basements was calculated for each region. Each of the 27 non-surveyed communities was assigned the percentages derived by region.

Structure Condition

The PSM classifies structures by condition in order to reflect a change in the structure's physical status. Housing structures were categorized as "below average" if they contained more than the median number of structural deficiencies for all properties in that community. Other structures were classified as "at or above average" if they contained the median or less than the median number of structural deficiencies for all properties in that community. Structural deficiencies include neglect or damage to the structure, including: broken windows, a sagging roof, missing bricks or other siding materials, or a crumbling foundation (U.S. Department of Commerce, 1996).

The PVM uses the PSM structure condition classification to adjust property values. Although the PVM is designed to estimate the change in property values due to changes in premiums, it is also necessary to provide the PSM with property value changes that reflect structural damages and improvements. The PSM uses these changes in the current value of structures to adjust rates of property growth and removal in each community.

Selected property value adjustments were applied to properties that were targeted as either upgraded based on improvements or downgraded based on damages. These adjustments reflected the percentage increase in the property value for improvements and the percentage decrease in the property value for damages. For purposes of estimating changes in the property values, four types of structural changes were considered: 1) non-substantial improvements, 2) non-substantial damages, 3) substantial improvements, and 4) substantial damages. Non-substantial and substantial improvements were modeled to be valued at 15 percent and 62 percent of the initial property value, respectively. The parameter for non-substantial improvements was the estimated value of non-substantial improvements reported from Sheaffer & Roland's study *Alternatives for Implementing Substantial Improvement* Definitions (FEMA, 1980). The study reports the mean dollar values and the percentages of non-substantial improvements. The parameter for substantial improvements was based on the damage to coverage ratios reported for the substantial damages in the claims data for the 50 sample communities. Non-substantial damages were modeled to be valued at 13 percent of the initial property value. This parameter was the estimated value of non-substantial damages reported in Shaeffer & Roland's study. Substantial damages were modeled such that the final property value equaled 90 percent of the initial property value. This parameter was based on an estimated 90 percent insurance to value coverage rate for substantially damaged properties in the 50 communities reported in the 1979 to 1995 NFIP claims data.

Elevation Difference

The PSM classifies structures as being either at or above the BFE, 1 or 2 feet below the BFE, 3, 4, or 5 feet below the BFE, or 6 feet or more below the BFE. Since the premium rate can vary considerably by elevation difference, particularly for negative elevation differences, the elevation differences were divided into the same categories in the PVM.

Several steps were used to estimate the number of pre-FIRM properties in the three categories below the BFE in each of the 50 communities. In general, the procedures involved the development of a set of community-level survey-based BFE results from the 23 surveyed communities, the development of a set of pooled survey-based results, and the assignment of elevation distributions to the 27 non-surveyed communities.

1. Community-Level Survey-Based BFE Results

As a first step, each of the 23 elevation certificate survey communities were grouped according to flood source (inland or coastal). Next, for each of the 23 surveyed communities, the percent of properties in each elevation category was calculated. These results were computed directly from the elevation certificate surveys (rounded to the nearest integer) and were used to classify the specific elevation distributions for the 23 surveyed communities.

2. Pooled Survey-Based BFE Results

First, the 23 surveyed communities, grouped by flood source, were ordered according to the percentage of structures in each elevation category. For example, all inland communities with high percentages of structures in the "6 feet or more below the BFE" category were classified together, and all inland communities with high percentages of structures in the "at or above the BFE" category were classified together. After the elevation percentages were ordered, communities with similar elevation percentages were divided into four sub-groups. The weighted average of the elevation percentages in each of the four sub-groups was calculated using the individual communities elevation percentage and the community weights developed for the 23 surveyed communities. These weights allow for estimation of the number of pre-FIRM structures at the national level based on estimates of pre-FIRM structures for the 23 communities.

3. Assignment of Elevation Distributions to 27 Non-surveyed Communities

First, the average number of NFIP pre-FIRM claims in the 1979 to 1995 period was calculated as a percent of pre-FIRM structures. Next, these average claim percentages were adjusted by the pre-FIRM policy participation for each of the 27 non-surveyed communities. The 27 non-surveyed communities were divided into four groups ordered by the adjusted average claim percentages. The 27 non-surveyed communities with the highest adjusted average claim percentages were assigned the elevation percentages with the largest percent of structures in the "6 feet or more below the BFE" category. Likewise, those communities with the lowest adjusted average claim percentages were assigned elevation percentages with the largest percentage of structures in the "at or above the BFE" category. Since all 27 non-surveyed communities were classified with inland flooding, only the 12 surveyed communities with inland flooding were used in this process.

For the 50 sample communities extrapolated to the national level using the pre-FIRM structure weights, 29.9 percent of pre-FIRM structures were classified with an elevation difference of 1 or 2 feet below the BFE; 12.2 percent of pre-FIRM structures were classified with an elevation difference of 3, 4, or 5 feet below the BFE; 12.6 percent of pre-FIRM structures were classified with an elevation difference of 6 feet or more below the BFE. Weighted to the national level, 45.4 percent of the pre-FIRM structures were classified at or above the BFE. (Data do not add to one hundred percent due to independent rounding.)

D.5 Property Value Estimates

In the PVM, a property value is estimated for each cell with no change in premiums. This property value is used as the baseline for estimating the effects of eliminating the subsidy for each scenario. This section describes the methodology and data sources used to estimate the property values. The section is divided into the following:

Overview
Data Collection
Estimating Property Values at the Structure Level
Imputing Property Values at the Cell Level

Overview

After collecting specific structure information from the elevation surveys, an estimation of the property values for each of these structures was needed. Property values were acquired for several of the surveyed structures in the 23 surveyed communities for use in characterizing the relationship between property values and the specific structural characteristics collected by the survey teams.

Data Collection

The elevation surveys resulted in detailed information for 7,628 structures from 23 communities. Property value information for 10 of the 23 communities came from two data sources. For seven of the 23 communities, including: Sacramento County, California; Santa Cruz City, California; Phoenix City, Arizona; Fort Lauderdale City, Florida; New Smyrna Beach City, Florida; St. Petersburg Beach City, Florida; and Cohasset Town, Massachusetts, specific property value information was collected from the Experian Property Data Research Center (Experian, 1997). Experian is a data provider that sells property research services which include custom reports detailing residential, commercial, and industrial property characteristics. The data received included structure specific information such as property value, year built, and square foot estimates. Because Experian provides data on a limited number of counties in the U.S., data for only seven of the sampled communities were available.

The second data source was tax assessment data from local tax assessor offices. The communities of Council Bluffs City, Iowa; League City, Texas; and Myrtle Beach City, South Carolina provided specific property information. Out of a total of 529 structures surveyed in these communities, property value information was acquired for 439 structures.

Since the initial model year is 1997, a small portion of the data acquired was adjusted to reflect 1997 values. The housing price index (HPI) published by the Office of Federal Housing Enterprise Oversight (OFHEO) was used to adjust these values (OFEHO, 1997). The HPI is published by OFHEO based on data provided by the Federal National Mortgage Association (Fannie Mae) and the Federal Home Loan Mortgage Corporation (Freddie Mac). The HPI is a broad measure of the movement of single-family house prices over quarterly periods. The HPI, provided by OFHEO at the state level, was supplemented with data available at the county level from the Bureau of Census. Using Census data from 1980 and 1990 to estimate an average growth in housing prices at the county level for each community (U.S. Department of Commerce, 1992, *op. cit*., 1982), the HPI provided by OFHEO was adjusted to reflect community-specific property value changes.

Estimating Property Values at the Cell Level

The 2,339 structures with known property values were used to estimate the property values for the remaining 5,289 structures. Property values are a function of structure value and land value. Property values were estimated by relating them to replacement cost — a reliable indication of structure value — and community-specific information to account for variations in property value due to locational affects. The replacement cost was estimated using the specific structure information collected for all 7,628 structures during the elevation surveys and the guidelines for preparing building cost estimates as outlined by the *Marshall & Swift Residential Cost Handbook*, (Marshall & Swift, 1997) a standard industry guide. Replacement costs are a function of type of structure, number of floors, quality of structure, exterior materials, and total square footage. The approach for estimating replacement costs is identical to the approach that was used to estimate replacement costs for the Premium Calculator (See Appendix A). The actual property value data were divided by structure type, and linear regression was used to estimate the property values for each structure type using the following equation:

> *Property Value = f(median property value, population growth, construction index, structure level replacement cost)*

Estimates were used at the county level for median property value, population growth, and a construction index from Bureau of Economic Analysis Regional Economic Measurement Division (U.S. Department of Commerce, 1997, *op. cit*., 1998). The construction index is the average wage per job for the construction industry for that county. This equation was estimated for each structure type, which included single family detached home, multiple family attached homes, hi-rise condominiums, manufactured homes, and non-residential structures.

Imputing Property Values at the Cell Level

Using the property values estimated for the 7,628 surveyed structures described in the previous section, an average property value was estimated for each cell in the 50 communities. As defined previously, a cell is a combination of seven characteristics. For example, one cell in a community might contain structures that are single family detached, two floors, basement, A Zone, 0 and above elevation, 20-50 years old, and pre-FIRM.

Three complications arose in estimating property values at the cell level:

1. The year built data, and therefore the age classification characteristic, were unknown for 5,235 of the 7,628 surveyed structures.
2. For the 23 surveyed communities, not all cells were represented by surveyed structures.
3. No survey data were available for the remaining 27 communities.

Each of these complications was solved using standard statistical techniques. These techniques are explained in detail below.

Approach

In order to estimate the average property values for each cell, all structure property value estimates were characterized according to the seven cell characteristics. For some of the communities, it was necessary to first impute the age classification for structures missing this information. All surveyed structures with missing age data were classified as pre-FIRM structures for the FIRM classification since the survey teams were instructed to survey only pre-FIRM structures within the sample communities. Then these property values, along with Census and Public Use Microdata Sample (PUMS) property value data (U.S. Department of Commerce 1993), were used to estimate the average property value in each community and cell.

Census data contain sample housing and population data weighted to represent the total population. These data are available at the geographic block group level where a block group is a Census geographic sub-division that generally contains between 250 and 550 housing units. PUMS data are microdata that contain the full range of population and housing information collected in the 1990 Census. In microdata, the basic unit is an individual housing unit and the persons who live in it. Public use microdata samples are extracts from the confidential microdata taken in a manner that avoids disclosure of information about identifiable households or individuals.

The following discussion describes how the property value estimates for the surveyed structures were used to estimate the average property values at the cell level.

1. Estimating the Year Built and Age of Surveyed Structures

Discriminant analysis, a technique used to classify observations into mutually exclusive categories (Cleveland, *et al*., 1998), was used to estimate the age of the surveyed structures with missing data based on their known property value and PUMS data, which includes average property values in the community. Structures missing information about their age were classified into either the 20 to50 years old category or the over 50 years old category. Nearly 70 percent of structures with missing age data were located within a few of the communities. The survey teams reported that the structures surveyed in these communities appeared to be built in the late 1950’s, 1960’s, and early 1970’s. Hence, the less than 20 years old age category was not used in the discriminant analysis.

The PUMS data provide average property value for structures detailed by occupancy, floors, age, and FIRM classification. However, the geographic coverage of the PUMS data does not identically match the FEMA community definition; it usually covers a larger area. Also, the PUMS data do not contain property value information detailed by basement, flood zone, or elevation difference. For each community, occupancy and floor category, an average PUMS property value was computed by taking a weighted average across the age and FIRM classification categories. This average was used in the discriminant analysis. Each surveyed structure was assigned an average PUMS property value based on the community in which it resided, its occupancy type, and number of floors.

The discriminant analysis compared the known property value to the PUMS average property value and classified the structure into one of the age categories. Using the 2,330 surveyed structures where the age was known, a discriminant function was computed. The discriminant function was a linear (or quadratic) function of the known property value and the PUMS property data. For each of the 2,330 structures, if the value of the discriminant function was above a cut-off point, it was classified in the 20 to 50 years old category. If it was below the cut-off point, it was classified in the over 50 age category. The cut-off point was chosen to minimize the misclassification of age. A discriminant analysis was performed separately for each of the five occupancy categories.

For each of the 5,235 surveyed structures without an age, their known property value and PUMS average property value were put into the discriminant function, compared against the cut-off point, and then classified into one of the two age categories. In the end, 4,863 of these structures were classified, resulting in a total of 7,193 structures that could be used to estimate average property values at the cell level.

2. Estimating the Effects of the Seven Characteristics on Property Value

Analysis of variance (ANOVA) was used to estimate the effects of the seven characteristics on property value for each community. ANOVA is a standard statistical technique (Florax *et al*., 1992) designed to determine whether or not a particular classification of the data is meaningful. This technique was chosen because not every cell combination was surveyed in each community. For example, the single family detached structures surveyed in community A may all have had basements. Then one would not know what effect not having a basement would have on property value. But structures without basements in communities B, C, and D were surveyed, and this information was used to estimate the effect of having no basement on property values in community A.

The single family detached category was further divided into two categories based on whether a property had one or two floors. For each community and cell, the average property value of the surveyed structures was computed. A multiplicative model was used to estimate the average property value. The multiplicative model is a specific functional form that assumes the dependent variable (average property value) is a product of several independent variables. The multiplicative model can be transformed to a linear relationship and used in a linear regression model by taking the natural logarithm, so the natural logarithm of the average property value was taken. Then, for each of the six occupancy categories, a linear regression model was estimated. The form of the regression model was:

log(average property value) = f(community, basement, elevation difference, age, firm, zone)

Not all of the 23 communities were represented for each occupancy type. For example, multiple family attached structures were surveyed in only 15 of the communities. For each of these 15 communities, the average property value in each cell was estimated using the results of the regression. For the other eight communities, the results of the regression and the Census property value data were used to estimate the average property value in each cell.

3. Estimating a Property Value Level for the Non-Surveyed Communities

While the ANOVA could not provide average property values if the community was not surveyed, Census and PUMS property values were available for all communities. Census data were available for residential structures matching the geographic boundaries of the FEMA community. To impute comparable property values for the non-residential structures in the community, an adjustment factor was applied to the Census data based on property value data provided in the NFIP Claims Database for residential and non-residential structures in the 50 sample communities. However, Census data was not detailed by occupancy, basement, or any of the other characteristics. Conversely, PUMS data did not match the geographic boundaries, but were detailed at the occupancy, floors, age, and FIRM classification level.

A factor analysis, a statistical technique used to compare data (Johnson *et al*., 1995), was used to explore the relation between Census and PUMS data. These two data sets were highly correlated with one another, meaning that nearly all the variability in the two data sets could be explained by one Factor equal to the average of the Census and PUMS data. For each occupancy type, a Factor was computed for each community.

Clustering was used to group communities with similar property values. In each cluster, at least one of the surveyed communities was included. The clustering was performed based on the Factor equal to the average of the Census and PUMS data. For each occupancy type, up to six clusters of communities were formed. The Census and PUMS average property values were similar for the communities in a cluster.

Within a cluster, the average property value for each cell was computed from the communities that were surveyed. The average Factor was also computed across these communities. For the communities that were not surveyed, the average property value for the cell was computed using the formula:

$$\text{Average Property Value for Non-Surveyed Communities} = \text{Average Property Value in Surveyed Communities} \times \frac{\text{Community Factor}}{\text{Average Community Factor in Surveyed Communities}}$$

The property value data in the 1990 Bureau of Census survey (adjusted for growth) were used to verify that these estimates conform to the property value ranges available at the block group level (the smallest geographic Census designation for which economic data are provided) in each community.

Table D.1 presents the 1997 estimates of average property values for all residential and non-residential structures for the 50 sample communities included in the study.

D.6 Model Simulation

Standard property valuation in real estate finance is based on the premise that, because real estate produces a flow of income over its economic life, investors will pay a price that reflects the income potential (rent) of the property. In the PVM, it is assumed that households will invest in structures to the point that the value of the annual rents received from the structures equals the annual cost of obtaining those rents (DiPasquale *et al*., 1996). Rental costs include real financing costs, nondeductible maintenance and depreciation costs (including insurance costs), and deductible property taxes. It is assumed that all nondeductible maintenance and depreciation costs, except flood insurance costs, will remain constant. It is also assumed that changes in any of the rental costs are balanced by offsetting changes in property values. Therefore, potential changes in flood insurance premium costs or coverage changes are capitalized into the total value of the property.

Table D.1
Average Property Values

Community	Residential Structures	Non-Residential Structures
All NFIP Study Communities	$110,623	$248,249

Phoenix City, AZ	77,050	132,550
Bay City, AR	63,352	343,952
Sacramento County, CA	81,494	258,814
Santa Cruz City, CA	201,861	380,987
Dolores Town, CO	90,168	227,916
Otero County, CO	61,998	224,977
Ft. Lauderdale City, FL	232,654	278,707
New Smyrna Beach City, FL	111,031	163,686
St. Petersburg Beach City, FL	230,789	169,784
Hailey City, ID	134,156	341,094
Grundy County, IL	124,195	260,766
Council Bluffs City, IA	48,379	196,431
Augusta City, KY	104,972	214,206
Lewisport City, KY	72,701	303,768
Louisville/Jefferson, KY	113,662	254,139
Allen Parish, LA	51,919	183,344
Jefferson Parish, LA	79,091	229,312
Shreveport, LA	45,449	158,892
Cohasset Town, MA	274,469	394,418
Vassar City, MI	60,157	189,126
Petal City, MS	42,507	249,919
Scott County, MO	59,006	225,556
Omaha City, NE	93,291	266,066
Pender Village, NE	97,846	170,972
Woodstock Town, NH	78,856	219,487
Bloomingdale Borough, NJ	148,882	192,949
Lincoln Park Borough, NJ	199,500	705,100
Niagara Town, NY	70,087	259,405
Waterford Village, NY	126,290	190,861
Carteret County, NC	78,953	227,380
Edenton Town, NC	169,504	258,916
New Miami Village, OH	105,672	236,468
Washington County, OK	74,209	220,851
Lane County, OR	72,595	230,052
Vernonia City, OR	72,024	249,906
Franklin Township, PA	70,031	296,986
Glen Rock Borough, PA	59,733	185,445
Lower Mt. Bethel Township, PA	85,410	191,829
New Cumberland Borough, PA	113,872	239,226
Myrtle Beach City, SC	170,374	318,022
Lawrence County, SD	72,917	263,803
Brookside Village City, TX	57,646	180,977
Garland City, TX	125,985	167,610
League City, TX	118,479	247,955

Table D.1 (Continued)
Average Property Values

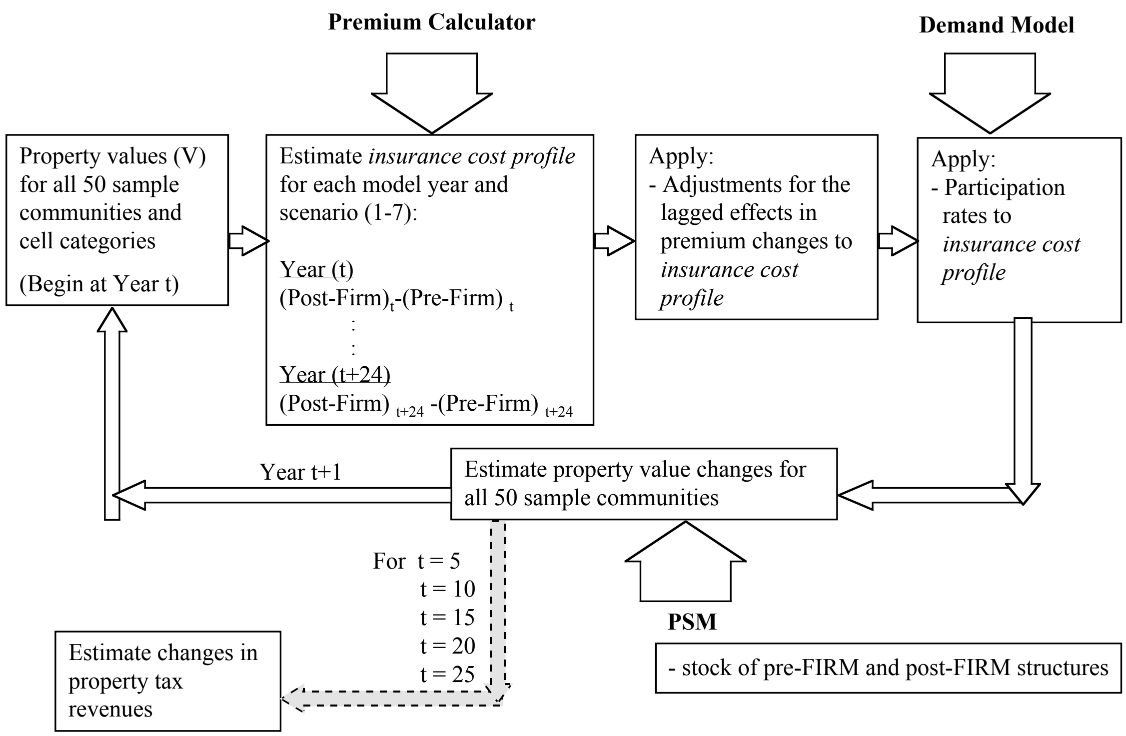
Community	Residential Structures	Non-Residential Structures
Grundy Town, VA	57,612	234,809
Ephrata City, WA	69,874	201,309
Leavenworth City, WA	50,035	257,982

Marlinton Town, WV	91,110	486,870
Philippi City, WV	46,952	166,066
Wheeling City, WV	42,710	157,042

The PVM simulation is run at the cell level for all 50 sample communities. As described earlier, the Premium Calculator, IDM, and PSM will provide inputs that are consistent with the cell classification in the PVM. The simulation begins in year 1997 with an initial property value assigned to each cell category.

Figure D.1 describes the steps in the PVM simulation and its relationship to the other models used in the study.

Figure D.1
Property Valuation Model



Model Simulation - Step 1

A property value is composed of an income stream generated from annual rents. In order to estimate the change in property values for each cell, an estimation of the deviations from the baseline future rental income stream is needed. It is assumed that all rental costs except flood insurance costs remain constant and that deviations in insurance costs due to the subsidy elimination directly affect the annual rental income stream.

Any one of the seven subsidy elimination scenarios can be thought of as a different *insurance cost profile* for the PVM over the 25-year period of interest. For example, Scenario 1 would eliminate the insurance subsidy through an immediate premium increase for new policy buyers and NFIP participants renewing their policies.

For this example, the future rental income stream for each cell will be adjusted to reflect changes in flood insurance costs. The Premium Calculator calculates the changes in flood insurance costs by providing the actuarial premiums and related premium changes for each of the pre-FIRM cells. For this example, the *insurance cost profile* would reflect an immediate change in insurance costs from the subsidized rate to the actuarial rate beginning in 1998 and continuing for the 25-year period. For the other scenarios, the *insurance cost profiles* similarly reflect the changes in insurance costs when the subsidy elimination is phased in over the 25-year period.

Note that the insurance cost profiles for the post-FIRM cells and the pre-FIRM cells with elevation rated structures will be zero for the entire 25-year period. There are no changes in premium rates for post-FIRM structures and no changes in premium rates for pre-FIRM elevation rated structures that pay the actuarial premium. The percentage of elevation rated structures for each of the 50 sample communities is specified in *Section B.3.10 - Elevation Rating* of Appendix B - The Insurance Demand Model.

Model Simulation - Step 2

The insurance cost profile reflects the immediate or graduated premium changes for each cell based on its specific estimated property value and the subsidized and actuarial premiums. The PVM assumes that the graduated premium changes will be fully capitalized into the future rental income stream for each pre-FIRM cell. The PVM assumes that the property value includes the land and the structure, because the property value is closely linked to the land on which it rests. In the long run, the supply of land is fixed while the structure part of housing may be supplied by highly competitive builders who respond to small changes in the price of structures. This suggests that changes in the insurance cost factors are effectively balanced by offsetting changes in property values. With this theory, the increase in flood insurance cost is capitalized into the total value of the property. The assumption of full capitalization is consistent with housing finance literature (Berger *et al*., 1997, DiPasquale *et al*., 1996, Donnelly, 1989, Hendershott, 1996. Montz *et al*., 1987).

Given an imperfect real estate market, it is assumed that the full capitalization of the premium changes will not occur instantaneously but will be phased in over an adjustment period of five years. The purpose in introducing an adjustment period is to reflect the realities of the market and the differences in these markets across the 50 sample communities. The adjustment period will compensate for the lagged effects of short-run changes in rental costs, and the rate varies across the communities.
The adjustment rate is a function of the ratio of pre-FIRM to post-FIRM structures and the state of the real estate market in each sample community. The state of the real estate market is captured by estimating a housing vacancy rate for each sample community. It is assumed that in a “tight” market with low vacancy rates, the adjustment rate will be higher

than in a "soft" market. A vacancy rate was estimated based on Census data for average sales time for a community. The average sales time within a market is widely recognized as an important barometer of market conditions. Average sales time depends on the degree of mobility of households in a community, where high mobility generates a lot of sales activity. A long sales time results when the inventory of vacant units is unusually high and the sales rate is below average. At the Census block group level, data on the number of structures sold and the average sale time for each community was collected, allowing for an estimation of the vacancy rate for all 50 communities (U.S. Department of Commerce, 1992).

The ratio of pre-FIRM structures to post-FIRM structures in a community is the second determinant used to assign the rate of full capitalization. It is assumed that communities with high percentages of post-FIRM structures (implicitly valued at the actuarial premium rate) will have a greater influence on the real estate market and increase the rate at which the premium change is capitalized into the value of the structure. The PSM provides a count of pre-FIRM and post-FIRM structures to the PVM, allowing the PVM to estimate the ratio of pre-FIRM to post-FIRM structures. The 50 sample communities were divided into five classes, where each class included communities with similar vacancy rates and similar ratios of pre-FIRM and post-FIRM structures. Each class of communities was assigned an adjustment rate that varied from 2 percent to 3.6 percent. For communities with an adjustment rate of 2 percent, it was assumed that in the first year of the premium change 90 percent of the premium change would be capitalized into the property value. The remaining 10 percent of the premium change is capitalized over the next four years. Table D.2 provides the adjustment rate for each class.

Model Simulation - Step 3

The changes in the future rental income stream for each pre-FIRM cell are adjusted to include flood insurance participation rates. The effects of eliminating the subsidy are felt directly by residential and commercial property owners that participate in the flood insurance program. The IDM provides participation rates to the PVM for each cell category to estimate the percentage of structures purchasing flood insurance.

Table D.2
Percent of Premium Capitalized in First Year

Class	Percent Capitalized in First Year	Adjustment Rate
1	82%	4.5
2	84%	4.0
3	86%	3.5
4	88%	3.0
5	90%	2.5

The participation rates for a given pre-FIRM cell vary by model year and policy year, where the model year is the year that an individual purchases flood insurance for the structure, and the policy year is the number of years since the individual first initiated the flood insurance policy. Since all policies are assumed to have a term of only one year, the policy year period includes uninterrupted years of participation. For example, policy year 3 and model year 2000 covers all individuals retaining flood insurance for three years since having first purchased a policy in 1997.

This distinction between the policy year and the model year is necessary for the PVM because the PVM considers participation rates over the entire rental income stream. The PVM uses participation rates by model year and policy year to model the *insurance cost* profile for the future rental income stream.

Model Simulation - Step 4

The final step in the PVM simulation is to estimate the average property value change for all pre-FIRM cells. The average property value change for all post-FIRM cells is zero, since their premiums do not change.

These results, together with the inputs from the PSM, which provide counts of pre-FIRM and post-FIRM structures for every model year, allow the PVM to calculate property value effects at the cell and community level.

D.7 Property Taxes

Overview

The PVM also provides estimates of the effects of changes in premiums on property tax revenues. The PVM assumes for this analysis that changes in property values will have a direct effect on the amount of property tax revenues collected by a community. For example, if it is estimated that property values will fall significantly in a community based on the elimination of the subsidy, a proportional decrease in the property tax revenues for that community would be expected. The PVM assumes that property tax rates are fixed.

Data Sources

Data for property tax rates were obtained from various local government tax assessor offices. For each NFIP sample community, the various tax assessor offices were contacted for each level of local government that collects taxes based on property assessments including village, town, city, and county governments. Phone interviews with staff members at the tax assessor offices were conducted to obtain the most current and accurate property tax rates. The data reflect rates for residential properties for the most recent fiscal year available, which was 1996 or 1997. In many of the communities, the rate for residential and non-residential property was the same.

Property tax rates for the counties in the NFIP community sample were based on county level data and some data from local governments within the respective counties. In each NFIP sample county, property tax data was collected for the largest city or town in the county. It was then assumed that the city represented a clustering of the county population, and the rates from these communities were combined with the county rate using a simple average to yield a single property tax rate for use in the PVM.

Method

Property tax revenues are a function of tax rates and the property value. To calculate the property tax, three pieces of information are necessary: the property tax rate or millage rate of the community, the tax assessment rate for the community, and the assessed value of the property.

The first step for calculating property taxes for an individual property is multiplying the assessed value of the property times the tax assessment rate, yielding the tax assessed value of the property. The tax assessment rate is generally equal to or less than 100 percent; thus, the tax assessed value is generally equal to or less than the assessed value of the property.

The millage rate is measured in collectable tax dollars per unit of assessed value. Some communities define the millage rate as tax dollars per $100 of assessed value. Other communities define the millage rate as collectable tax dollars per $1,000 of assessed value. Since the millage rate definition varied across communities, many of the interviews with staff at tax assessor offices included asking a staff member to calculate the property tax for a property with a fair market value of $50,000. Since the definition of assessment rates was uniform across communities, the millage denominator was back-calculated by using the quoted tax on a $50,000 property and the quoted millage rate. This established if the millage rate was in dollars per $1,000 of assessed property value or dollars per $100 of assessed value. For use in the PVM, the millage rates were normalized, so that the millage definition referred to tax dollars per $100 of assessed property value.

For sample communities that were not counties, information was collected from the tax assessor's office for the appropriate local government as defined in the NFIP community name; e.g., for Waterford Village, New York, the village government was contacted.

In some local governments, the millage rates varied by school district (primary and secondary schools) and other districts defined for delivering public services such as: fire protection; reduced damages from flood and mud; ambulance service; municipal water systems; sewer systems; and libraries. Since the PVM is designed to accept a single property tax rate for each sample community, data for communities with multiple property tax rates were averaged to derive a property tax rate representative of the property owners in the community. For these communities, property tax rate data on all the districts within a community was collected, and then these rates were averaged to yield a single property tax rate for the community. Weighted averages could not be estimated because of data limitations, but these simple averages are reasonable approximations.

Many of the NFIP sample communities offer various exemptions for property taxes. Generally, these exemptions allow for reducing the assessed value of a property (e.g. by 25 percent), but are limited to senior citizens and veterans. Since the average taxpayer is not eligible for these exemptions, the exemptions were not included in the property tax rate estimates. In communities with different property tax rates for primary residences and second homes, the rate for the primary residences was used.

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14. Appendix E: Extrapolation to the Universe of NFIP Study Communities

This appendix describes the approach used to extrapolate the results of the study from the 50 sample communities to the universe of all 15,461 NFIP study communities.

The extrapolation of the results of the 50 sample communities to the universe of all 15,461 NFIP study communities consisted of the following steps:

- Development of a count of the number of housing units for each of the 15,461 study communities from the 1990 decennial Census data
- Conversion of the count of housing units to a count of residential structures
- Estimation of the number of non-residential structures for the 15,461 study communities
- Disaggregation of the estimates of residential and non-residential structures into pre-FIRM and post-FIRM structure types adjusted to reflect structure counts for 1997
- Estimation of SFHA structure counts
- Disaggregation of SFHA structure counts by selected NFIP community economic and flood risk characteristics using the universe of 1997 pre-FIRM and post-FIRM structure totals and the community sampling weights.

14.1 Estimating Counts of Housing Units

The SFHAs were first mapped from Q3 Flood Data onto block groups for all 7,767 Q3 communities. This procedure allowed for determining which block groups or portions of block groups were located in a particular SFHA. Although the Q3 communities include only about half of the 15,461 NFIP communities in the study, the Q3 communities account for about 75 percent of the households and structures located in the universe of study communities.

For the remaining 7,694 non-Q3 communities, the number of housing units was measured in several steps. First, the number of households was estimated in each NFIP community using data from FEMA's Community Information System (CIS) database. The FEMA CIS estimates of the number of households in NFIP communities are based on a study undertaken by Donnelly Marketing (Donnelly) for FEMA during the mid 1980s. In this study, Donnelly developed 1980 population and housing unit estimates for about 17,500 NFIP communities by digitally mapping NFIP communities with their most closely corresponding Census Places as defined in the 1980 decennial Census. In addition to NFIP community total estimates, the Donnelly study produced 1980 population and housing unit estimates for SFHA's within each NFIP community by manually overlaying SFHA boundaries on NFIP community boundaries at the community level. For the NFIP communities and their corresponding SFHA's, 1980 population and housing unit estimates were extrapolated to later years using postcensal extrapolators developed by Donnelly.

Next, the 1990 estimates of NFIP community housing units were applied to the estimated percent of land area in the flood plain developed for the community sampling. This yielded an estimate of housing units in the SFHA for each of the 7,694 non-Q3 communities.

Data on the number of housing units were extracted from the 1990 decennial Census data (U.S. Department of Commerce, 1992). These data were sorted by structure type including single family detached, single family or multiple family attached, high-rise condominium, or manufactured housing unit type for all block groups contained within each of the 15,461 study community SFHAs. The total number of housing units within each block group from the Census housing data was distributed by the estimated proportion of each block group's land area contained within the SFHA. The block groups, or block group portions, were then summed to SFHA totals to estimate the total number of housing units for each of the 15,461 study SFHAs.

14.2 Estimating Residential Structures

In the second step of developing structure counts, housing units were converted to residential structures by estimating the number of residential structures per housing unit for all multiple-unit housing units. Using both the Census Residential Finance Survey and the American Housing Survey, (U.S. Department of Commerce, November, 1997B, *ibid.*, August 1996) which report the number of units per building for multi-unit residential structures, the average number of residential units per building was estimated for each multi-unit housing group. The total number of multi-unit residential structures was estimated by dividing multiple housing units by the average number of housing units per residential structure.

14.3 Estimating Non-Residential Structures

A count of non-residential structures for the 15,461 study communities was estimated using data on the number of commercial buildings and workers by Census region and urban or rural status from the 1989 Commercial Building Energy Consumption Survey (CBECS) conducted by the U.S. Department of Energy's Energy Information Administration (U.S. Department of Energy, 1991). Rather than using a later CBECS, the 1989 CBECS survey was used for consistency since it was the CBECS which coincided most closely with the 1990 decennial Census.

The first step in estimating non-residential structures was to estimate the ratio of commercial workers to commercial buildings by Census region and by urban and rural status, the most detailed geographic levels identified in the CBECS. Next, this ratio was applied to an estimate of the number of commercial employees in each community in 1989. The estimate of the number of commercial employees in each community was derived by using county level tabulations of commercial workers obtained from the 1989 County Business Patterns (U.S. Department of Commerce, 1991) adjusted to the population of the sample community SFHA:

Number of commercial workers in SFHA =

$$\frac{\text{The number of commercial workers in associated county}}{\text{Total population of associated county}} \times \text{Total population in SFHA}$$

The number of commercial structures for each SFHA was estimated by dividing the estimate of the number of commercial workers in each SFHA by the CBECS-derived estimate of the number of commercial workers per commercial building:

$$\text{Number of commercial buildings} = \frac{\text{Number of commercial workers in SFHA}}{\text{Number of commercial workers per commercial building}}$$

On average for the 15,461 study communities, non-residential structures were estimated to account for approximately six percent of all structures.

14.4 Estimating Pre-FIRM And Post-FIRM Structures

The classification of structures as pre-FIRM or post-FIRM was determined using the decennial Census data, which provides an aggregated count of structures built within specific time intervals for all structures within a given area. Assuming a uniform distribution of structures built within each time period—a standard statistical procedure for developing estimates for small geographic areas for which annual observations are not available (Murdock, 1989) —the effective date of the initial FIRM was used to estimate the percentage of pre-FIRM and post-FIRM structures in each group. For the universe of study communities as a whole, about 65 percent of structures were estimated to be pre-FIRM structures in 1997.

14.5 Estimating Structure Counts for 1997

Since the data used to initially estimate the count of structures in each sample community were for 1990, the 1990 stock of structures had to be adjusted to reflect the 1997 stock of structures. To accomplish this adjustment, an estimate of the 1990 to 1997 net growth of structures based on the 1990 to 1997 growth in local area age 21 to 65 population (U.S. Department of Commerce, 1998) was applied to the historic relationship between net growth in structures and the growth in age 21 to 65 population. This adjustment was accomplished in two steps, which are detailed below.

First, the ratio of the growth in housing units to the growth in the age 21 to 65 population was estimated using 1980 and 1990 decennial Census data for the Census place that corresponded to the sample community:

$$\text{Housing unit growth to growth in age 21 to 65 population} = \frac{\dfrac{\text{1990 housing units}}{\text{1980 housing units}}}{\dfrac{\text{1990 age 21 to 65 population}}{\text{1980 age 21 to 65 population}}}$$

Next, this ratio was multiplied by the 1990 to 1997 change in the age 21 to 65 population for the corresponding county or Census place to estimate the growth in structures from 1990 to 1997 (U.S. Department of Commerce, November, 1997A). The source for the 1990 to 1997 population change was data from the Census Bureau's small area population program which provided Census place estimates through 1996. The rate of change from 1995 to 1996 was used to develop population estimates for 1997.

1990 to 1997 growth in structures =

$$\frac{\text{1997 population - 1990 population}}{\text{1990 population}} \times \text{Housing unit growth to growth in age 21 to 65 population}$$

This methodology resulted in an estimate of 4,294,673 pre-FIRM SFHA structures and 6,577,979 total SFHA structures in the universe of 15,461 study communities in 1997.

14.6 Disaggregating SFHA Pre-FIRM and Post-FIRM Structures by the Economic and Risk Characteristics

Structure weights were developed to obtain national estimates of pre-FIRM and post-FIRM structures grouped by the economic and risk characteristics used in the community sampling.

As described in Section 2 of this report, the methodology used to select the sample of communities and structures included constructing a set of community weights for the 50 sample communities. These community weights reflect the 15,461 study communities grouped by the seven economic and risk characteristics identified for the community sampling procedures. To develop pre-FIRM structure weights from these community weights, the community weights were first multiplied by the number of pre-FIRM structures estimated in each of the 50 sample communities and summed to a sample community total. Next, the estimated universe total of 4,294,673 pre-FIRM structures was divided by this sample community total to derive a pre-FIRM structure weight conversion factor. This pre-FIRM structure weight conversion factor was then applied to each of the 50 sampling community weights to arrive at a set of pre-FIRM structure weights that reflect the universe of 4,294,673 estimated pre-FIRM structures. A similar approach was used to develop a set of post-FIRM structure weights.

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15. Appendix F: Property Valuation Model Results

This appendix contains detailed results from the Property Valuation Model (PVM) for the Universe of all 15,461 NFIP study communities and for the 50 sample communities. For selected years over the 1998 to 2022 period, results for Scenarios 1 through 7 are presented for single family, multiple family, and non residential structures.

Tables F.1 through F.8 present property value changes for pre-FIRM structures below the BFE. Tables F.9 through F.16 present community level property value changes for pre-FIRM structures at or above the BFE.

TABLE F.1

Percent Change from Baseline for Average Real Pre-FIRM Property Values from 1997 to 202
Property Elevation Below BFE
All NFIP Study Communities

Scenario	1998	2002	2007	2012	2017	2022
Scenario 1						
Single Family	-3.5%	-1.9%	-1.9%	-2.0%	-1.9%	-1.9%
Multiple Family	-6.7%	-3.9%	-4.1%	-4.4%	-4.5%	-4.5%
Non-Residential	-4.3%	-2.7%	-2.8%	-2.9%	-2.9%	-2.9%
Scenario 2						
Single Family	-1.7%	-2.1%	-2.2%	-2.0%	-2.1%	-2.0%
Multiple Family	-3.2%	-4.0%	-4.4%	-4.2%	-4.6%	-4.7%
Non-Residential	-2.4%	-2.9%	-3.1%	-2.9%	-2.9%	-2.9%
Scenario 3						
Single Family	-1.2%	-1.5%	-2.0%	-2.3%	-2.4%	-2.4%
Multiple Family	-2.2%	-3.0%	-3.9%	-4.5%	-4.8%	-5.1%
Non-Residential	-1.8%	-2.2%	-2.8%	-3.1%	-3.2%	-3.1%
Scenario 4						
Single Family	-0.9%	-1.3%	-1.7%	-1.9%	-2.1%	-2.1%
Multiple Family	-1.7%	-2.5%	-3.2%	-3.7%	-4.0%	-4.2%
Non-Residential	-1.4%	-2.0%	-2.5%	-2.8%	-3.0%	-3.0%
Scenario 5						
Single Family	-3.3%	-2.1%	-2.1%	-2.1%	-2.0%	-2.0%
Multiple Family	-6.5%	-4.1%	-4.3%	-4.4%	-4.5%	-4.6%
Non-Residential	-4.3%	-2.8%	-2.9%	-2.9%	-2.9%	-2.9%
Scenario 6						
Single Family	-2.7%	-2.2%	-2.1%	-2.1%	-2.1%	-2.1%
Multiple Family	-5.5%	-4.2%	-4.3%	-4.4%	-4.6%	-4.6%
Non-Residential	-3.9%	-2.9%	-3.0%	-3.0%	-2.9%	-2.9%
Scenario 7						
Single Family	-3.0%	-2.1%	-2.1%	-2.1%	-2.1%	-2.0%
Multiple Family	-5.8%	-4.2%	-4.3%	-4.4%	-4.6%	-4.6%
Non-Residential	-4.0%	-2.9%	-2.9%	-3.0%	-2.9%	-2.9%

Table F.2
Percent Change from Baseline for Average Real Pre-FIRM Property Values from 1997 to 2022
Scenario 1: Property Elevation Below BFE
Sample Communities

Community	1998	2002	2007	2012	2017	2022
Phoenix City, AZ						
Single Family	-1.8%	-1.8%	-1.8%	-1.8%	-1.8%	-1.8%
Multiple Family	-1.6%	-1.3%	-1.3%	-1.4%	-1.4%	-1.4%
Non-Residential	-1.5%	-1.4%	-1.4%	-1.3%	-1.3%	-1.3%
Bay City, AR						
Single Family	-1.9%	-1.3%	-1.4%	-1.4%	-1.4%	-1.3%
Multiple Family	-2.1%	-1.8%	-2.0%	-2.2%	-2.3%	-2.4%
Non-Residential	-1.4%	-1.1%	-1.1%	-1.1%	-1.1%	-1.1%
Sacramento County, CA						
Single Family	-2.2%	-2.3%	-2.4%	-2.5%	-2.5%	-2.5%
Multiple Family	-1.5%	-1.4%	-1.5%	-1.6%	-1.7%	-1.7%
Non-Residential	-2.4%	-2.5%	-2.5%	-2.5%	-2.4%	-2.3%
Santa Cruz City, CA						
Single Family	-5.9%	-2.3%	-2.2%	-2.0%	-1.9%	-1.7%
Multiple Family	-3.3%	-1.7%	-1.7%	-1.8%	-1.8%	-1.9%
Non-Residential	-3.9%	-2.1%	-2.1%	-2.1%	-2.0%	-2.0%
Dolores Town, CO						
Single Family	-2.4%	-1.6%	-1.7%	-1.7%	-1.7%	-1.7%
Multiple Family	-0.8%	-0.7%	-0.7%	-0.7%	-0.7%	-0.7%
Non-Residential	-1.4%	-1.1%	-1.2%	-1.2%	-1.2%	-1.2%
Otero County, CO						
Single Family	-1.5%	-1.1%	-1.2%	-1.3%	-1.3%	-1.3%
Multiple Family	-1.0%	-0.8%	-0.9%	-0.9%	-1.0%	-1.0%
Non-Residential	-0.9%	-0.7%	-0.8%	-0.8%	-0.8%	-0.8%
Ft. Lauderdale City, FL						
Single Family	-0.8%	-0.7%	-0.7%	-0.7%	-0.7%	-0.7%
Multiple Family	-2.0%	-1.7%	-1.6%	-1.6%	-1.5%	-1.5%
Non-Residential	-1.3%	-1.2%	-1.1%	-1.0%	-1.0%	-0.9%
New Smyrna Beach City, FL						
Single Family	-0.7%	-0.8%	-0.9%	-0.9%	-0.9%	-1.0%
Multiple Family	-1.4%	-1.5%	-1.6%	-1.7%	-1.7%	-1.8%
Non-Residential	-1.2%	-1.5%	-1.7%	-1.8%	-1.9%	-2.0%
St. Petersburg Beach City, FL						
Single Family	-20.0%	-18.2%	-20.0%	-20.8%	-21.0%	-21.1%
Multiple Family	-11.0%	-10.0%	-10.9%	-11.4%	-11.4%	-11.4%
Non-Residential	-28.4%	-26.5%	-29.3%	-30.8%	-31.1%	-31.3%
Hailey City, ID						
Single Family	0.0%	0.5%	0.6%	0.6%	0.7%	0.7%
Multiple Family	-1.2%	-1.0%	-1.0%	-1.0%	-1.0%	-1.0%
Non-Residential	-1.6%	-1.0%	-1.0%	-0.9%	-0.9%	-0.8%
Grundy County, IL						
Single Family	-3.5%	-1.3%	-1.2%	-1.2%	-1.2%	-1.2%
Multiple Family	-4.3%	-1.4%	-1.4%	-1.5%	-1.5%	-1.5%
Non-Residential	-5.4%	-1.7%	-1.5%	-1.5%	-1.5%	-1.5%
Council Bluffs City, IA						
Single Family	-2.7%	-1.7%	-1.7%	-1.6%	-1.5%	-1.5%
Multiple Family	-6.9%	-2.5%	-2.4%	-2.3%	-2.2%	-2.2%
Non-Residential	-10.0%	-4.1%	-3.9%	-3.9%	-3.8%	-3.8%
Augusta City, KY						
Single Family	-0.2%	0.4%	0.6%	0.6%	0.7%	0.8%
Multiple Family	-2.1%	-1.6%	-1.7%	-1.7%	-1.7%	-1.7%
Non-Residential	-1.2%	-1.0%	-1.0%	-1.0%	-1.0%	-1.0%

Table F.2 (Continued)
Percent Change from Baseline for Average Real Pre-FIRM Property Values from 1997 to 2022
Scenario 1: Property Elevation Below BFE
Sample Communities

Community	1998	2002	2007	2012	2017	2022
Lewisport City, KY						
Single Family	0.9%	1.4%	1.6%	1.7%	1.7%	1.8%
Multiple Family	-2.0%	-1.8%	-2.0%	-2.1%	-2.2%	-2.3%
Non-Residential	-0.9%	-0.8%	-0.8%	-0.8%	-0.8%	-0.8%
Louisville/Jefferson, KY						
Single Family	-14.3%	-4.9%	-4.6%	-4.4%	-4.0%	-3.7%
Multiple Family	-11.8%	-5.0%	-5.2%	-5.3%	-5.3%	-5.3%
Non-Residential	-7.1%	-2.9%	-2.8%	-2.6%	-2.5%	-2.4%
Allen Parish, LA						
Single Family	-1.4%	-1.1%	-1.3%	-1.3%	-1.3%	-1.4%
Multiple Family	-1.1%	-1.0%	-1.2%	-1.3%	-1.4%	-1.4%
Non-Residential	-0.9%	-0.8%	-0.9%	-0.9%	-0.9%	-0.9%
Jefferson Parish, LA						
Single Family	-2.8%	-1.9%	-1.9%	-1.9%	-1.9%	-1.9%
Multiple Family	-3.6%	-2.4%	-2.4%	-2.3%	-2.3%	-2.3%
Non-Residential	-3.1%	-2.4%	-2.3%	-2.1%	-2.0%	-2.0%
Shreveport City, LA						
Single Family	-4.7%	-4.7%	-4.6%	-4.6%	-4.6%	-4.6%
Multiple Family	-5.4%	-5.6%	-6.1%	-6.5%	-6.7%	-6.9%
Non-Residential	-4.2%	-4.0%	-3.9%	-3.8%	-3.7%	-3.6%
Cohasset Town, MA						
Single Family	-2.2%	-0.6%	-0.5%	-0.4%	-0.4%	-0.4%
Multiple Family	-3.7%	-1.6%	-1.5%	-1.5%	-1.6%	-1.6%
Non-Residential	-4.8%	-2.1%	-1.9%	-1.7%	-1.8%	-1.8%
Vassar City, MI						
Single Family	0.8%	1.3%	1.5%	1.7%	1.7%	1.8%
Multiple Family	-1.2%	-1.1%	-1.2%	-1.3%	-1.3%	-1.3%
Non-Residential	-1.4%	-1.1%	-1.1%	-1.1%	-1.1%	-1.1%
Petal City, MS						
Single Family	-2.1%	-1.9%	-2.1%	-2.2%	-2.2%	-2.3%
Multiple Family	-1.3%	-1.2%	-1.3%	-1.4%	-1.5%	-1.5%
Non-Residential	-1.2%	-1.2%	-1.2%	-1.3%	-1.3%	-1.2%
Scott County, MO						
Single Family	0.4%	0.9%	1.0%	1.1%	1.1%	1.2%
Multiple Family	-1.2%	-1.2%	-1.4%	-1.6%	-1.6%	-1.7%
Non-Residential	-1.0%	-0.8%	-0.9%	-0.9%	-0.9%	-0.9%
Omaha City, NE						
Single Family	-0.8%	0.8%	0.9%	1.0%	1.0%	1.1%
Multiple Family	-2.8%	-1.3%	-1.3%	-1.4%	-1.4%	-1.4%
Non-Residential	-3.3%	-1.3%	-1.2%	-1.2%	-1.1%	-1.1%
Pender Village, NE						
Single Family	-0.9%	0.0%	0.1%	0.3%	0.3%	0.4%
Multiple Family	-2.6%	-1.3%	-1.3%	-1.3%	-1.3%	-1.3%
Non-Residential	-2.9%	-1.2%	-1.2%	-1.2%	-1.2%	-1.2%
Woodstock Town, NH						
Single Family	0.6%	1.3%	1.5%	1.6%	1.7%	1.8%
Multiple Family	-1.8%	-1.3%	-1.3%	-1.4%	-1.4%	-1.4%
Non-Residential	-1.3%	-1.1%	-1.1%	-1.2%	-1.1%	-1.1%

Table F.2 (Continued)

Percent Change from Baseline for Average Real Pre-FIRM Property Values from 1997 to 2022
Scenario 1: Property Elevation Below BFE
Sample Communities

Community	1998	2002	2007	2012	2017	2022
Bloomingdale Borough, NJ						
Single Family	0.9%	1.4%	1.5%	1.5%	1.5%	1.5%
Multiple Family	-2.2%	-1.4%	-1.5%	-1.5%	-1.6%	-1.6%
Non-Residential	-1.7%	-1.3%	-1.3%	-1.3%	-1.2%	-1.2%
Lincoln Park Borough, NJ						
Single Family	-8.8%	-3.3%	-3.2%	-3.3%	-3.2%	-3.2%
Multiple Family	-18.2%	-7.7%	-8.1%	-8.5%	-8.8%	-9.0%
Non-Residential	-17.4%	-7.0%	-6.8%	-6.8%	-6.7%	-6.6%
Niagara Town, NY						
Single Family	-6.7%	-2.0%	-1.8%	-1.7%	-1.5%	-1.4%
Multiple Family	-7.6%	-3.2%	-3.4%	-3.8%	-4.1%	-4.2%
Non-Residential	-2.5%	-0.9%	-0.8%	-0.8%	-0.8%	-0.8%
Waterford Village, NY						
Single Family	-1.1%	0.2%	0.3%	0.4%	0.5%	0.5%
Multiple Family	-5.3%	-2.3%	-2.3%	-2.2%	-2.2%	-2.2%
Non-Residential	-3.2%	-1.5%	-1.5%	-1.5%	-1.5%	-1.5%
Carteret County, NC						
Single Family	-1.9%	-2.0%	-2.1%	-2.1%	-2.0%	-2.0%
Multiple Family	-1.3%	-1.3%	-1.4%	-1.5%	-1.5%	-1.6%
Non-Residential	-1.2%	-1.3%	-1.4%	-1.4%	-1.4%	-1.4%
Edenton, NC						
Single Family	-0.9%	-1.0%	-1.0%	-1.1%	-1.1%	-1.1%
Multiple Family	-0.9%	-1.1%	-1.3%	-1.4%	-1.4%	-1.5%
Non-Residential	-1.5%	-1.7%	-1.8%	-1.8%	-1.9%	-1.8%
New Miami Village, OH						
Single Family	1.0%	1.4%	1.5%	1.5%	1.5%	1.5%
Multiple Family	-1.0%	-1.0%	-1.2%	-1.3%	-1.3%	-1.4%
Non-Residential	-1.0%	-0.9%	-0.9%	-1.0%	-1.0%	-1.0%
Washington County, OK						
Single Family	-1.3%	-1.1%	-1.2%	-1.2%	-1.2%	-1.2%
Multiple Family	-0.7%	-0.6%	-0.7%	-0.8%	-0.9%	-0.9%
Non-Residential	-0.8%	-0.8%	-0.8%	-0.8%	-0.8%	-0.8%
Lane County, OR						
Single Family	-1.6%	-1.4%	-1.5%	-1.5%	-1.5%	-1.5%
Multiple Family	-1.0%	-0.9%	-0.9%	-1.0%	-1.0%	-1.0%
Non-Residential	-1.0%	-1.0%	-1.0%	-1.0%	-1.0%	-1.0%
Vernonia City, OR						
Single Family	-3.4%	-2.3%	-2.3%	-2.4%	-2.4%	-2.4%
Multiple Family	-1.4%	-1.1%	-1.0%	-1.0%	-1.0%	-0.9%
Non-Residential	-1.5%	-1.1%	-1.1%	-1.1%	-1.1%	-1.1%
Franklin Township, PA						
Single Family	-2.2%	-1.3%	-1.5%	-1.7%	-1.7%	-1.8%
Multiple Family	-4.3%	-1.4%	-1.7%	-1.9%	-2.0%	-2.1%
Non-Residential	-2.6%	-0.9%	-1.0%	-1.0%	-1.0%	-1.0%
Glen Rock Borough, PA						
Single Family	-23.6%	-16.8%	-18.5%	-19.6%	-20.4%	-21.4%
Multiple Family	-58.4%	-46.1%	-57.1%	-67.4%	-77.2%	-85.1%
Non-Residential	-27.3%	-31.2%	-36.0%	-35.6%	-32.9%	-35.3%
Lower Mt. Bethel Township, PA						
Single Family	-10.6%	-6.8%	-6.6%	-6.5%	-6.2%	-6.1%
Multiple Family	-18.4%	-16.8%	-13.6%	-10.1%	-5.3%	0.0%
Non-Residential	-15.5%	-13.1%	-9.9%	-6.9%	-3.5%	0.0%

Table F.2 (Continued)
Percent Change from Baseline for Average Real Pre-FIRM Property Values from 1997 to 2022

Scenario 1: Property Elevation Below BFE
Sample Communities

Community	1998	2002	2007	2012	2017	2022
New Cumberland Borough, PA						
Single Family	-6.3%	-2.9%	-2.9%	-2.9%	-2.8%	-2.7%
Multiple Family	-15.4%	-6.6%	-6.8%	-6.8%	-6.6%	-6.5%
Non-Residential	-9.6%	-4.1%	-4.1%	-4.1%	-4.1%	-4.3%
Myrtle Beach City, SC						
Single Family	-7.6%	-4.0%	-3.6%	-3.3%	-3.1%	-2.9%
Multiple Family	-5.0%	-2.7%	-2.6%	-2.6%	-2.5%	-2.3%
Non-Residential	-2.4%	-2.4%	-2.2%	-2.0%	-1.8%	-1.6%
Lawrence County, SD						
Single Family	0.6%	1.1%	1.3%	1.4%	1.4%	1.5%
Multiple Family	-1.1%	-1.0%	-1.0%	-1.0%	-1.0%	-1.0%
Non-Residential	-0.9%	-0.7%	-0.8%	-0.8%	-0.8%	-0.8%
Brookside Village City, TX						
Single Family	-14.9%	-5.7%	-5.7%	-5.6%	-5.5%	-5.3%
Multiple Family	-10.7%	-4.3%	-3.6%	-2.9%	-2.1%	-0.5%
Non-Residential	-10.5%	-4.3%	-4.2%	-4.2%	-4.2%	-4.1%
Garland City, TX						
Single Family	-1.9%	-1.1%	-1.1%	-1.1%	-1.0%	-1.0%
Multiple Family	-1.4%	-0.9%	-1.0%	-1.1%	-1.2%	-1.2%
Non-Residential	-1.6%	-1.2%	-1.2%	-1.2%	-1.2%	-1.2%
League City, TX						
Single Family	-4.0%	-2.0%	-2.0%	-1.9%	-1.9%	-1.9%
Multiple Family	-2.7%	-1.4%	-1.5%	-1.5%	-1.5%	-1.6%
Non-Residential	-3.0%	-1.7%	-1.8%	-1.7%	-1.7%	-1.7%
Grundy Town, VA						
Single Family	-14.7%	-6.8%	-6.6%	-6.5%	-6.5%	-6.3%
Multiple Family	-20.3%	-13.2%	-13.2%	-13.7%	-12.4%	-10.8%
Non-Residential	-15.0%	-6.8%	-6.6%	-6.6%	-6.9%	-7.0%
Ephrata City, WA						
Single Family	-2.7%	-2.0%	-2.0%	-2.0%	-2.0%	-2.0%
Multiple Family	-2.5%	-1.7%	-1.8%	-1.8%	-1.9%	-1.9%
Non-Residential	-1.8%	-1.3%	-1.3%	-1.3%	-1.3%	-1.3%
Leavenworth City, WA						
Single Family	-6.9%	-3.4%	-3.4%	-3.4%	-3.3%	-3.2%
Multiple Family	-3.2%	-1.8%	-1.5%	-1.2%	-0.7%	0.0%
Non-Residential	-1.7%	-1.8%	-1.5%	-1.1%	-0.6%	0.0%
Marlinton Town, WV						
Single Family	-6.1%	-2.6%	-2.4%	-2.3%	-2.2%	-2.1%
Multiple Family	-7.0%	-3.8%	-3.6%	-3.5%	-3.4%	-3.3%
Non-Residential	-6.6%	-3.1%	-3.0%	-2.9%	-2.9%	-2.9%
Philippi City, WV						
Single Family	-9.8%	-4.8%	-4.8%	-4.7%	-4.6%	-4.4%
Multiple Family	-18.4%	-9.2%	-9.8%	-10.3%	-10.8%	-10.9%
Non-Residential	-13.7%	-5.9%	-5.9%	-5.8%	-5.8%	-5.7%
Wheeling City, WV						
Single Family	-5.5%	-1.9%	-1.7%	-1.7%	-1.5%	-1.4%
Multiple Family	-15.8%	-6.8%	-6.7%	-6.8%	-6.4%	-6.4%
Non-Residential	-18.0%	-7.3%	-7.0%	-6.9%	-6.5%	-6.5%

Table F.3
Percent Change from Baseline for Average Real Pre-FIRM Property Values from 1997 to 2022
Scenario 2: Property Elevation Below BFE

Sample Communities

Community	1998	2002	2007	2012	2017	2022
Phoenix City, AZ						
Single Family	-1.3%	-1.6%	-1.8%	-1.8%	-1.8%	-1.8%
Multiple Family	-1.3%	-1.7%	-1.9%	-1.7%	-1.6%	-1.6%
Non-Residential	-1.1%	-1.4%	-1.5%	-1.4%	-1.3%	-1.3%
Bay City, AR						
Single Family	-1.2%	-1.4%	-1.5%	-1.4%	-1.3%	-1.4%
Multiple Family	-1.7%	-2.3%	-2.6%	-2.4%	-2.4%	-2.5%
Non-Residential	-1.1%	-1.3%	-1.4%	-1.2%	-1.1%	-1.1%
Sacramento County, CA						
Single Family	-2.0%	-2.4%	-2.7%	-2.6%	-2.5%	-2.5%
Multiple Family	-1.6%	-2.0%	-2.3%	-2.1%	-2.0%	-2.0%
Non-Residential	-2.1%	-2.5%	-2.7%	-2.5%	-2.4%	-2.4%
Santa Cruz City, CA						
Single Family	-2.1%	-2.4%	-2.2%	-1.7%	-1.9%	-1.8%
Multiple Family	-1.7%	-2.1%	-2.1%	-1.8%	-1.9%	-2.0%
Non-Residential	-2.3%	-2.7%	-2.6%	-2.1%	-2.0%	-2.0%
Dolores Town, CO						
Single Family	-1.5%	-1.9%	-2.0%	-1.8%	-1.8%	-1.8%
Multiple Family	-0.9%	-1.2%	-1.2%	-1.0%	-0.9%	-1.0%
Non-Residential	-1.0%	-1.3%	-1.4%	-1.3%	-1.2%	-1.2%
Otero County, CO						
Single Family	-1.2%	-1.5%	-1.7%	-1.6%	-1.5%	-1.5%
Multiple Family	-1.0%	-1.3%	-1.5%	-1.4%	-1.3%	-1.3%
Non-Residential	-0.8%	-1.1%	-1.1%	-1.1%	-1.0%	-1.0%
Ft. Lauderdale City, FL						
Single Family	-0.6%	-0.7%	-0.8%	-0.8%	-0.8%	-0.8%
Multiple Family	-1.5%	-1.9%	-2.0%	-1.8%	-1.7%	-1.6%
Non-Residential	-0.9%	-1.1%	-1.1%	-1.0%	-1.0%	-0.9%
New Smyrna Beach City, FL						
Single Family	-0.6%	-0.8%	-0.9%	-0.9%	-1.0%	-1.0%
Multiple Family	-1.3%	-1.8%	-2.1%	-2.0%	-1.9%	-1.9%
Non-Residential	-1.0%	-1.4%	-1.7%	-1.9%	-1.9%	-2.0%
St. Petersburg Beach City, FL						
Single Family	-12.9%	-16.4%	-19.8%	-20.8%	-21.0%	-21.1%
Multiple Family	-7.2%	-9.1%	-10.9%	-11.3%	-11.4%	-11.4%
Non-Residential	-18.5%	-23.9%	-29.2%	-30.7%	-31.2%	-31.3%
Hailey City, ID						
Single Family	0.6%	0.6%	0.6%	0.6%	0.7%	0.7%
Multiple Family	-0.8%	-1.1%	-1.2%	-1.1%	-1.0%	-1.0%
Non-Residential	-0.8%	-1.0%	-1.0%	-0.9%	-0.9%	-0.9%
Grundy County, IL						
Single Family	-1.9%	-2.3%	-2.2%	-1.8%	-1.6%	-1.5%
Multiple Family	-1.9%	-2.5%	-2.4%	-1.9%	-1.8%	-1.7%
Non-Residential	-2.4%	-3.0%	-2.7%	-2.1%	-1.9%	-1.8%
Council Bluffs City, IA						
Single Family	-1.5%	-1.8%	-1.8%	-1.6%	-1.5%	-1.5%
Multiple Family	-2.9%	-3.3%	-2.9%	-2.3%	-1.9%	-1.8%
Non-Residential	-4.1%	-4.8%	-4.4%	-3.6%	-3.2%	-3.2%
Augusta City, KY						
Single Family	0.4%	0.4%	0.5%	0.7%	0.7%	0.8%
Multiple Family	-1.4%	-1.8%	-1.9%	-1.8%	-1.8%	-1.8%
Non-Residential	-0.8%	-1.0%	-1.1%	-1.0%	-1.0%	-1.0%

Table F.3 (Continued)

Percent Change from Baseline for Average Real Pre-FIRM Property Values from 1997 to 2022

Scenario 2: Property Elevation Below BFE

Sample Communities

Community	1998	2002	2007	2012	2017	2022
Lewisport City, KY						
Single Family	1.2%	1.3%	1.5%	1.7%	1.7%	1.8%
Multiple Family	-1.6%	-2.1%	-2.4%	-2.3%	-2.3%	-2.4%
Non-Residential	-0.8%	-0.9%	-1.0%	-0.9%	-0.8%	-0.8%
Louisville/Jefferson, KY						
Single Family	-4.7%	-5.1%	-4.6%	-3.7%	-4.3%	-4.1%
Multiple Family	-4.2%	-5.0%	-5.0%	-4.4%	-4.5%	-5.5%
Non-Residential	-2.6%	-2.9%	-2.6%	-2.2%	-2.0%	-2.4%
Allen Parish, LA						
Single Family	-1.2%	-1.5%	-1.7%	-1.6%	-1.6%	-1.6%
Multiple Family	-1.1%	-1.6%	-1.9%	-1.8%	-1.8%	-1.7%
Non-Residential	-0.8%	-1.1%	-1.2%	-1.1%	-1.1%	-1.1%
Jefferson Parish, LA						
Single Family	-1.6%	-2.0%	-2.1%	-2.0%	-2.0%	-2.0%
Multiple Family	-2.3%	-2.9%	-3.1%	-2.8%	-2.7%	-2.6%
Non-Residential	-2.1%	-2.4%	-2.5%	-2.2%	-2.0%	-2.0%
Shreveport City, LA						
Single Family	-3.3%	-4.1%	-4.6%	-4.6%	-4.6%	-4.6%
Multiple Family	-3.6%	-4.9%	-6.1%	-6.5%	-6.7%	-6.9%
Non-Residential	-3.0%	-3.6%	-3.9%	-3.8%	-3.7%	-3.6%
Cohasset Town, MA						
Single Family	-0.9%	-1.0%	-0.9%	-0.7%	-0.6%	-0.5%
Multiple Family	-2.1%	-2.6%	-2.5%	-2.2%	-2.1%	-2.0%
Non-Residential	-3.0%	-3.5%	-3.4%	-2.8%	-2.6%	-2.5%
Vassar City, MI						
Single Family	1.0%	1.2%	1.4%	1.6%	1.7%	1.7%
Multiple Family	-1.1%	-1.4%	-1.6%	-1.5%	-1.5%	-1.4%
Non-Residential	-1.1%	-1.3%	-1.4%	-1.3%	-1.2%	-1.2%
Petal City, MS						
Single Family	-1.6%	-2.1%	-2.4%	-2.4%	-2.4%	-2.4%
Multiple Family	-1.4%	-1.9%	-2.2%	-2.0%	-1.9%	-1.9%
Non-Residential	-1.2%	-1.5%	-1.6%	-1.5%	-1.4%	-1.4%
Scott County, MO						
Single Family	0.5%	0.6%	0.7%	0.9%	1.0%	1.1%
Multiple Family	-1.1%	-1.6%	-1.9%	-1.9%	-1.8%	-1.8%
Non-Residential	-0.9%	-1.1%	-1.2%	-1.1%	-1.0%	-1.0%
Omaha City, NE						
Single Family	0.4%	0.4%	0.6%	0.9%	1.0%	1.1%
Multiple Family	-1.5%	-1.9%	-2.0%	-1.7%	-1.5%	-1.5%
Non-Residential	-1.7%	-1.9%	-1.7%	-1.4%	-1.3%	-1.2%
Pender Village, NE						
Single Family	-0.2%	-0.3%	-0.3%	-0.1%	0.0%	0.1%
Multiple Family	-1.4%	-1.8%	-2.0%	-1.8%	-1.7%	-1.7%
Non-Residential	-1.6%	-2.0%	-2.0%	-1.7%	-1.6%	-1.6%
Woodstock Town, NH						
Single Family	1.1%	1.2%	1.4%	1.6%	1.7%	1.8%
Multiple Family	-1.3%	-1.7%	-1.8%	-1.6%	-1.5%	-1.6%
Non-Residential	-0.9%	-1.2%	-1.3%	-1.2%	-1.1%	-1.1%

Table F.3 (Continued)

Percent Change from Baseline for Average Real Pre-FIRM Property Values from 1997 to 2022

Scenario 2: Property Elevation Below BFE

Sample Communities

Community	1998	2002	2007	2012	2017	2022
Bloomingdale Borough, NJ						
Single Family	1.2%	1.3%	1.4%	1.5%	1.5%	1.5%
Multiple Family	-1.7%	-2.1%	-2.4%	-2.2%	-2.1%	-2.1%
Non-Residential	-1.3%	-1.5%	-1.6%	-1.4%	-1.3%	-1.2%
Lincoln Park Borough, NJ						
Single Family	-3.1%	-3.5%	-3.2%	-2.6%	-3.2%	-3.2%
Multiple Family	-6.1%	-7.3%	-7.3%	-6.5%	-8.8%	-9.1%
Non-Residential	-6.2%	-7.0%	-6.5%	-5.4%	-5.0%	-6.6%
Niagara Town, NY						
Single Family	-2.3%	-2.8%	-2.4%	-1.8%	-1.4%	-1.2%
Multiple Family	-3.8%	-5.3%	-5.5%	-4.6%	-4.0%	-4.1%
Non-Residential	-1.6%	-1.9%	-1.8%	-1.4%	-1.2%	-1.1%
Waterford Village, NY						
Single Family	0.0%	-0.1%	0.0%	0.4%	0.4%	0.4%
Multiple Family	-2.2%	-2.7%	-2.5%	-2.1%	-2.3%	-2.3%
Non-Residential	-1.5%	-1.9%	-1.7%	-1.4%	-1.3%	-1.4%
Carteret County, NC						
Single Family	-1.8%	-2.1%	-2.3%	-2.2%	-2.1%	-2.0%
Multiple Family	-1.3%	-1.8%	-2.0%	-1.9%	-1.8%	-1.8%
Non-Residential	-1.1%	-1.3%	-1.5%	-1.4%	-1.4%	-1.4%
Edenton, NC						
Single Family	-1.1%	-1.3%	-1.5%	-1.4%	-1.4%	-1.3%
Multiple Family	-1.2%	-1.7%	-2.0%	-1.9%	-1.9%	-1.9%
Non-Residential	-1.3%	-1.6%	-1.9%	-1.9%	-1.9%	-1.9%
New Miami Village, OH						
Single Family	1.1%	1.2%	1.3%	1.4%	1.5%	1.5%
Multiple Family	-1.1%	-1.4%	-1.6%	-1.5%	-1.5%	-1.5%
Non-Residential	-1.0%	-1.2%	-1.2%	-1.1%	-1.1%	-1.1%
Washington County, OK						
Single Family	-1.1%	-1.5%	-1.6%	-1.5%	-1.4%	-1.4%
Multiple Family	-0.9%	-1.2%	-1.3%	-1.2%	-1.1%	-1.1%
Non-Residential	-0.8%	-1.0%	-1.1%	-1.0%	-0.9%	-0.9%
Lane County, OR						
Single Family	-1.1%	-1.4%	-1.6%	-1.5%	-1.5%	-1.5%
Multiple Family	-0.9%	-1.2%	-1.4%	-1.2%	-1.2%	-1.1%
Non-Residential	-0.8%	-1.0%	-1.1%	-1.1%	-1.0%	-1.0%
Vernonia City, OR						
Single Family	-1.9%	-2.4%	-2.5%	-2.3%	-2.3%	-2.5%
Multiple Family	-1.1%	-1.5%	-1.6%	-1.4%	-1.3%	-1.3%
Non-Residential	-1.0%	-1.2%	-1.3%	-1.1%	-1.1%	-1.1%
Franklin Township, PA						
Single Family	-1.7%	-2.3%	-2.6%	-2.5%	-2.4%	-2.4%
Multiple Family	-2.8%	-3.8%	-4.3%	-4.0%	-4.0%	-4.0%
Non-Residential	-1.9%	-2.4%	-2.5%	-2.2%	-2.0%	-2.0%
Glen Rock Borough, PA						
Single Family	-14.2%	-16.7%	-18.8%	-19.6%	-20.5%	-21.4%
Multiple Family	-34.8%	-45.2%	-57.6%	-67.8%	-77.0%	-85.0%
Non-Residential	-22.5%	-28.8%	-35.3%	-35.0%	-35.0%	-39.1%
Lower Mt. Bethel Township, PA						
Single Family	-6.0%	-6.6%	-7.0%	-6.7%	-6.3%	-6.2%
Multiple Family	-15.1%	-14.7%	-14.1%	-10.6%	-5.7%	0.0%
Non-Residential	-13.0%	-11.8%	-10.5%	-7.3%	-3.7%	0.0%

Table F.3 (Continued)

Percent Change from Baseline for Average Real Pre-FIRM Property Values from 1997 to 2022

Scenario 2: Property Elevation Below BFE

Sample Communities

Community	1998	2002	2007	2012	2017	2022
New Cumberland Borough, PA						
Single Family	-2.7%	-3.2%	-3.1%	-2.7%	-3.0%	-3.0%
Multiple Family	-5.1%	-6.1%	-5.8%	-6.4%	-6.6%	-6.5%
Non-Residential	-3.4%	-3.9%	-3.5%	-3.7%	-4.1%	-4.3%
Myrtle Beach City, SC						
Single Family	-3.1%	-3.4%	-3.9%	-3.4%	-3.1%	-2.9%
Multiple Family	-2.1%	-2.5%	-2.9%	-2.7%	-2.5%	-2.4%
Non-Residential	-1.6%	-2.0%	-2.0%	-2.0%	-1.7%	-1.5%
Lawrence County, SD						
Single Family	1.0%	1.1%	1.2%	1.4%	1.5%	1.5%
Multiple Family	-0.9%	-1.1%	-1.2%	-1.1%	-1.1%	-1.1%
Non-Residential	-0.7%	-0.8%	-0.9%	-0.8%	-0.7%	-0.8%
Brookside Village City, TX						
Single Family	-4.6%	-5.8%	-5.4%	-4.3%	-5.5%	-5.3%
Multiple Family	-3.4%	-4.3%	-3.4%	-2.5%	-2.2%	-0.5%
Non-Residential	-3.5%	-4.1%	-4.0%	-3.2%	-4.2%	-4.2%
Garland City, TX						
Single Family	-1.4%	-1.7%	-1.7%	-1.4%	-1.2%	-1.1%
Multiple Family	-1.2%	-1.6%	-1.8%	-1.5%	-1.4%	-1.4%
Non-Residential	-1.3%	-1.6%	-1.7%	-1.4%	-1.3%	-1.3%
League City, TX						
Single Family	-1.9%	-2.4%	-2.4%	-2.1%	-1.9%	-1.8%
Multiple Family	-1.4%	-1.9%	-2.1%	-1.8%	-1.7%	-1.7%
Non-Residential	-1.6%	-2.1%	-2.1%	-1.9%	-1.7%	-1.7%
Grundy Town, VA						
Single Family	-5.0%	-5.5%	-6.6%	-6.3%	-6.6%	-6.4%
Multiple Family	-7.7%	-9.9%	-10.9%	-13.6%	-11.6%	-9.6%
Non-Residential	-5.1%	-5.6%	-5.9%	-5.5%	-6.4%	-7.0%
Ephrata City, WA						
Single Family	-1.7%	-2.1%	-2.3%	-2.0%	-1.9%	-2.0%
Multiple Family	-1.7%	-2.3%	-2.5%	-2.2%	-2.0%	-2.1%
Non-Residential	-1.2%	-1.5%	-1.6%	-1.4%	-1.3%	-1.3%
Leavenworth City, WA						
Single Family	-3.2%	-3.9%	-3.7%	-3.1%	-2.8%	-3.2%
Multiple Family	-1.9%	-2.3%	-1.8%	-1.1%	-0.6%	0.0%
Non-Residential	-1.9%	-2.2%	-1.7%	-1.0%	-0.5%	0.0%
Marlinton Town, WV						
Single Family	-2.1%	-2.5%	-2.3%	-1.9%	-2.1%	-2.0%
Multiple Family	-2.7%	-3.4%	-3.4%	-3.7%	-3.6%	-3.5%
Non-Residential	-2.5%	-2.9%	-2.9%	-2.5%	-2.8%	-2.9%
Philippi City, WV						
Single Family	-3.8%	-4.6%	-4.7%	-4.1%	-3.8%	-4.5%
Multiple Family	-6.6%	-8.4%	-9.0%	-8.1%	-8.2%	-10.7%
Non-Residential	-5.0%	-6.0%	-5.8%	-4.9%	-4.6%	-5.5%
Wheeling City, WV						
Single Family	-3.1%	-3.9%	-4.0%	-3.2%	-2.8%	-2.9%
Multiple Family	-5.4%	-6.6%	-6.5%	-5.5%	-5.6%	-6.6%
Non-Residential	-6.0%	-6.9%	-6.6%	-5.4%	-5.6%	-6.2%

Table F.4
Percent Change from Baseline for Average Real Pre-FIRM Property Values from 1997 to 2022
Scenario 3: Property Elevation Below BFE
Sample Communities

Community	1998	2002	2007	2012	2017	2022
Phoenix City, AZ						
Single Family	-1.0%	-1.3%	-1.6%	-1.8%	-1.9%	-1.9%
Multiple Family	-1.1%	-1.5%	-2.0%	-2.3%	-2.3%	-2.2%
Non-Residential	-0.9%	-1.1%	-1.4%	-1.5%	-1.5%	-1.4%
Bay City, AR						
Single Family	-0.9%	-1.2%	-1.4%	-1.5%	-1.5%	-1.5%
Multiple Family	-1.5%	-2.0%	-2.7%	-3.3%	-3.6%	-3.6%
Non-Residential	-0.8%	-1.1%	-1.3%	-1.4%	-1.4%	-1.3%
Sacramento County, CA						
Single Family	-1.6%	-2.1%	-2.5%	-2.8%	-2.9%	-2.8%
Multiple Family	-1.5%	-2.0%	-2.6%	-3.0%	-3.1%	-3.0%
Non-Residential	-1.7%	-2.0%	-2.4%	-2.6%	-2.6%	-2.5%
Santa Cruz City, CA						
Single Family	-1.5%	-1.8%	-2.1%	-2.0%	-1.7%	-2.0%
Multiple Family	-1.4%	-1.8%	-2.2%	-2.4%	-2.4%	-2.4%
Non-Residential	-2.1%	-2.5%	-2.9%	-3.0%	-2.7%	-2.5%
Dolores Town, CO						
Single Family	-1.2%	-1.6%	-2.0%	-2.3%	-2.3%	-2.1%
Multiple Family	-0.8%	-0.9%	-0.9%	-0.8%	-0.5%	0.0%
Non-Residential	-0.8%	-1.1%	-1.4%	-1.6%	-1.7%	-1.6%
Otero County, CO						
Single Family	-0.9%	-1.2%	-1.5%	-1.8%	-1.8%	-1.8%
Multiple Family	-0.9%	-1.3%	-1.7%	-2.0%	-2.1%	-2.0%
Non-Residential	-0.7%	-0.9%	-1.1%	-1.2%	-1.2%	-1.2%
Ft. Lauderdale City, FL						
Single Family	-0.4%	-0.5%	-0.7%	-0.8%	-0.8%	-0.8%
Multiple Family	-1.2%	-1.5%	-1.9%	-2.1%	-2.2%	-2.0%
Non-Residential	-0.7%	-0.8%	-0.9%	-1.0%	-1.0%	-0.9%
New Smyrna Beach City, FL						
Single Family	-0.5%	-0.6%	-0.8%	-1.0%	-1.0%	-1.0%
Multiple Family	-1.1%	-1.6%	-2.1%	-2.5%	-2.6%	-2.5%
Non-Residential	-0.7%	-1.1%	-1.5%	-1.8%	-2.0%	-2.0%
St. Petersburg Beach City, FL						
Single Family	-8.7%	-11.4%	-15.1%	-18.6%	-20.8%	-21.0%
Multiple Family	-5.0%	-6.5%	-8.5%	-10.3%	-11.3%	-11.4%
Non-Residential	-12.6%	-16.8%	-22.3%	-27.6%	-30.9%	-31.2%
Hailey City, ID						
Single Family	0.8%	0.8%	0.7%	0.7%	0.7%	0.8%
Multiple Family	-0.6%	-0.8%	-0.9%	-0.7%	-0.3%	-0.1%
Non-Residential	-0.6%	-0.7%	-0.8%	-0.9%	-0.9%	-0.8%
Grundy County, IL						
Single Family	-1.4%	-1.8%	-2.3%	-2.5%	-2.4%	-2.2%
Multiple Family	-1.4%	-1.9%	-2.5%	-2.6%	-2.5%	-2.3%
Non-Residential	-1.8%	-2.3%	-2.8%	-2.8%	-2.7%	-2.5%
Council Bluffs City, IA						
Single Family	-1.0%	-1.3%	-1.6%	-1.7%	-1.7%	-1.6%
Multiple Family	-2.1%	-2.6%	-3.0%	-2.9%	-2.7%	-2.5%
Non-Residential	-2.9%	-3.6%	-4.3%	-4.4%	-4.2%	-3.9%
Augusta City, KY						
Single Family	0.6%	0.6%	0.6%	0.6%	0.7%	0.8%
Multiple Family	-1.1%	-1.5%	-1.9%	-2.1%	-2.2%	-2.1%
Non-Residential	-0.6%	-0.7%	-0.9%	-1.0%	-1.0%	-0.9%

Table F.4 (Continued)

Percent Change from Baseline for Average Real Pre-FIRM Property Values from 1997 to 2022

Scenario 3: Property Elevation Below BFE

Sample Communities

Community	1998	2002	2007	2012	2017	2022

Lewisport City, KY						
Single Family	1.2%	1.4%	1.5%	1.6%	1.6%	1.7%
Multiple Family	-1.3%	-1.8%	-2.4%	-2.8%	-3.0%	-2.9%
Non-Residential	-0.5%	-0.7%	-0.8%	-0.9%	-0.8%	-0.8%
Louisville/Jefferson, KY						
Single Family	-3.3%	-4.1%	-4.8%	-5.0%	-4.7%	-5.3%
Multiple Family	-2.9%	-3.8%	-4.8%	-5.2%	-5.2%	-5.3%
Non-Residential	-1.7%	-2.0%	-2.4%	-2.4%	-2.3%	-2.0%
Allen Parish, LA						
Single Family	-1.5%	-2.0%	-2.5%	-2.7%	-2.6%	-2.4%
Multiple Family	-1.5%	-2.1%	-2.8%	-3.2%	-3.3%	-3.1%
Non-Residential	-1.0%	-1.4%	-1.7%	-1.8%	-1.7%	-1.6%
Jefferson Parish, LA						
Single Family	-1.4%	-1.7%	-2.0%	-2.2%	-2.3%	-2.2%
Multiple Family	-1.8%	-2.5%	-3.2%	-3.6%	-3.8%	-3.6%
Non-Residential	-1.6%	-1.9%	-2.2%	-2.4%	-2.3%	-2.2%
Shreveport City, LA						
Single Family	-2.4%	-3.1%	-3.8%	-4.3%	-4.6%	-4.6%
Multiple Family	-2.5%	-3.6%	-4.9%	-6.0%	-6.7%	-6.9%
Non-Residential	-2.1%	-2.6%	-3.2%	-3.5%	-3.7%	-3.6%
Cohasset Town, MA						
Single Family	-0.5%	-0.7%	-0.9%	-1.0%	-1.0%	-0.8%
Multiple Family	-1.7%	-2.1%	-2.6%	-2.8%	-2.8%	-2.8%
Non-Residential	-2.5%	-3.0%	-3.5%	-3.6%	-3.6%	-3.3%
Vassar City, MI						
Single Family	-0.2%	-0.4%	-0.6%	-0.7%	-0.6%	-0.5%
Multiple Family	-1.4%	-2.0%	-2.6%	-2.9%	-3.0%	-3.0%
Non-Residential	-1.6%	-2.0%	-2.4%	-2.6%	-2.5%	-2.3%
Petal City, MS						
Single Family	-1.3%	-1.8%	-2.3%	-2.6%	-2.7%	-2.7%
Multiple Family	-1.2%	-1.8%	-2.4%	-2.8%	-2.9%	-2.7%
Non-Residential	-1.0%	-1.3%	-1.6%	-1.7%	-1.7%	-1.6%
Scott County, MO						
Single Family	0.7%	0.7%	0.7%	0.7%	0.8%	0.9%
Multiple Family	-0.9%	-1.3%	-1.7%	-2.0%	-2.1%	-2.0%
Non-Residential	-0.7%	-0.9%	-1.1%	-1.3%	-1.3%	-1.2%
Omaha City, NE						
Single Family	0.6%	0.6%	0.5%	0.5%	0.6%	0.7%
Multiple Family	-1.3%	-1.7%	-2.1%	-2.3%	-2.3%	-2.1%
Non-Residential	-1.4%	-1.6%	-1.9%	-1.9%	-1.7%	-1.6%
Pender Village, NE						
Single Family	-0.1%	-0.2%	-0.4%	-0.5%	-0.5%	-0.3%
Multiple Family	-1.1%	-1.5%	-2.0%	-2.4%	-2.6%	-2.5%
Non-Residential	-1.2%	-1.6%	-2.0%	-2.2%	-2.1%	-2.0%
Woodstock Town, NH						
Single Family	1.3%	1.4%	1.5%	1.5%	1.6%	1.7%
Multiple Family	-1.2%	-1.5%	-1.9%	-2.2%	-2.2%	-2.1%
Non-Residential	-0.7%	-0.9%	-1.0%	-1.1%	-1.1%	-1.1%

Table F.4 (Continued)

Percent Change from Baseline for Average Real Pre-FIRM Property Values from 1997 to 2022

Scenario 3: Property Elevation Below BFE

Sample Communities

Community	1998	2002	2007	2012	2017	2022

Bloomingdale Borough, NJ						
Single Family	1.3%	1.4%	1.4%	1.3%	1.3%	1.3%
Multiple Family	-1.5%	-2.1%	-2.8%	-3.3%	-3.6%	-3.5%
Non-Residential	-1.0%	-1.1%	-1.3%	-1.4%	-1.3%	-1.2%
Lincoln Park Borough, NJ						
Single Family	-1.9%	-2.4%	-2.9%	-3.0%	-2.9%	-3.5%
Multiple Family	-3.6%	-4.7%	-6.1%	-6.7%	-6.9%	-9.2%
Non-Residential	-3.9%	-4.7%	-5.7%	-5.8%	-5.5%	-5.3%
Niagara Town, NY						
Single Family	-1.6%	-2.0%	-2.4%	-2.4%	-2.2%	-1.9%
Multiple Family	-2.9%	-4.1%	-5.5%	-6.0%	-5.7%	-5.6%
Non-Residential	-1.5%	-1.9%	-2.3%	-2.3%	-2.1%	-1.9%
Waterford Village, NY						
Single Family	0.1%	0.0%	-0.2%	-0.1%	0.0%	0.2%
Multiple Family	-1.7%	-2.1%	-2.6%	-2.7%	-2.5%	-2.7%
Non-Residential	-1.3%	-1.6%	-1.9%	-1.9%	-1.7%	-1.6%
Carteret County, NC						
Single Family	-1.5%	-1.8%	-2.2%	-2.4%	-2.4%	-2.3%
Multiple Family	-1.3%	-1.7%	-2.3%	-2.7%	-2.8%	-2.7%
Non-Residential	-0.9%	-1.1%	-1.3%	-1.5%	-1.5%	-1.5%
Edenton, NC						
Single Family	-1.0%	-1.3%	-1.6%	-1.9%	-1.9%	-1.9%
Multiple Family	-1.2%	-1.6%	-2.2%	-2.7%	-2.8%	-2.8%
Non-Residential	-1.1%	-1.3%	-1.6%	-1.9%	-2.0%	-1.9%
New Miami Village, OH						
Single Family	1.1%	1.3%	1.3%	1.3%	1.3%	1.3%
Multiple Family	-0.9%	-1.2%	-1.6%	-1.8%	-1.8%	-1.8%
Non-Residential	-0.8%	-1.0%	-1.2%	-1.4%	-1.4%	-1.3%
Washington County, OK						
Single Family	-0.9%	-1.2%	-1.5%	-1.7%	-1.7%	-1.7%
Multiple Family	-0.8%	-1.1%	-1.6%	-1.9%	-2.0%	-2.0%
Non-Residential	-0.7%	-0.9%	-1.1%	-1.2%	-1.2%	-1.1%
Lane County, OR						
Single Family	-0.8%	-1.1%	-1.4%	-1.6%	-1.6%	-1.6%
Multiple Family	-0.8%	-1.1%	-1.5%	-1.7%	-1.7%	-1.6%
Non-Residential	-0.6%	-0.8%	-1.0%	-1.1%	-1.1%	-1.1%
Vernonia City, OR						
Single Family	-1.3%	-1.8%	-2.2%	-2.6%	-2.7%	-2.6%
Multiple Family	-1.0%	-1.4%	-2.0%	-2.3%	-2.3%	-1.8%
Non-Residential	-0.8%	-1.0%	-1.2%	-1.3%	-1.4%	-1.4%
Franklin Township, PA						
Single Family	-1.3%	-1.8%	-2.4%	-2.8%	-3.0%	-2.9%
Multiple Family	-2.3%	-3.2%	-4.4%	-5.1%	-5.4%	-5.3%
Non-Residential	-1.5%	-2.0%	-2.5%	-2.8%	-2.8%	-2.6%
Glen Rock Borough, PA						
Single Family	-9.8%	-12.3%	-15.6%	-18.3%	-20.2%	-21.3%
Multiple Family	-23.9%	-32.8%	-45.6%	-60.1%	-74.0%	-82.3%
Non-Residential	-16.7%	-21.8%	-28.7%	-31.9%	-31.6%	-34.2%
Lower Mt. Bethel Township, PA						
Single Family	-3.9%	-4.7%	-5.7%	-6.5%	-6.8%	-6.8%
Multiple Family	-11.4%	-11.7%	-10.9%	-9.2%	-5.3%	0.0%
Non-Residential	-10.2%	-9.8%	-8.4%	-6.6%	-3.6%	0.0%

Table F.4 (Continued)

Percent Change from Baseline for Average Real Pre-FIRM Property Values from 1997 to 2022

Scenario 3: Property Elevation Below BFE

Sample Communities

Community	1998	2002	2007	2012	2017	2022
New Cumberland Borough, PA						

Single Family	-1.8%	-2.2%	-2.8%	-3.0%	-3.0%	-3.4%
Multiple Family	-3.0%	-3.8%	-4.8%	-5.1%	-6.6%	-6.5%
Non-Residential	-2.1%	-2.6%	-3.0%	-3.0%	-4.1%	-4.0%
Myrtle Beach City, SC						
Single Family	-2.3%	-2.6%	-3.0%	-3.9%	-4.0%	-3.6%
Multiple Family	-1.5%	-2.0%	-2.4%	-3.2%	-3.3%	-3.1%
Non-Residential	-1.2%	-1.6%	-1.9%	-2.0%	-2.0%	-1.8%
Lawrence County, SD						
Single Family	1.1%	1.2%	1.3%	1.3%	1.3%	1.4%
Multiple Family	-0.7%	-0.9%	-1.2%	-1.4%	-1.5%	-1.4%
Non-Residential	-0.5%	-0.7%	-0.8%	-0.9%	-1.0%	-1.0%
Brookside Village City, TX						
Single Family	-2.9%	-3.7%	-4.7%	-4.7%	-4.4%	-5.4%
Multiple Family	-2.1%	-2.5%	-2.7%	-2.2%	-1.6%	-0.5%
Non-Residential	-2.3%	-2.9%	-3.6%	-3.6%	-3.4%	-4.4%
Garland City, TX						
Single Family	-1.2%	-1.5%	-1.8%	-1.9%	-1.8%	-1.6%
Multiple Family	-1.1%	-1.5%	-2.0%	-2.3%	-2.4%	-2.2%
Non-Residential	-1.2%	-1.5%	-1.7%	-1.8%	-1.7%	-1.6%
League City, TX						
Single Family	-1.4%	-1.9%	-2.4%	-2.6%	-2.5%	-2.4%
Multiple Family	-1.1%	-1.6%	-2.2%	-2.5%	-2.6%	-2.5%
Non-Residential	-1.3%	-1.7%	-2.1%	-2.2%	-2.1%	-2.0%
Grundy Town, VA						
Single Family	-2.7%	-3.5%	-4.5%	-5.1%	-5.9%	-6.3%
Multiple Family	-4.7%	-6.5%	-8.6%	-10.2%	-12.5%	-10.4%
Non-Residential	-3.1%	-3.8%	-4.8%	-5.4%	-5.4%	-6.7%
Ephrata City, WA						
Single Family	-1.3%	-1.7%	-2.1%	-2.3%	-2.4%	-2.2%
Multiple Family	-1.4%	-2.1%	-2.8%	-3.2%	-3.4%	-3.3%
Non-Residential	-1.0%	-1.3%	-1.5%	-1.7%	-1.7%	-1.6%
Leavenworth City, WA						
Single Family	-2.4%	-3.0%	-3.6%	-3.6%	-3.4%	-3.5%
Multiple Family	-1.5%	-1.8%	-1.9%	-1.6%	-0.9%	0.0%
Non-Residential	-1.6%	-1.8%	-1.8%	-1.4%	-0.8%	0.0%
Marlinton Town, WV						
Single Family	-1.4%	-1.7%	-2.1%	-2.2%	-2.0%	-2.3%
Multiple Family	-1.8%	-2.4%	-3.0%	-3.2%	-4.0%	-4.0%
Non-Residential	-1.7%	-2.1%	-2.6%	-2.7%	-2.7%	-3.1%
Philippi City, WV						
Single Family	-2.4%	-3.1%	-3.9%	-4.4%	-4.4%	-4.1%
Multiple Family	-4.0%	-5.6%	-7.4%	-8.6%	-9.0%	-8.8%
Non-Residential	-3.1%	-4.0%	-4.9%	-5.3%	-5.4%	-5.2%
Wheeling City, WV						
Single Family	-2.5%	-3.3%	-4.3%	-4.9%	-4.9%	-4.4%
Multiple Family	-3.3%	-4.3%	-5.5%	-6.0%	-5.9%	-6.0%
Non-Residential	-3.6%	-4.5%	-5.5%	-5.8%	-5.7%	-5.6%

TABLE F.5
Percent Change from Baseline for Average Real Pre-FIRM Property Values from 1997 to 2022
Scenario 4: Property Elevation Below BFE
Sample Communities

Community	1998	2002	2007	2012	2017	2022
Phoenix City, AZ						
Single Family	-1.2%	-1.6%	-1.9%	-2.1%	-2.1%	-2.2%

Multiple Family	-0.8%	-1.1%	-1.3%	-1.5%	-1.5%	-1.6%
Non-Residential	-1.0%	-1.3%	-1.4%	-1.5%	-1.5%	-1.5%
Bay City, AR						
Single Family	-1.0%	-1.3%	-1.6%	-1.7%	-1.8%	-1.8%
Multiple Family	-1.3%	-1.8%	-2.3%	-2.7%	-3.0%	-3.1%
Non-Residential	-0.9%	-1.2%	-1.4%	-1.5%	-1.5%	-1.5%
Sacramento County, CA						
Single Family	-1.8%	-2.3%	-2.6%	-2.7%	-2.8%	-2.8%
Multiple Family	-1.0%	-1.4%	-1.6%	-1.8%	-1.9%	-2.0%
Non-Residential	-2.1%	-2.5%	-2.7%	-2.8%	-2.7%	-2.7%
Santa Cruz City, CA						
Single Family	-1.3%	-1.9%	-2.2%	-2.4%	-2.4%	-2.4%
Multiple Family	-0.9%	-1.4%	-1.8%	-2.1%	-2.3%	-2.4%
Non-Residential	-1.4%	-2.0%	-2.4%	-2.6%	-2.7%	-2.7%
Dolores Town, CO						
Single Family	-1.1%	-1.5%	-1.8%	-2.0%	-2.1%	-2.1%
Multiple Family	-0.6%	-0.7%	-0.6%	-0.5%	-0.4%	0.0%
Non-Residential	-0.8%	-1.1%	-1.4%	-1.5%	-1.6%	-1.6%
Otero County, CO						
Single Family	-0.9%	-1.2%	-1.5%	-1.8%	-1.9%	-1.9%
Multiple Family	-0.6%	-0.8%	-1.1%	-1.3%	-1.4%	-1.4%
Non-Residential	-0.7%	-0.9%	-1.1%	-1.2%	-1.2%	-1.2%
Ft. Lauderdale City, FL						
Single Family	-0.4%	-0.6%	-0.7%	-0.8%	-0.8%	-0.8%
Multiple Family	-0.9%	-1.3%	-1.5%	-1.6%	-1.6%	-1.6%
Non-Residential	-0.9%	-1.0%	-1.1%	-1.1%	-1.1%	-1.0%
New Smyrna Beach City, FL						
Single Family	-0.6%	-0.8%	-0.9%	-1.0%	-1.1%	-1.1%
Multiple Family	-0.9%	-1.3%	-1.6%	-1.8%	-1.9%	-1.9%
Non-Residential	-1.0%	-1.4%	-1.8%	-2.0%	-2.2%	-2.3%
St. Petersburg Beach City, FL						
Single Family	-7.7%	-12.4%	-15.6%	-17.3%	-18.2%	-18.4%
Multiple Family	-4.3%	-6.9%	-8.6%	-9.5%	-9.9%	-10.1%
Non-Residential	-11.3%	-18.3%	-23.1%	-25.9%	-27.2%	-27.7%
Hailey City, ID						
Single Family	0.4%	0.6%	0.7%	0.8%	0.9%	0.9%
Multiple Family	-0.7%	-0.9%	-0.9%	-0.7%	-0.3%	-0.1%
Non-Residential	-0.7%	-0.9%	-1.0%	-1.0%	-1.0%	-0.9%
Grundy County, IL						
Single Family	-0.7%	-1.0%	-1.3%	-1.5%	-1.7%	-1.8%
Multiple Family	-0.7%	-1.2%	-1.7%	-2.1%	-2.6%	-2.8%
Non-Residential	-1.0%	-1.6%	-2.0%	-2.5%	-3.0%	-3.3%
Council Bluffs City, IA						
Single Family	-1.1%	-1.4%	-1.6%	-1.7%	-1.8%	-1.8%
Multiple Family	-1.1%	-1.6%	-2.0%	-2.3%	-2.6%	-2.7%
Non-Residential	-1.7%	-2.5%	-3.1%	-3.6%	-4.0%	-4.3%
Augusta City, KY						
Single Family	0.4%	0.5%	0.6%	0.7%	0.8%	0.9%
Multiple Family	-1.1%	-1.4%	-1.7%	-1.9%	-1.9%	-1.9%
Non-Residential	-0.6%	-0.8%	-0.9%	-1.0%	-1.1%	-1.0%

Table F.5 (Continued)

Percent Change from Baseline for Average Real Pre-FIRM Property Values from 1997 to 2022

Scenario 4: Property Elevation Below BFE

Sample Communities

Community	1998	2002	2007	2012	2017	2022
Lewisport City, KY						
Single Family	0.9%	1.2%	1.5%	1.7%	1.8%	1.9%
Multiple Family	-1.2%	-1.7%	-2.1%	-2.4%	-2.6%	-2.6%

Non-Residential	-0.6%	-0.8%	-0.9%	-0.9%	-0.9%	-0.8%
Louisville/Jefferson, KY						
Single Family	-1.8%	-2.6%	-3.0%	-3.2%	-3.1%	-3.1%
Multiple Family	-1.8%	-2.8%	-3.5%	-4.0%	-4.4%	-4.6%
Non-Residential	-1.2%	-1.6%	-1.8%	-1.9%	-1.9%	-1.9%
Allen Parish, LA						
Single Family	-0.8%	-1.3%	-1.9%	-2.4%	-2.8%	-3.1%
Multiple Family	-1.0%	-1.5%	-2.2%	-2.9%	-3.6%	-3.9%
Non-Residential	-0.6%	-0.9%	-1.3%	-1.6%	-1.9%	-2.1%
Jefferson Parish, LA						
Single Family	-0.8%	-1.2%	-1.4%	-1.6%	-1.7%	-1.7%
Multiple Family	-1.0%	-1.4%	-1.8%	-2.0%	-2.1%	-2.2%
Non-Residential	-1.2%	-1.5%	-1.8%	-1.9%	-2.0%	-2.1%
Shreveport City, LA						
Single Family	-2.7%	-3.3%	-3.8%	-4.0%	-4.1%	-4.1%
Multiple Family	-2.7%	-3.9%	-4.9%	-5.5%	-5.9%	-6.2%
Non-Residential	-2.3%	-2.8%	-3.1%	-3.3%	-3.3%	-3.3%
Cohasset Town, MA						
Single Family	-0.2%	-0.3%	-0.3%	-0.4%	-0.4%	-0.4%
Multiple Family	-0.8%	-1.1%	-1.3%	-1.5%	-1.7%	-1.8%
Non-Residential	-1.2%	-1.6%	-1.9%	-2.1%	-2.3%	-2.4%
Vassar City, MI						
Single Family	-0.3%	-0.4%	-0.4%	-0.4%	-0.5%	-0.5%
Multiple Family	-0.8%	-1.2%	-1.5%	-1.8%	-2.1%	-2.4%
Non-Residential	-1.1%	-1.4%	-1.7%	-2.0%	-2.3%	-2.4%
Petal City, MS						
Single Family	-1.2%	-1.6%	-2.1%	-2.5%	-2.7%	-2.8%
Multiple Family	-0.9%	-1.3%	-1.7%	-1.9%	-1.9%	-1.9%
Non-Residential	-1.0%	-1.3%	-1.5%	-1.6%	-1.6%	-1.5%
Scott County, MO						
Single Family	0.5%	0.6%	0.8%	0.9%	0.9%	1.0%
Multiple Family	-0.8%	-1.1%	-1.5%	-1.7%	-1.8%	-1.9%
Non-Residential	-0.7%	-0.9%	-1.1%	-1.2%	-1.3%	-1.3%
Omaha City, NE						
Single Family	0.7%	0.7%	0.8%	0.8%	0.7%	0.7%
Multiple Family	-0.7%	-1.1%	-1.5%	-1.8%	-2.0%	-2.1%
Non-Residential	-0.8%	-1.2%	-1.4%	-1.6%	-1.8%	-1.9%
Pender Village, NE						
Single Family	0.1%	0.2%	0.2%	0.3%	0.3%	0.3%
Multiple Family	-0.5%	-0.8%	-1.1%	-1.3%	-1.6%	-1.7%
Non-Residential	-0.6%	-0.9%	-1.3%	-1.6%	-1.8%	-2.0%
Woodstock Town, NH						
Single Family	0.9%	1.1%	1.4%	1.6%	1.8%	1.9%
Multiple Family	-0.8%	-1.1%	-1.3%	-1.4%	-1.4%	-1.4%
Non-Residential	-0.7%	-0.9%	-1.1%	-1.2%	-1.2%	-1.2%

Table F.5 (Continued)
Percent Change from Baseline for Average Real Pre-FIRM Property Values from 1997 to 2022
Scenario 4: Property Elevation Below BFE
Sample Communities

Community	1998	2002	2007	2012	2017	2022
Bloomingdale Borough, NJ						
Single Family	1.0%	1.2%	1.4%	1.5%	1.6%	1.6%
Multiple Family	-0.7%	-1.0%	-1.3%	-1.5%	-1.7%	-1.7%
Non-Residential	-0.8%	-1.0%	-1.1%	-1.1%	-1.1%	-1.1%

Lincoln Park Borough, NJ						
Single Family	-1.1%	-1.7%	-2.0%	-2.2%	-2.3%	-2.3%
Multiple Family	-2.4%	-3.8%	-4.6%	-5.2%	-5.6%	-5.9%
Non-Residential	-2.5%	-3.6%	-4.2%	-4.6%	-4.9%	-5.1%
Niagara Town, NY						
Single Family	-0.8%	-1.3%	-1.6%	-1.8%	-2.1%	-2.2%
Multiple Family	-1.7%	-2.7%	-3.8%	-5.0%	-6.4%	-7.4%
Non-Residential	-0.7%	-1.2%	-1.6%	-2.0%	-2.2%	-2.3%
Waterford Village, NY						
Single Family	0.1%	0.1%	0.2%	0.3%	0.3%	0.3%
Multiple Family	-1.2%	-1.8%	-2.2%	-2.5%	-2.7%	-2.9%
Non-Residential	-1.0%	-1.4%	-1.7%	-2.0%	-2.2%	-2.2%
Carteret County, NC						
Single Family	-1.6%	-1.9%	-2.2%	-2.3%	-2.3%	-2.3%
Multiple Family	-0.9%	-1.2%	-1.4%	-1.6%	-1.7%	-1.8%
Non-Residential	-1.1%	-1.3%	-1.5%	-1.6%	-1.6%	-1.6%
Edenton, NC						
Single Family	-0.7%	-0.8%	-1.0%	-1.1%	-1.1%	-1.1%
Multiple Family	-0.7%	-1.0%	-1.2%	-1.4%	-1.5%	-1.6%
Non-Residential	-1.3%	-1.5%	-1.8%	-1.9%	-2.0%	-2.0%
New Miami Village, OH						
Single Family	1.0%	1.2%	1.4%	1.4%	1.5%	1.5%
Multiple Family	-0.8%	-1.1%	-1.3%	-1.5%	-1.6%	-1.6%
Non-Residential	-0.9%	-1.1%	-1.3%	-1.4%	-1.4%	-1.4%
Washington County, OK						
Single Family	-1.0%	-1.3%	-1.7%	-1.8%	-1.9%	-1.9%
Multiple Family	-0.5%	-0.8%	-1.0%	-1.2%	-1.3%	-1.4%
Non-Residential	-0.7%	-0.9%	-1.1%	-1.2%	-1.2%	-1.2%
Lane County, OR						
Single Family	-1.0%	-1.3%	-1.6%	-1.8%	-1.9%	-1.9%
Multiple Family	-0.6%	-0.8%	-1.0%	-1.2%	-1.2%	-1.2%
Non-Residential	-0.8%	-1.0%	-1.1%	-1.2%	-1.3%	-1.2%
Vernonia City, OR						
Single Family	-1.2%	-1.6%	-2.0%	-2.3%	-2.5%	-2.6%
Multiple Family	-0.7%	-1.0%	-1.1%	-1.2%	-1.2%	-1.0%
Non-Residential	-0.7%	-0.9%	-1.1%	-1.2%	-1.3%	-1.3%
Franklin Township, PA						
Single Family	-0.7%	-0.9%	-1.2%	-1.5%	-1.7%	-1.8%
Multiple Family	-0.6%	-0.9%	-1.3%	-1.7%	-2.1%	-2.4%
Non-Residential	-0.4%	-0.6%	-0.8%	-1.1%	-1.3%	-1.5%
Glen Rock Borough, PA						
Single Family	-9.1%	-13.1%	-16.0%	-17.6%	-18.6%	-19.5%
Multiple Family	-24.7%	-37.3%	-50.1%	-61.0%	-70.5%	-77.4%
Non-Residential	-30.7%	-35.5%	-39.9%	-38.2%	-34.4%	-36.3%
Lower Mt. Bethel Township, PA						
Single Family	-4.6%	-5.5%	-5.7%	-5.8%	-5.6%	-5.6%
Multiple Family	-21.3%	-19.5%	-15.5%	-11.2%	-5.9%	0.0%
Non-Residential	-17.9%	-15.3%	-11.3%	-7.7%	-3.8%	0.0%

Table F.5 (Continued)

Percent Change from Baseline for Average Real Pre-FIRM Property Values from 1997 to 2022

Scenario 4: Property Elevation Below BFE

Sample Communities

Community	1998	2002	2007	2012	2017	2022
New Cumberland Borough, PA						
Single Family	-1.2%	-1.7%	-1.9%	-2.1%	-2.2%	-2.3%
Multiple Family	-2.3%	-3.4%	-4.1%	-4.6%	-5.0%	-5.3%
Non-Residential	-1.7%	-2.5%	-3.1%	-3.6%	-4.2%	-4.6%
Myrtle Beach City, SC						

Single Family	-1.9%	-2.3%	-2.5%	-2.6%	-2.7%	-2.6%
Multiple Family	-1.1%	-1.6%	-1.8%	-2.1%	-2.2%	-2.2%
Non-Residential	-2.0%	-2.1%	-2.2%	-2.1%	-1.8%	-1.6%
Lawrence County, SD						
Single Family	0.8%	1.0%	1.3%	1.4%	1.5%	1.5%
Multiple Family	-0.7%	-0.9%	-1.1%	-1.3%	-1.3%	-1.3%
Non-Residential	-0.6%	-0.8%	-0.9%	-1.0%	-1.0%	-1.1%
Brookside Village City, TX						
Single Family	-2.3%	-3.5%	-4.4%	-5.2%	-6.0%	-6.4%
Multiple Family	-2.0%	-2.6%	-2.6%	-2.5%	-2.0%	-0.5%
Non-Residential	-1.8%	-2.7%	-3.4%	-4.1%	-4.8%	-5.3%
Garland City, TX						
Single Family	-0.7%	-1.0%	-1.2%	-1.4%	-1.5%	-1.5%
Multiple Family	-0.6%	-0.9%	-1.3%	-1.6%	-1.8%	-1.9%
Non-Residential	-0.8%	-1.1%	-1.4%	-1.5%	-1.6%	-1.6%
League City, TX						
Single Family	-1.1%	-1.5%	-1.9%	-2.2%	-2.4%	-2.5%
Multiple Family	-0.7%	-1.1%	-1.4%	-1.7%	-1.9%	-2.1%
Non-Residential	-1.1%	-1.5%	-1.8%	-2.0%	-2.2%	-2.3%
Grundy Town, VA						
Single Family	-1.8%	-2.8%	-3.3%	-3.7%	-3.9%	-4.1%
Multiple Family	-5.4%	-6.9%	-8.4%	-10.0%	-9.8%	-8.6%
Non-Residential	-2.0%	-2.9%	-3.6%	-4.2%	-4.8%	-5.1%
Ephrata City, WA						
Single Family	-1.4%	-1.8%	-2.1%	-2.3%	-2.4%	-2.4%
Multiple Family	-0.9%	-1.4%	-1.7%	-2.0%	-2.1%	-2.0%
Non-Residential	-1.0%	-1.2%	-1.4%	-1.5%	-1.6%	-1.6%
Leavenworth City, WA						
Single Family	-2.1%	-3.0%	-3.6%	-4.2%	-4.6%	-4.6%
Multiple Family	-1.5%	-1.8%	-1.9%	-1.8%	-1.2%	0.0%
Non-Residential	-3.6%	-3.8%	-3.4%	-2.7%	-1.6%	0.0%
Marlinton Town, WV						
Single Family	-0.9%	-1.3%	-1.6%	-1.8%	-1.9%	-1.9%
Multiple Family	-1.6%	-2.2%	-2.6%	-3.0%	-3.3%	-3.4%
Non-Residential	-1.1%	-1.6%	-2.0%	-2.3%	-2.6%	-2.7%
Philippi City, WV						
Single Family	-1.4%	-2.1%	-2.7%	-3.0%	-3.3%	-3.3%
Multiple Family	-2.7%	-3.8%	-4.7%	-5.4%	-6.0%	-6.6%
Non-Residential	-1.5%	-2.4%	-3.0%	-3.5%	-4.0%	-4.4%
Wheeling City, WV						
Single Family	-0.5%	-1.0%	-1.3%	-1.5%	-1.7%	-1.7%
Multiple Family	-1.8%	-2.8%	-3.5%	-4.0%	-4.4%	-4.7%
Non-Residential	-2.0%	-3.0%	-3.6%	-4.0%	-4.5%	-4.8%

Table F.6
Percent Change from Baseline for Average Real Pre-FIRM Property Values from 1997 to 2022
Scenario 5: Property Elevation Below BFE
Sample Communities

Community	1998	2002	2007	2012	2017	2022
Phoenix City, AZ						
Single Family	-1.8%	-1.8%	-1.8%	-1.8%	-1.8%	-1.8%
Multiple Family	-1.6%	-1.5%	-1.5%	-1.5%	-1.5%	-1.5%
Non-Residential	-1.5%	-1.4%	-1.4%	-1.3%	-1.3%	-1.3%
Bay City, AR						
Single Family	-1.6%	-1.4%	-1.4%	-1.4%	-1.4%	-1.4%
Multiple Family	-2.0%	-2.2%	-2.3%	-2.5%	-2.7%	-2.8%
Non-Residential	-1.3%	-1.2%	-1.2%	-1.2%	-1.2%	-1.2%

Sacramento County, CA						
Single Family	-2.3%	-2.6%	-2.5%	-2.5%	-2.5%	-2.5%
Multiple Family	-1.8%	-1.9%	-1.8%	-1.8%	-1.8%	-1.8%
Non-Residential	-2.4%	-2.5%	-2.5%	-2.5%	-2.4%	-2.3%
Santa Cruz City, CA						
Single Family	-5.9%	-2.5%	-2.3%	-2.1%	-2.0%	-1.8%
Multiple Family	-3.3%	-1.8%	-1.8%	-1.9%	-1.9%	-1.9%
Non-Residential	-3.9%	-2.1%	-2.1%	-2.0%	-2.0%	-2.0%
Dolores Town, CO						
Single Family	-1.9%	-1.7%	-1.8%	-1.8%	-1.8%	-1.8%
Multiple Family	-1.0%	-0.8%	-0.6%	-0.4%	-0.2%	0.0%
Non-Residential	-1.3%	-1.2%	-1.3%	-1.4%	-1.4%	-1.4%
Otero County, CO						
Single Family	-1.4%	-1.5%	-1.5%	-1.5%	-1.5%	-1.5%
Multiple Family	-1.1%	-1.2%	-1.2%	-1.2%	-1.3%	-1.3%
Non-Residential	-0.9%	-0.9%	-1.0%	-1.0%	-1.0%	-1.0%
Ft. Lauderdale City, FL						
Single Family	-0.7%	-0.7%	-0.7%	-0.7%	-0.7%	-0.7%
Multiple Family	-2.1%	-1.8%	-1.6%	-1.6%	-1.5%	-1.5%
Non-Residential	-1.3%	-1.2%	-1.1%	-1.0%	-1.0%	-0.9%
New Smyrna Beach City, FL						
Single Family	-0.7%	-0.9%	-0.9%	-0.9%	-1.0%	-1.0%
Multiple Family	-1.6%	-1.7%	-1.7%	-1.8%	-1.8%	-1.8%
Non-Residential	-1.2%	-1.5%	-1.7%	-1.8%	-1.9%	-2.0%
St. Petersburg Beach City, FL						
Single Family	-18.9%	-18.3%	-20.1%	-21.0%	-21.2%	-21.3%
Multiple Family	-10.9%	-10.1%	-11.0%	-11.4%	-11.5%	-11.5%
Non-Residential	-27.4%	-26.4%	-29.5%	-31.0%	-31.4%	-31.5%
Hailey City, ID						
Single Family	0.3%	0.6%	0.6%	0.7%	0.8%	0.8%
Multiple Family	-1.2%	-1.0%	-0.8%	-0.6%	-0.3%	-0.1%
Non-Residential	-1.4%	-1.0%	-1.0%	-0.9%	-0.8%	-0.8%
Grundy County, IL						
Single Family	-3.2%	-1.6%	-1.4%	-1.3%	-1.3%	-1.2%
Multiple Family	-4.0%	-1.5%	-1.4%	-1.5%	-1.5%	-1.5%
Non-Residential	-5.1%	-1.7%	-1.6%	-1.5%	-1.6%	-1.6%
Council Bluffs City, IA						
Single Family	-2.2%	-1.9%	-1.7%	-1.6%	-1.7%	-1.6%
Multiple Family	-6.3%	-2.6%	-2.4%	-2.4%	-2.3%	-2.2%
Non-Residential	-9.5%	-4.1%	-3.9%	-3.9%	-3.8%	-3.8%
Augusta City, KY						
Single Family	0.2%	0.4%	0.6%	0.6%	0.7%	0.8%
Multiple Family	-1.7%	-1.8%	-1.8%	-1.8%	-1.8%	-1.8%
Non-Residential	-1.0%	-0.9%	-0.9%	-0.9%	-0.9%	-0.9%

Table F.6 (Continued)
Percent Change from Baseline for Average Real Pre-FIRM Property Values from 1997 to 2022
Scenario 5: Property Elevation Below BFE
Sample Communities

Community	1998	2002	2007	2012	2017	2022
Lewisport City, KY						
Single Family	1.0%	1.3%	1.5%	1.6%	1.7%	1.7%
Multiple Family	-1.8%	-2.1%	-2.1%	-2.2%	-2.3%	-2.3%
Non-Residential	-0.9%	-0.8%	-0.8%	-0.8%	-0.8%	-0.7%
Louisville/Jefferson, KY						
Single Family	-14.0%	-5.7%	-5.2%	-4.8%	-4.5%	-4.2%
Multiple Family	-12.0%	-5.3%	-5.5%	-5.7%	-5.7%	-5.7%
Non-Residential	-6.7%	-3.0%	-2.8%	-2.7%	-2.6%	-2.5%
Allen Parish, LA						
Single Family	-2.5%	-1.7%	-1.4%	-1.4%	-1.3%	-1.3%

Multiple Family	-1.9%	-1.4%	-1.3%	-1.4%	-1.4%	-1.4%
Non-Residential	-1.8%	-0.8%	-0.8%	-0.9%	-0.8%	-0.8%
Jefferson Parish, LA						
Single Family	-3.3%	-2.4%	-2.2%	-2.0%	-1.9%	-1.7%
Multiple Family	-3.4%	-3.0%	-2.7%	-2.6%	-2.4%	-2.3%
Non-Residential	-3.1%	-2.4%	-2.2%	-2.1%	-2.0%	-2.0%
Shreveport City, LA						
Single Family	-4.3%	-4.7%	-4.6%	-4.6%	-4.6%	-4.6%
Multiple Family	-4.9%	-5.6%	-6.1%	-6.5%	-6.7%	-6.9%
Non-Residential	-4.2%	-4.0%	-3.9%	-3.8%	-3.7%	-3.6%
Cohasset Town, MA						
Single Family	-2.2%	-0.6%	-0.5%	-0.5%	-0.5%	-0.4%
Multiple Family	-3.7%	-1.6%	-1.5%	-1.5%	-1.6%	-1.7%
Non-Residential	-4.9%	-2.1%	-1.9%	-1.8%	-1.8%	-1.8%
Vassar City, MI						
Single Family	-1.3%	-0.6%	-0.4%	-0.2%	0.0%	0.0%
Multiple Family	-3.1%	-1.9%	-1.9%	-1.9%	-2.0%	-2.1%
Non-Residential	-2.9%	-1.8%	-1.6%	-1.5%	-1.4%	-1.5%
Petal City, MS						
Single Family	-2.0%	-2.1%	-2.1%	-2.1%	-2.2%	-2.2%
Multiple Family	-1.3%	-1.6%	-1.6%	-1.6%	-1.6%	-1.6%
Non-Residential	-1.2%	-1.1%	-1.2%	-1.2%	-1.2%	-1.2%
Scott County, MO						
Single Family	0.5%	0.6%	0.8%	0.9%	1.0%	1.0%
Multiple Family	-1.2%	-1.5%	-1.6%	-1.6%	-1.7%	-1.7%
Non-Residential	-1.0%	-1.0%	-1.0%	-1.0%	-1.0%	-1.0%
Omaha City, NE						
Single Family	-0.6%	0.7%	0.9%	1.0%	1.0%	1.0%
Multiple Family	-2.9%	-1.3%	-1.4%	-1.4%	-1.4%	-1.4%
Non-Residential	-3.3%	-1.3%	-1.2%	-1.1%	-1.1%	-1.1%
Pender Village, NE						
Single Family	-0.9%	-0.1%	0.1%	0.2%	0.3%	0.3%
Multiple Family	-2.5%	-1.5%	-1.5%	-1.5%	-1.5%	-1.4%
Non-Residential	-2.9%	-1.4%	-1.2%	-1.2%	-1.2%	-1.2%
Woodstock Town, NH						
Single Family	1.1%	1.3%	1.5%	1.6%	1.7%	1.8%
Multiple Family	-1.6%	-1.5%	-1.5%	-1.4%	-1.4%	-1.4%
Non-Residential	-1.1%	-1.0%	-1.1%	-1.1%	-1.1%	-1.1%

Table F.6 (Continued)
Percent Change from Baseline for Average Real Pre-FIRM Property Values from 1997 to 2022
Scenario 5: Property Elevation Below BFE
Sample Communities

Community	1998	2002	2007	2012	2017	2022
Bloomingdale Borough, NJ						
Single Family	1.0%	1.3%	1.4%	1.5%	1.5%	1.5%
Multiple Family	-2.2%	-1.7%	-1.7%	-1.7%	-1.7%	-1.7%
Non-Residential	-1.5%	-1.2%	-1.1%	-1.1%	-1.1%	-1.0%
Lincoln Park Borough, NJ						
Single Family	-8.5%	-3.4%	-3.3%	-3.3%	-3.2%	-3.2%
Multiple Family	-17.1%	-7.8%	-8.1%	-8.6%	-8.9%	-9.1%
Non-Residential	-17.4%	-7.0%	-6.8%	-6.8%	-6.7%	-6.6%
Niagara Town, NY						
Single Family	-5.8%	-2.2%	-2.0%	-1.8%	-1.6%	-1.5%
Multiple Family	-6.0%	-3.5%	-3.5%	-3.8%	-4.1%	-4.2%
Non-Residential	-2.6%	-0.9%	-0.9%	-0.8%	-0.8%	-0.8%

Waterford Village, NY						
Single Family	-1.3%	-0.2%	0.0%	0.2%	0.3%	0.3%
Multiple Family	-5.3%	-2.5%	-2.4%	-2.4%	-2.4%	-2.4%
Non-Residential	-3.1%	-1.6%	-1.6%	-1.5%	-1.5%	-1.5%
Carteret County, NC						
Single Family	-2.0%	-2.1%	-2.1%	-2.1%	-2.0%	-2.0%
Multiple Family	-1.5%	-1.6%	-1.6%	-1.6%	-1.7%	-1.7%
Non-Residential	-1.3%	-1.4%	-1.4%	-1.4%	-1.4%	-1.4%
Edenton, NC						
Single Family	-0.9%	-1.0%	-1.0%	-1.1%	-1.1%	-1.1%
Multiple Family	-1.2%	-1.5%	-1.5%	-1.6%	-1.6%	-1.6%
Non-Residential	-1.5%	-1.7%	-1.8%	-1.8%	-1.9%	-1.8%
New Miami Village, OH						
Single Family	1.0%	1.2%	1.3%	1.4%	1.4%	1.4%
Multiple Family	-1.1%	-1.2%	-1.3%	-1.4%	-1.4%	-1.4%
Non-Residential	-1.0%	-1.1%	-1.1%	-1.1%	-1.1%	-1.1%
Washington County, OK						
Single Family	-1.3%	-1.4%	-1.5%	-1.5%	-1.5%	-1.4%
Multiple Family	-0.9%	-1.1%	-1.1%	-1.1%	-1.2%	-1.3%
Non-Residential	-0.9%	-0.9%	-1.0%	-1.0%	-1.0%	-1.0%
Lane County, OR						
Single Family	-1.7%	-1.4%	-1.5%	-1.5%	-1.5%	-1.5%
Multiple Family	-1.2%	-1.1%	-1.1%	-1.0%	-1.0%	-1.0%
Non-Residential	-1.1%	-1.0%	-1.0%	-1.0%	-1.0%	-1.0%
Vernonia City, OR						
Single Family	-2.7%	-2.2%	-2.3%	-2.3%	-2.4%	-2.4%
Multiple Family	-1.7%	-1.5%	-1.4%	-1.3%	-1.2%	-1.0%
Non-Residential	-1.4%	-1.1%	-1.2%	-1.2%	-1.2%	-1.2%
Franklin Township, PA						
Single Family	-2.1%	-1.5%	-1.6%	-1.7%	-1.8%	-1.8%
Multiple Family	-3.7%	-1.8%	-1.8%	-2.0%	-2.1%	-2.2%
Non-Residential	-2.5%	-0.8%	-0.9%	-1.0%	-1.0%	-1.0%
Glen Rock Borough, PA						
Single Family	-22.0%	-17.0%	-19.1%	-20.1%	-20.9%	-21.8%
Multiple Family	-53.0%	-45.7%	-57.3%	-67.7%	-77.3%	-85.0%
Non-Residential	-26.5%	-31.1%	-36.1%	-35.8%	-32.9%	-35.3%
Lower Mt. Bethel Township, PA						
Single Family	-10.9%	-7.6%	-7.7%	-7.5%	-7.1%	-7.0%
Multiple Family	-18.5%	-17.5%	-14.4%	-10.7%	-5.7%	0.0%
Non-Residential	-16.0%	-13.9%	-10.6%	-7.4%	-3.7%	0.0%

Table F.6 (Continued)
Percent Change from Baseline for Average Real Pre-FIRM Property Values from 1997 to 2022
Scenario 5: Property Elevation Below BFE
Sample Communities

Community	1998	2002	2007	2012	2017	2022
New Cumberland Borough, PA						
Single Family	-5.8%	-3.1%	-3.0%	-2.9%	-2.8%	-2.7%
Multiple Family	-13.6%	-6.6%	-6.6%	-6.6%	-6.4%	-6.4%
Non-Residential	-8.9%	-4.0%	-4.1%	-4.0%	-4.1%	-4.3%
Myrtle Beach City, SC						
Single Family	-8.3%	-4.8%	-4.3%	-4.0%	-3.7%	-3.4%
Multiple Family	-5.6%	-3.2%	-3.1%	-3.0%	-2.9%	-2.7%
Non-Residential	-2.6%	-2.7%	-2.5%	-2.3%	-2.0%	-1.7%
Lawrence County, SD						
Single Family	0.8%	1.1%	1.2%	1.3%	1.4%	1.4%
Multiple Family	-1.0%	-1.0%	-1.1%	-1.1%	-1.2%	-1.1%
Non-Residential	-0.8%	-0.8%	-0.8%	-0.9%	-0.9%	-0.9%
Brookside Village City, TX						
Single Family	-12.1%	-5.9%	-5.5%	-5.6%	-5.5%	-5.4%

Multiple Family	-9.3%	-4.5%	-3.6%	-2.9%	-2.1%	-0.5%
Non-Residential	-9.8%	-4.3%	-4.3%	-4.3%	-4.3%	-4.3%
Garland City, TX						
Single Family	-1.9%	-1.1%	-1.1%	-1.0%	-1.0%	-1.0%
Multiple Family	-1.4%	-1.2%	-1.1%	-1.1%	-1.2%	-1.2%
Non-Residential	-1.6%	-1.3%	-1.2%	-1.1%	-1.1%	-1.1%
League City, TX						
Single Family	-4.2%	-2.3%	-2.2%	-2.1%	-2.0%	-2.0%
Multiple Family	-2.8%	-1.5%	-1.6%	-1.6%	-1.6%	-1.7%
Non-Residential	-3.2%	-1.8%	-1.8%	-1.7%	-1.7%	-1.7%
Grundy Town, VA						
Single Family	-12.2%	-6.7%	-6.4%	-6.2%	-6.1%	-6.0%
Multiple Family	-16.2%	-12.8%	-12.8%	-13.6%	-12.8%	-11.3%
Non-Residential	-13.9%	-6.7%	-6.5%	-6.6%	-6.9%	-7.0%
Ephrata City, WA						
Single Family	-2.3%	-2.3%	-2.2%	-2.1%	-2.1%	-2.1%
Multiple Family	-2.0%	-2.2%	-2.0%	-2.0%	-2.0%	-2.0%
Non-Residential	-1.6%	-1.4%	-1.4%	-1.4%	-1.4%	-1.4%
Leavenworth City, WA						
Single Family	-6.3%	-3.5%	-3.3%	-3.3%	-3.3%	-3.2%
Multiple Family	-3.1%	-2.0%	-1.6%	-1.3%	-0.8%	0.0%
Non-Residential	-1.6%	-1.8%	-1.5%	-1.1%	-0.6%	0.0%
Marlinton Town, WV						
Single Family	-4.6%	-2.8%	-2.3%	-2.4%	-2.3%	-2.2%
Multiple Family	-6.3%	-4.2%	-3.8%	-3.7%	-3.6%	-3.5%
Non-Residential	-6.9%	-3.3%	-3.2%	-3.1%	-3.1%	-3.0%
Philippi City, WV						
Single Family	-7.7%	-5.0%	-4.6%	-4.8%	-4.7%	-4.5%
Multiple Family	-15.4%	-9.5%	-9.7%	-10.1%	-10.8%	-10.9%
Non-Residential	-12.8%	-6.1%	-6.0%	-5.9%	-6.0%	-5.9%
Wheeling City, WV						
Single Family	-4.6%	-3.5%	-2.8%	-2.7%	-2.3%	-2.2%
Multiple Family	-12.6%	-6.9%	-6.8%	-6.9%	-6.5%	-6.5%
Non-Residential	-16.8%	-7.4%	-7.0%	-6.9%	-6.5%	-6.5%

Table F.7
Percent Change from Baseline for Average Real Pre-FIRM Property Values from 1997 to 2022
Scenario 6: Property Elevation Below BFE
Sample Communities

Community	1998	2002	2007	2012	2017	2022
Phoenix City, AZ						
Single Family	-1.6%	-1.8%	-1.8%	-1.8%	-1.8%	-1.8%
Multiple Family	-1.4%	-1.6%	-1.5%	-1.5%	-1.5%	-1.5%
Non-Residential	-1.3%	-1.5%	-1.4%	-1.3%	-1.3%	-1.3%
Bay City, AR						
Single Family	-1.4%	-1.5%	-1.4%	-1.4%	-1.4%	-1.4%
Multiple Family	-1.9%	-2.3%	-2.4%	-2.5%	-2.7%	-2.8%
Non-Residential	-1.2%	-1.3%	-1.3%	-1.2%	-1.2%	-1.2%
Sacramento County, CA						
Single Family	-2.1%	-2.5%	-2.5%	-2.5%	-2.5%	-2.5%
Multiple Family	-1.6%	-1.9%	-1.8%	-1.8%	-1.8%	-1.8%
Non-Residential	-2.4%	-2.7%	-2.6%	-2.5%	-2.4%	-2.4%
Santa Cruz City, CA						
Single Family	-4.5%	-2.5%	-2.0%	-2.1%	-1.9%	-1.8%
Multiple Family	-2.6%	-2.0%	-1.8%	-1.8%	-1.9%	-2.0%
Non-Residential	-3.3%	-2.4%	-2.1%	-2.0%	-2.0%	-2.0%

Dolores Town, CO						
Single Family	-1.7%	-1.9%	-1.8%	-1.8%	-1.8%	-1.8%
Multiple Family	-1.0%	-0.9%	-0.6%	-0.4%	-0.3%	0.0%
Non-Residential	-1.2%	-1.4%	-1.4%	-1.4%	-1.4%	-1.4%
Otero County, CO						
Single Family	-1.3%	-1.5%	-1.5%	-1.6%	-1.5%	-1.5%
Multiple Family	-1.0%	-1.3%	-1.3%	-1.3%	-1.3%	-1.3%
Non-Residential	-0.9%	-1.0%	-1.0%	-1.0%	-1.0%	-1.0%
Ft. Lauderdale City, FL						
Single Family	-0.7%	-0.8%	-0.8%	-0.7%	-0.7%	-0.7%
Multiple Family	-1.9%	-2.0%	-1.8%	-1.7%	-1.6%	-1.6%
Non-Residential	-1.2%	-1.2%	-1.1%	-1.0%	-1.0%	-0.9%
New Smyrna Beach City, FL						
Single Family	-0.7%	-0.9%	-0.9%	-0.9%	-0.9%	-1.0%
Multiple Family	-1.5%	-1.8%	-1.8%	-1.8%	-1.8%	-1.8%
Non-Residential	-1.1%	-1.5%	-1.7%	-1.8%	-1.9%	-2.0%
St. Petersburg Beach City, FL						
Single Family	-17.0%	-18.6%	-20.2%	-21.0%	-21.2%	-21.3%
Multiple Family	-10.0%	-10.2%	-11.0%	-11.4%	-11.5%	-11.5%
Non-Residential	-24.5%	-27.3%	-29.7%	-31.1%	-31.4%	-31.5%
Hailey City, ID						
Single Family	0.4%	0.6%	0.6%	0.7%	0.8%	0.8%
Multiple Family	-1.0%	-1.1%	-0.9%	-0.6%	-0.3%	-0.1%
Non-Residential	-1.1%	-1.0%	-1.0%	-0.9%	-0.8%	-0.8%
Grundy County, IL						
Single Family	-2.8%	-1.7%	-1.5%	-1.4%	-1.3%	-1.3%
Multiple Family	-3.1%	-1.8%	-1.6%	-1.5%	-1.5%	-1.5%
Non-Residential	-4.6%	-1.8%	-1.6%	-1.5%	-1.6%	-1.6%
Council Bluffs City, IA						
Single Family	-1.7%	-1.9%	-1.7%	-1.7%	-1.6%	-1.6%
Multiple Family	-3.6%	-3.0%	-2.2%	-1.9%	-1.7%	-2.2%
Non-Residential	-7.7%	-3.3%	-3.9%	-4.0%	-3.9%	-3.8%
Augusta City, KY						
Single Family	0.3%	0.4%	0.6%	0.6%	0.7%	0.8%
Multiple Family	-1.6%	-1.8%	-1.8%	-1.8%	-1.8%	-1.8%
Non-Residential	-0.9%	-0.9%	-0.9%	-0.9%	-0.9%	-0.9%

Table F.7 (Continued)
Percent Change from Baseline for Average Real Pre-FIRM Property Values from 1997 to 2022
Scenario 6: Property Elevation Below BFE
Sample Communities

Community	1998	2002	2007	2012	2017	2022
Lewisport City, KY						
Single Family	1.1%	1.3%	1.5%	1.6%	1.7%	1.7%
Multiple Family	-1.7%	-2.1%	-2.2%	-2.2%	-2.3%	-2.4%
Non-Residential	-0.8%	-0.8%	-0.8%	-0.8%	-0.8%	-0.7%
Louisville/Jefferson, KY						
Single Family	-12.7%	-6.0%	-5.4%	-5.0%	-4.6%	-4.3%
Multiple Family	-11.0%	-5.4%	-5.5%	-5.7%	-5.7%	-5.7%
Non-Residential	-4.8%	-2.4%	-2.9%	-2.7%	-2.6%	-2.5%
Allen Parish, LA						
Single Family	-2.0%	-2.0%	-1.7%	-1.6%	-1.5%	-1.5%
Multiple Family	-1.9%	-2.1%	-1.9%	-1.8%	-1.8%	-1.7%
Non-Residential	-1.6%	-1.0%	-0.9%	-0.9%	-0.9%	-0.9%
Jefferson Parish, LA						
Single Family	-2.5%	-2.3%	-2.0%	-2.0%	-1.9%	-1.7%
Multiple Family	-2.9%	-3.1%	-2.6%	-2.6%	-2.4%	-2.3%
Non-Residential	-2.7%	-2.6%	-2.2%	-2.1%	-2.1%	-2.0%
Shreveport City, LA						
Single Family	-4.0%	-4.6%	-4.6%	-4.6%	-4.6%	-4.6%

Multiple Family	-4.4%	-5.6%	-6.1%	-6.5%	-6.7%	-6.9%
Non-Residential	-3.7%	-4.0%	-3.9%	-3.8%	-3.7%	-3.6%
Cohasset Town, MA						
Single Family	-1.9%	-0.7%	-0.5%	-0.5%	-0.5%	-0.4%
Multiple Family	-3.3%	-1.8%	-1.6%	-1.6%	-1.6%	-1.7%
Non-Residential	-4.6%	-2.3%	-2.1%	-1.9%	-1.9%	-1.8%
Vassar City, MI						
Single Family	-0.7%	-0.5%	-0.2%	-0.1%	0.1%	0.0%
Multiple Family	-2.3%	-2.2%	-2.0%	-1.9%	-1.9%	-2.1%
Non-Residential	-2.4%	-2.2%	-1.8%	-1.6%	-1.5%	-1.4%
Petal City, MS						
Single Family	-1.8%	-2.2%	-2.2%	-2.2%	-2.2%	-2.2%
Multiple Family	-1.3%	-1.7%	-1.6%	-1.6%	-1.6%	-1.6%
Non-Residential	-1.2%	-1.4%	-1.3%	-1.3%	-1.2%	-1.2%
Scott County, MO						
Single Family	0.5%	0.6%	0.8%	0.9%	1.0%	1.0%
Multiple Family	-1.2%	-1.5%	-1.6%	-1.6%	-1.7%	-1.7%
Non-Residential	-1.0%	-1.1%	-1.1%	-1.1%	-1.0%	-1.0%
Omaha City, NE						
Single Family	0.1%	0.5%	0.9%	1.0%	1.1%	1.0%
Multiple Family	-2.6%	-1.6%	-1.5%	-1.4%	-1.4%	-1.5%
Non-Residential	-2.8%	-1.4%	-1.3%	-1.2%	-1.1%	-1.1%
Pender Village, NE						
Single Family	-0.8%	-0.3%	-0.1%	0.1%	0.2%	0.2%
Multiple Family	-1.8%	-1.6%	-1.5%	-1.6%	-1.6%	-1.6%
Non-Residential	-2.6%	-1.6%	-1.3%	-1.3%	-1.2%	-1.2%
Woodstock Town, NH						
Single Family	1.1%	1.3%	1.5%	1.6%	1.7%	1.8%
Multiple Family	-1.5%	-1.6%	-1.5%	-1.4%	-1.4%	-1.4%
Non-Residential	-1.0%	-1.1%	-1.1%	-1.1%	-1.1%	-1.1%

Table F.7 (Continued)
Percent Change from Baseline for Average Real Pre-FIRM Property Values from 1997 to 2022
Scenario 6: Property Elevation Below BFE
Sample Communities

Community	1998	2002	2007	2012	2017	2022
Bloomingdale Borough, NJ						
Single Family	1.1%	1.3%	1.4%	1.5%	1.5%	1.5%
Multiple Family	-1.8%	-1.9%	-1.8%	-1.8%	-1.8%	-1.8%
Non-Residential	-1.4%	-1.3%	-1.2%	-1.1%	-1.1%	-1.0%
Lincoln Park Borough, NJ						
Single Family	-7.2%	-3.7%	-3.3%	-3.2%	-3.1%	-3.2%
Multiple Family	-15.6%	-8.0%	-8.1%	-8.5%	-8.9%	-9.1%
Non-Residential	-16.0%	-7.0%	-6.7%	-6.8%	-6.7%	-6.6%
Niagara Town, NY						
Single Family	-3.7%	-2.2%	-1.6%	-1.4%	-1.5%	-1.5%
Multiple Family	-4.7%	-4.4%	-3.6%	-3.3%	-3.0%	-4.1%
Non-Residential	-1.9%	-1.6%	-1.2%	-0.9%	-0.8%	-0.7%
Waterford Village, NY						
Single Family	-1.0%	-0.2%	0.1%	0.2%	0.3%	0.3%
Multiple Family	-3.4%	-2.4%	-2.1%	-2.3%	-2.4%	-2.4%
Non-Residential	-2.0%	-1.8%	-1.4%	-1.3%	-1.5%	-1.5%
Carteret County, NC						
Single Family	-1.9%	-2.2%	-2.1%	-2.1%	-2.0%	-2.0%
Multiple Family	-1.4%	-1.6%	-1.6%	-1.6%	-1.6%	-1.7%
Non-Residential	-1.2%	-1.4%	-1.4%	-1.4%	-1.4%	-1.4%

Edenton, NC						
Single Family	-1.1%	-1.3%	-1.3%	-1.2%	-1.2%	-1.2%
Multiple Family	-1.2%	-1.5%	-1.5%	-1.6%	-1.6%	-1.6%
Non-Residential	-1.5%	-1.8%	-1.8%	-1.9%	-1.9%	-1.8%
New Miami Village, OH						
Single Family	1.0%	1.2%	1.3%	1.4%	1.4%	1.4%
Multiple Family	-1.0%	-1.3%	-1.3%	-1.4%	-1.4%	-1.4%
Non-Residential	-1.0%	-1.1%	-1.2%	-1.1%	-1.1%	-1.1%
Washington County, OK						
Single Family	-1.2%	-1.5%	-1.5%	-1.5%	-1.5%	-1.5%
Multiple Family	-0.9%	-1.1%	-1.1%	-1.1%	-1.2%	-1.3%
Non-Residential	-0.9%	-1.0%	-1.0%	-1.0%	-1.0%	-1.0%
Lane County, OR						
Single Family	-1.5%	-1.5%	-1.5%	-1.5%	-1.5%	-1.5%
Multiple Family	-1.1%	-1.2%	-1.1%	-1.1%	-1.1%	-1.0%
Non-Residential	-1.0%	-1.1%	-1.0%	-1.0%	-1.0%	-1.0%
Vernonia City, OR						
Single Family	-2.3%	-2.4%	-2.3%	-2.3%	-2.4%	-2.4%
Multiple Family	-1.4%	-1.6%	-1.4%	-1.3%	-1.2%	-1.0%
Non-Residential	-1.2%	-1.3%	-1.2%	-1.2%	-1.2%	-1.2%
Franklin Township, PA						
Single Family	-1.9%	-1.9%	-1.9%	-2.0%	-2.0%	-2.0%
Multiple Family	-3.1%	-3.0%	-2.9%	-2.9%	-3.0%	-3.0%
Non-Residential	-2.3%	-1.2%	-1.2%	-1.2%	-1.2%	-1.2%
Glen Rock Borough, PA						
Single Family	-18.3%	-18.1%	-19.5%	-20.3%	-21.0%	-21.9%
Multiple Family	-45.5%	-47.4%	-58.1%	-68.1%	-77.5%	-85.2%
Non-Residential	-25.5%	-31.0%	-36.1%	-35.8%	-32.9%	-35.3%
Lower Mt. Bethel Township, PA						
Single Family	-9.1%	-8.2%	-7.9%	-7.6%	-7.2%	-7.1%
Multiple Family	-18.1%	-17.4%	-14.4%	-10.7%	-5.7%	0.0%
Non-Residential	-15.6%	-13.9%	-10.6%	-7.4%	-3.7%	0.0%

Table F.7 (Continued)
Percent Change from Baseline for Average Real Pre-FIRM Property Values from 1997 to 2022
Scenario 6: Property Elevation Below BFE
Sample Communities

Community	1998	2002	2007	2012	2017	2022
New Cumberland Borough, PA						
Single Family	-5.2%	-3.3%	-3.1%	-2.9%	-2.8%	-2.8%
Multiple Family	-8.5%	-5.4%	-6.5%	-6.6%	-6.4%	-6.4%
Non-Residential	-7.2%	-4.1%	-3.8%	-4.0%	-4.1%	-4.3%
Myrtle Beach City, SC						
Single Family	-6.3%	-4.5%	-4.3%	-4.0%	-3.7%	-3.4%
Multiple Family	-4.4%	-3.2%	-3.2%	-3.0%	-2.9%	-2.7%
Non-Residential	-2.2%	-2.5%	-2.5%	-2.3%	-2.0%	-1.7%
Lawrence County, SD						
Single Family	0.9%	1.0%	1.2%	1.3%	1.4%	1.4%
Multiple Family	-0.9%	-1.1%	-1.1%	-1.2%	-1.2%	-1.1%
Non-Residential	-0.8%	-0.8%	-0.8%	-0.9%	-0.9%	-0.9%
Brookside Village City, TX						
Single Family	-6.9%	-5.4%	-4.6%	-5.6%	-5.6%	-5.4%
Multiple Family	-5.8%	-3.7%	-3.6%	-2.9%	-2.1%	-0.5%
Non-Residential	-8.8%	-4.4%	-4.3%	-4.3%	-4.3%	-4.2%
Garland City, TX						
Single Family	-1.7%	-1.6%	-1.2%	-1.1%	-1.0%	-1.0%
Multiple Family	-1.2%	-1.4%	-1.2%	-1.1%	-1.1%	-1.2%
Non-Residential	-1.4%	-1.5%	-1.3%	-1.2%	-1.1%	-1.1%
League City, TX						
Single Family	-3.7%	-2.3%	-2.2%	-2.0%	-2.0%	-2.0%

Multiple Family	-2.7%	-1.7%	-1.7%	-1.7%	-1.7%	-1.8%
Non-Residential	-2.9%	-1.9%	-1.8%	-1.7%	-1.7%	-1.7%
Grundy Town, VA						
Single Family	-9.0%	-6.4%	-6.1%	-6.2%	-6.1%	-6.0%
Multiple Family	-11.4%	-13.1%	-12.7%	-13.7%	-12.8%	-11.3%
Non-Residential	-11.5%	-6.4%	-6.1%	-6.7%	-6.9%	-7.0%
Ephrata City, WA						
Single Family	-2.0%	-2.3%	-2.2%	-2.1%	-2.1%	-2.1%
Multiple Family	-1.8%	-2.2%	-2.0%	-2.0%	-2.0%	-2.0%
Non-Residential	-1.5%	-1.6%	-1.5%	-1.4%	-1.4%	-1.4%
Leavenworth City, WA						
Single Family	-4.1%	-3.7%	-3.0%	-2.9%	-3.3%	-3.2%
Multiple Family	-2.3%	-2.1%	-1.4%	-1.3%	-0.8%	0.0%
Non-Residential	-1.6%	-1.9%	-1.5%	-1.1%	-0.6%	0.0%
Marlinton Town, WV						
Single Family	-2.8%	-2.5%	-2.6%	-2.3%	-2.3%	-2.2%
Multiple Family	-4.4%	-4.4%	-3.9%	-3.6%	-3.6%	-3.5%
Non-Residential	-6.0%	-3.4%	-3.1%	-3.0%	-3.1%	-3.0%
Philippi City, WV						
Single Family	-4.9%	-4.5%	-4.3%	-4.7%	-4.8%	-4.5%
Multiple Family	-10.2%	-7.8%	-9.4%	-10.1%	-10.5%	-10.9%
Non-Residential	-10.3%	-6.4%	-5.8%	-5.6%	-5.5%	-5.9%
Wheeling City, WV						
Single Family	-3.3%	-3.6%	-2.9%	-2.7%	-2.4%	-2.3%
Multiple Family	-8.5%	-6.2%	-5.9%	-5.7%	-6.5%	-6.5%
Non-Residential	-14.5%	-7.1%	-7.0%	-6.9%	-6.5%	-6.5%

Table F.8
Percent Change from Baseline for Average Real Pre-FIRM Property Values from 1997 to 202
Scenario 7: Property Elevation Below BFE
Sample Communities

Community	1998	2002	2007	2012	2017	2022
Phoenix City, AZ						
Single Family	-1.6%	-1.8%	-1.8%	-1.8%	-1.8%	-1.8%
Multiple Family	-1.4%	-1.6%	-1.5%	-1.5%	-1.5%	-1.5%
Non-Residential	-1.4%	-1.5%	-1.4%	-1.3%	-1.3%	-1.3%
Bay City, AR						
Single Family	-1.4%	-1.5%	-1.4%	-1.4%	-1.4%	-1.4%
Multiple Family	-1.9%	-2.3%	-2.4%	-2.5%	-2.7%	-2.8%
Non-Residential	-1.2%	-1.2%	-1.2%	-1.2%	-1.2%	-1.2%
Sacramento County, CA						
Single Family	-2.2%	-2.5%	-2.5%	-2.5%	-2.5%	-2.5%
Multiple Family	-1.6%	-1.9%	-1.8%	-1.8%	-1.8%	-1.8%
Non-Residential	-2.5%	-2.7%	-2.6%	-2.5%	-2.4%	-2.4%
Santa Cruz City, CA						
Single Family	-4.9%	-2.5%	-2.2%	-2.1%	-1.9%	-1.8%
Multiple Family	-2.7%	-2.0%	-1.8%	-1.8%	-1.9%	-2.0%
Non-Residential	-3.5%	-2.1%	-2.0%	-2.0%	-2.0%	-2.0%
Dolores Town, CO						
Single Family	-1.8%	-1.9%	-1.8%	-1.8%	-1.8%	-1.8%
Multiple Family	-1.0%	-0.8%	-0.6%	-0.4%	-0.3%	0.0%
Non-Residential	-1.3%	-1.3%	-1.4%	-1.4%	-1.4%	-1.4%
Otero County, CO						
Single Family	-1.3%	-1.5%	-1.5%	-1.5%	-1.5%	-1.5%
Multiple Family	-1.1%	-1.3%	-1.3%	-1.3%	-1.3%	-1.3%
Non-Residential	-0.9%	-1.0%	-1.0%	-1.0%	-1.0%	-1.0%

Ft. Lauderdale City, FL						
Single Family	-0.7%	-0.8%	-0.8%	-0.7%	-0.7%	-0.7%
Multiple Family	-2.0%	-2.0%	-1.8%	-1.6%	-1.6%	-1.6%
Non-Residential	-1.3%	-1.2%	-1.1%	-1.0%	-1.0%	-0.9%
New Smyrna Beach City, FL						
Single Family	-0.7%	-0.9%	-0.9%	-0.9%	-0.9%	-1.0%
Multiple Family	-1.5%	-1.8%	-1.8%	-1.8%	-1.8%	-1.8%
Non-Residential	-1.1%	-1.4%	-1.7%	-1.8%	-1.9%	-2.0%
St. Petersburg Beach City, FL						
Single Family	-17.9%	-18.1%	-20.0%	-21.0%	-21.2%	-21.3%
Multiple Family	-9.9%	-10.1%	-11.0%	-11.4%	-11.5%	-11.5%
Non-Residential	-25.7%	-27.2%	-29.7%	-31.1%	-31.4%	-31.5%
Hailey City, ID						
Single Family	0.3%	0.5%	0.6%	0.7%	0.8%	0.8%
Multiple Family	-1.2%	-1.1%	-0.9%	-0.6%	-0.3%	-0.1%
Non-Residential	-1.3%	-1.0%	-1.0%	-0.9%	-0.8%	-0.8%
Grundy County, IL						
Single Family	-2.8%	-1.6%	-1.4%	-1.3%	-1.3%	-1.3%
Multiple Family	-3.5%	-1.5%	-1.4%	-1.4%	-1.4%	-1.5%
Non-Residential	-4.7%	-1.7%	-1.6%	-1.5%	-1.6%	-1.6%
Council Bluffs City, IA						
Single Family	-2.1%	-1.9%	-1.7%	-1.6%	-1.7%	-1.6%
Multiple Family	-3.8%	-3.0%	-2.2%	-1.9%	-1.7%	-2.2%
Non-Residential	-9.0%	-4.2%	-3.9%	-4.0%	-3.9%	-3.8%
Augusta City, KY						
Single Family	0.3%	0.4%	0.6%	0.6%	0.7%	0.8%
Multiple Family	-1.6%	-1.8%	-1.8%	-1.8%	-1.8%	-1.8%
Non-Residential	-0.9%	-0.9%	-0.9%	-0.9%	-0.9%	-0.9%

Table F.8 (Continued)
Percent Change from Baseline for Average Real Pre-FIRM Property Values from 1997 to 2022
Scenario 7: Property Elevation Below BFE
Sample Communities

Community	1998	2002	2007	2012	2017	2022
Lewisport City, KY						
Single Family	1.1%	1.3%	1.5%	1.6%	1.7%	1.7%
Multiple Family	-1.7%	-2.1%	-2.2%	-2.2%	-2.3%	-2.4%
Non-Residential	-0.8%	-0.8%	-0.8%	-0.8%	-0.8%	-0.7%
Louisville/Jefferson, KY						
Single Family	-13.4%	-5.8%	-5.3%	-4.9%	-4.5%	-4.2%
Multiple Family	-11.2%	-5.4%	-5.5%	-5.7%	-5.7%	-5.7%
Non-Residential	-6.5%	-3.0%	-2.9%	-2.7%	-2.6%	-2.5%
Allen Parish, LA						
Single Family	-2.0%	-2.0%	-1.7%	-1.6%	-1.5%	-1.5%
Multiple Family	-2.0%	-2.1%	-1.9%	-1.8%	-1.8%	-1.7%
Non-Residential	-1.7%	-1.0%	-0.9%	-0.9%	-0.9%	-0.9%
Jefferson Parish, LA						
Single Family	-2.9%	-2.3%	-2.0%	-2.0%	-1.9%	-1.7%
Multiple Family	-3.0%	-3.1%	-2.6%	-2.6%	-2.4%	-2.3%
Non-Residential	-2.9%	-2.6%	-2.3%	-2.1%	-2.1%	-2.0%
Shreveport City, LA						
Single Family	-4.1%	-4.6%	-4.6%	-4.6%	-4.6%	-4.6%
Multiple Family	-4.5%	-5.6%	-6.1%	-6.5%	-6.7%	-6.9%
Non-Residential	-3.9%	-4.0%	-3.9%	-3.8%	-3.7%	-3.6%
Cohasset Town, MA						
Single Family	-1.9%	-0.6%	-0.5%	-0.4%	-0.5%	-0.4%
Multiple Family	-3.4%	-1.7%	-1.6%	-1.6%	-1.7%	-1.7%
Non-Residential	-4.7%	-2.3%	-2.0%	-1.8%	-1.9%	-1.9%
Vassar City, MI						
Single Family	-1.1%	-0.6%	-0.3%	-0.1%	0.0%	0.0%

Multiple Family	-2.3%	-2.2%	-2.0%	-1.9%	-1.9%	-2.1%
Non-Residential	-2.7%	-1.8%	-1.7%	-1.5%	-1.5%	-1.5%
Petal City, MS						
Single Family	-1.9%	-2.1%	-2.1%	-2.2%	-2.2%	-2.2%
Multiple Family	-1.3%	-1.7%	-1.6%	-1.6%	-1.6%	-1.6%
Non-Residential	-1.2%	-1.3%	-1.3%	-1.2%	-1.2%	-1.2%
Scott County, MO						
Single Family	0.5%	0.6%	0.8%	0.9%	1.0%	1.0%
Multiple Family	-1.2%	-1.5%	-1.6%	-1.6%	-1.7%	-1.7%
Non-Residential	-1.0%	-1.0%	-1.1%	-1.1%	-1.0%	-1.0%
Omaha City, NE						
Single Family	-0.5%	0.6%	0.8%	1.0%	1.0%	1.0%
Multiple Family	-2.7%	-1.5%	-1.4%	-1.4%	-1.4%	-1.5%
Non-Residential	-3.1%	-1.4%	-1.3%	-1.2%	-1.1%	-1.1%
Pender Village, NE						
Single Family	-0.8%	-0.2%	-0.1%	0.1%	0.2%	0.3%
Multiple Family	-1.8%	-1.6%	-1.5%	-1.6%	-1.6%	-1.6%
Non-Residential	-2.7%	-1.6%	-1.3%	-1.3%	-1.2%	-1.2%
Woodstock Town, NH						
Single Family	1.1%	1.3%	1.5%	1.6%	1.7%	1.8%
Multiple Family	-1.5%	-1.6%	-1.5%	-1.5%	-1.4%	-1.4%
Non-Residential	-1.0%	-1.1%	-1.1%	-1.1%	-1.1%	-1.1%

Table F.8 (Continued)
Percent Change from Baseline for Average Real Pre-FIRM Property Values from 1997 to 2022
Scenario 7: Property Elevation Below BFE
Sample Communities

Community	1998	2002	2007	2012	2017	2022
Bloomingdale Borough, NJ						
Single Family	1.0%	1.3%	1.4%	1.5%	1.5%	1.5%
Multiple Family	-1.9%	-1.9%	-1.8%	-1.8%	-1.8%	-1.8%
Non-Residential	-1.5%	-1.3%	-1.2%	-1.1%	-1.1%	-1.0%
Lincoln Park Borough, NJ						
Single Family	-7.7%	-3.4%	-3.2%	-3.1%	-3.2%	-3.2%
Multiple Family	-15.8%	-8.0%	-8.1%	-8.5%	-8.9%	-9.1%
Non-Residential	-15.8%	-7.0%	-6.8%	-6.8%	-6.7%	-6.6%
Niagara Town, NY						
Single Family	-1.4%	-2.2%	-2.0%	-1.8%	-1.6%	-1.5%
Multiple Family	-4.8%	-4.4%	-3.6%	-3.3%	-3.0%	-4.1%
Non-Residential	-2.2%	-1.0%	-0.8%	-0.7%	-0.6%	-0.8%
Waterford Village, NY						
Single Family	-1.1%	-0.1%	0.1%	0.2%	0.3%	0.3%
Multiple Family	-4.8%	-2.5%	-2.4%	-2.3%	-2.4%	-2.4%
Non-Residential	-2.8%	-1.7%	-1.6%	-1.5%	-1.5%	-1.5%
Carteret County, NC						
Single Family	-1.9%	-2.2%	-2.1%	-2.1%	-2.0%	-2.0%
Multiple Family	-1.3%	-1.6%	-1.6%	-1.6%	-1.6%	-1.7%
Non-Residential	-1.3%	-1.4%	-1.4%	-1.4%	-1.4%	-1.4%
Edenton, NC						
Single Family	-1.0%	-1.2%	-1.2%	-1.2%	-1.2%	-1.2%
Multiple Family	-1.2%	-1.6%	-1.6%	-1.7%	-1.7%	-1.7%
Non-Residential	-1.5%	-1.7%	-1.8%	-1.8%	-1.9%	-1.8%
New Miami Village, OH						
Single Family	1.0%	1.2%	1.3%	1.4%	1.4%	1.4%
Multiple Family	-1.0%	-1.3%	-1.3%	-1.4%	-1.4%	-1.4%
Non-Residential	-1.1%	-1.1%	-1.2%	-1.1%	-1.1%	-1.1%

Washington County, OK						
Single Family	-1.3%	-1.5%	-1.5%	-1.5%	-1.5%	-1.4%
Multiple Family	-0.9%	-1.1%	-1.1%	-1.1%	-1.2%	-1.3%
Non-Residential	-0.9%	-1.0%	-1.0%	-1.0%	-1.0%	-1.0%
Lane County, OR						
Single Family	-1.6%	-1.5%	-1.5%	-1.5%	-1.5%	-1.5%
Multiple Family	-1.1%	-1.2%	-1.1%	-1.1%	-1.1%	-1.0%
Non-Residential	-1.0%	-1.0%	-1.0%	-1.0%	-1.0%	-1.0%
Vernonia City, OR						
Single Family	-2.4%	-2.4%	-2.3%	-2.4%	-2.4%	-2.4%
Multiple Family	-1.4%	-1.6%	-1.5%	-1.3%	-1.2%	-1.0%
Non-Residential	-1.3%	-1.3%	-1.2%	-1.2%	-1.2%	-1.2%
Franklin Township, PA						
Single Family	-1.7%	-1.5%	-1.6%	-1.7%	-1.8%	-1.8%
Multiple Family	-3.2%	-3.0%	-2.9%	-2.9%	-3.0%	-3.0%
Non-Residential	-2.3%	-0.8%	-0.9%	-1.0%	-1.0%	-1.0%
Glen Rock Borough, PA						
Single Family	-21.3%	-16.9%	-19.0%	-20.1%	-20.8%	-21.8%
Multiple Family	-46.2%	-47.4%	-58.1%	-68.1%	-77.5%	-85.2%
Non-Residential	-25.7%	-30.9%	-36.1%	-35.7%	-32.9%	-35.3%
Lower Mt. Bethel Township, PA						
Single Family	-10.2%	-7.7%	-7.7%	-7.5%	-7.1%	-7.0%
Multiple Family	-18.2%	-17.5%	-14.4%	-10.7%	-5.7%	0.0%
Non-Residential	-15.8%	-13.9%	-10.6%	-7.4%	-3.7%	0.0%

Table F.8 (Continued)

Percent Change from Baseline for Average Real Pre-FIRM Property Values from 1997 to 202

Scenario 7: Property Elevation Below BFE

Sample Communities

Community	1998	2002	2007	2012	2017	2022
New Cumberland Borough, PA						
Single Family	-5.3%	-3.3%	-3.1%	-2.9%	-2.8%	-2.8%
Multiple Family	-12.6%	-6.4%	-6.6%	-6.6%	-6.4%	-6.4%
Non-Residential	-8.1%	-3.8%	-4.1%	-4.0%	-4.1%	-4.3%
Myrtle Beach City, SC						
Single Family	-7.3%	-4.7%	-4.3%	-4.0%	-3.7%	-3.4%
Multiple Family	-4.6%	-3.2%	-3.2%	-3.0%	-2.9%	-2.7%
Non-Residential	-2.3%	-2.7%	-2.5%	-2.3%	-2.0%	-1.7%
Lawrence County, SD						
Single Family	0.9%	1.0%	1.2%	1.3%	1.4%	1.4%
Multiple Family	-1.0%	-1.1%	-1.1%	-1.2%	-1.2%	-1.1%
Non-Residential	-0.8%	-0.8%	-0.8%	-0.9%	-0.9%	-0.9%
Brookside Village City, TX						
Single Family	-11.7%	-5.9%	-5.5%	-5.6%	-5.5%	-5.4%
Multiple Family	-8.8%	-4.5%	-3.6%	-2.9%	-2.1%	-0.5%
Non-Residential	-9.1%	-4.4%	-4.3%	-4.3%	-4.3%	-4.3%
Garland City, TX						
Single Family	-1.9%	-1.3%	-1.2%	-1.1%	-1.1%	-1.0%
Multiple Family	-1.3%	-1.3%	-1.2%	-1.2%	-1.2%	-1.3%
Non-Residential	-1.5%	-1.5%	-1.3%	-1.2%	-1.1%	-1.1%
League City, TX						
Single Family	-3.9%	-2.3%	-2.2%	-2.0%	-2.0%	-2.0%
Multiple Family	-2.7%	-1.8%	-1.8%	-1.7%	-1.7%	-1.8%
Non-Residential	-3.0%	-1.8%	-1.8%	-1.7%	-1.7%	-1.7%
Grundy Town, VA						
Single Family	-7.0%	-6.7%	-6.4%	-6.2%	-6.1%	-6.0%
Multiple Family	-11.7%	-13.1%	-12.7%	-13.7%	-12.8%	-11.3%
Non-Residential	-12.3%	-6.7%	-6.5%	-6.6%	-6.9%	-7.0%
Ephrata City, WA						
Single Family	-2.1%	-2.3%	-2.2%	-2.1%	-2.1%	-2.1%

Multiple Family	-1.9%	-2.2%	-2.0%	-2.0%	-2.0%	-2.0%
Non-Residential	-1.6%	-1.6%	-1.5%	-1.4%	-1.4%	-1.4%
Leavenworth City, WA						
Single Family	-5.2%	-3.6%	-3.4%	-3.3%	-3.3%	-3.2%
Multiple Family	-2.9%	-2.1%	-1.7%	-1.3%	-0.8%	0.0%
Non-Residential	-1.6%	-1.9%	-1.5%	-1.1%	-0.6%	0.0%
Marlinton Town, WV						
Single Family	-3.7%	-2.7%	-2.5%	-2.3%	-2.3%	-2.2%
Multiple Family	-4.5%	-4.4%	-3.9%	-3.6%	-3.6%	-3.5%
Non-Residential	-6.2%	-3.3%	-3.2%	-3.1%	-3.1%	-3.0%
Philippi City, WV						
Single Family	-5.1%	-4.5%	-4.3%	-4.7%	-4.7%	-4.5%
Multiple Family	-10.5%	-7.8%	-9.4%	-10.1%	-10.5%	-10.9%
Non-Residential	-11.5%	-6.2%	-6.0%	-5.9%	-6.0%	-5.9%
Wheeling City, WV						
Single Family	-3.5%	-3.5%	-2.9%	-2.7%	-2.4%	-2.2%
Multiple Family	-8.4%	-6.3%	-5.9%	-5.7%	-6.5%	-6.5%
Non-Residential	-15.4%	-7.4%	-7.0%	-6.9%	-6.5%	-6.5%

TABLE F.9
Percent Change from Baseline for Average Real Pre-FIRM Property Values from 1997 to 2022
Property Elevation At and Above BFE
All NFIP Study Communities

Scenario	1998	2002	2007	2012	2017	2022
Scenario 1						
Single Family	1.0%	1.2%	1.2%	1.3%	1.3%	1.3%
Multiple Family	0.7%	0.8%	0.8%	0.9%	0.9%	1.0%
Non-Residential	1.3%	1.5%	1.6%	1.6%	1.6%	1.6%
Scenario 2						
Single Family	1.0%	1.2%	1.2%	1.3%	1.3%	1.3%
Multiple Family	0.7%	0.8%	0.8%	0.9%	0.9%	1.0%
Non-Residential	1.3%	1.5%	1.6%	1.6%	1.6%	1.6%
Scenario 3						
Single Family	1.0%	1.2%	1.2%	1.3%	1.3%	1.3%
Multiple Family	0.7%	0.8%	0.8%	0.9%	0.9%	1.0%
Non-Residential	1.3%	1.5%	1.6%	1.6%	1.6%	1.6%
Scenario 4						
Single Family	1.0%	1.2%	1.2%	1.3%	1.3%	1.3%
Multiple Family	0.7%	0.8%	0.8%	0.9%	0.9%	1.0%
Non-Residential	1.3%	1.5%	1.6%	1.6%	1.6%	1.6%
Scenario 5						
Single Family	1.0%	1.2%	1.2%	1.3%	1.3%	1.3%
Multiple Family	0.7%	0.8%	0.8%	0.9%	0.9%	1.0%
Non-Residential	1.3%	1.5%	1.6%	1.6%	1.6%	1.6%
Scenario 6						
Single Family	1.0%	1.2%	1.2%	1.3%	1.3%	1.3%
Multiple Family	0.7%	0.8%	0.8%	0.9%	0.9%	1.0%
Non-Residential	1.3%	1.5%	1.6%	1.6%	1.6%	1.6%

Scenario 7						
Single Family	1.0%	1.2%	1.2%	1.3%	1.3%	1.3%
Multiple Family	0.7%	0.8%	0.8%	0.9%	0.9%	1.0%
Non-Residential	1.3%	1.5%	1.6%	1.6%	1.6%	1.6%

Table F.10
Percent Change from Baseline for Average Real Pre-FIRM Property Values from 1997 to 2022
Scenario 1: Property Elevation At and Above BFE
Sample Communities

Community	1998	2002	2007	2012	2017	2022
Phoenix City, AZ						
Single Family	1.3%	1.5%	1.5%	1.6%	1.5%	1.5%
Multiple Family	0.9%	1.1%	1.1%	1.2%	1.2%	1.2%
Non-Residential	1.9%	2.1%	2.0%	1.9%	1.8%	1.8%
Bay City, AR						
Single Family	1.3%	1.5%	1.6%	1.6%	1.6%	1.6%
Multiple Family	1.4%	1.8%	2.0%	2.2%	2.2%	2.3%
Non-Residential	1.6%	1.8%	1.8%	1.8%	1.8%	1.7%
Sacramento County, CA						
Single Family	2.0%	2.3%	2.3%	2.3%	2.3%	2.3%
Multiple Family	1.2%	1.4%	1.6%	1.7%	1.7%	1.8%
Non-Residential	2.2%	2.4%	2.4%	2.3%	2.2%	2.2%
Santa Cruz City, CA						
Single Family	1.0%	1.1%	1.2%	1.2%	1.2%	1.1%
Multiple Family	1.1%	1.3%	1.3%	1.4%	1.4%	1.5%
Non-Residential	2.2%	2.5%	2.5%	2.5%	2.5%	2.5%
Dolores Town, CO						
Single Family	1.2%	1.5%	1.5%	1.6%	1.6%	1.6%
Multiple Family	0.9%	1.0%	1.1%	1.1%	1.2%	1.2%
Non-Residential	1.9%	2.4%	2.6%	2.7%	2.7%	2.7%
Otero County, CO						
Single Family	1.2%	1.5%	1.6%	1.7%	1.7%	1.7%
Multiple Family	0.9%	1.1%	1.3%	1.3%	1.3%	1.4%
Non-Residential	1.7%	2.0%	2.1%	2.1%	2.1%	2.1%
Ft. Lauderdale City, FL						
Single Family	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%
Multiple Family	0.4%	0.4%	0.4%	0.4%	0.4%	0.4%
Non-Residential	0.6%	0.6%	0.5%	0.5%	0.5%	0.5%
New Smyrna Beach City, FL						
Single Family	0.2%	0.3%	0.3%	0.3%	0.3%	0.3%
Multiple Family	0.2%	0.2%	0.3%	0.3%	0.3%	0.3%
Non-Residential	0.4%	0.4%	0.4%	0.3%	0.3%	0.3%
St. Petersburg Beach City, FL						
Single Family	2.0%	2.0%	2.1%	2.2%	2.3%	2.4%

Multiple Family	1.1%	1.1%	1.1%	1.2%	1.2%	1.2%
Non-Residential	3.2%	3.2%	3.2%	3.3%	3.3%	3.3%
Hailey City, ID						
Single Family	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Multiple Family	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Non-Residential	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Grundy County, IL						
Single Family	1.4%	1.6%	1.7%	1.8%	1.8%	1.8%
Multiple Family	1.0%	1.3%	1.4%	1.5%	1.5%	1.6%
Non-Residential	2.4%	2.9%	3.2%	3.3%	3.4%	3.4%
Council Bluffs City, IA						
Single Family	2.1%	2.3%	2.5%	2.5%	2.6%	2.7%
Multiple Family	0.9%	1.1%	1.2%	1.2%	1.2%	1.2%
Non-Residential	1.5%	1.6%	1.7%	1.6%	1.7%	1.7%
Augusta City, KY						
Single Family	1.1%	1.3%	1.4%	1.5%	1.5%	1.5%
Multiple Family	1.3%	1.5%	1.6%	1.6%	1.6%	1.6%
Non-Residential	1.6%	1.9%	2.0%	2.0%	2.0%	2.1%

Table F.10 (Continued)

Percent Change from Baseline for Average Real Pre-FIRM Property Values from 1997 to 202

Scenario 1: Property Elevation At and Above BFE

Sample Communities

Community	1998	2002	2007	2012	2017	2022
Lewisport City, KY						
Single Family	0.7%	0.8%	0.8%	0.9%	0.9%	0.9%
Multiple Family	0.7%	0.8%	0.9%	1.0%	1.0%	1.0%
Non-Residential	0.7%	0.8%	0.8%	0.8%	0.8%	0.8%
Louisville/Jefferson, KY						
Single Family	2.0%	2.2%	2.3%	2.3%	2.3%	2.3%
Multiple Family	1.5%	1.8%	2.0%	2.1%	2.2%	2.2%
Non-Residential	3.7%	3.8%	3.4%	3.0%	2.7%	2.4%
Allen Parish, LA						
Single Family	0.7%	0.9%	1.0%	1.0%	1.0%	1.0%
Multiple Family	0.6%	0.8%	0.9%	1.0%	1.1%	1.1%
Non-Residential	0.9%	1.1%	1.3%	1.3%	1.3%	1.3%
Jefferson Parish, LA						
Single Family	0.9%	0.9%	0.8%	0.8%	0.8%	0.8%
Multiple Family	0.7%	0.8%	0.8%	0.9%	0.9%	0.9%
Non-Residential	1.0%	1.0%	0.9%	0.9%	0.8%	0.8%
Shreveport City, LA						
Single Family	0.8%	0.8%	0.8%	0.7%	0.7%	0.7%
Multiple Family	0.4%	0.5%	0.5%	0.5%	0.5%	0.5%
Non-Residential	0.8%	0.7%	0.7%	0.7%	0.7%	0.7%
Cohasset Town, MA						
Single Family	1.3%	1.5%	1.5%	1.5%	1.5%	1.5%
Multiple Family	1.2%	1.5%	1.6%	1.7%	1.7%	1.7%
Non-Residential	2.6%	3.0%	3.3%	3.3%	3.4%	3.4%
Vassar City, MI						
Single Family	1.7%	2.0%	2.1%	2.2%	2.2%	2.2%
Multiple Family	1.1%	1.4%	1.6%	1.6%	1.7%	1.7%
Non-Residential	2.1%	2.4%	2.4%	2.4%	2.3%	2.3%
Petal City, MS						
Single Family	1.5%	1.9%	2.0%	2.1%	2.2%	2.2%
Multiple Family	1.1%	1.4%	1.6%	1.7%	1.8%	1.8%
Non-Residential	1.5%	1.8%	1.9%	1.9%	1.9%	1.8%
Scott County, MO						
Single Family	0.5%	0.6%	0.6%	0.6%	0.6%	0.7%
Multiple Family	0.4%	0.6%	0.6%	0.7%	0.7%	0.7%
Non-Residential	0.6%	0.7%	0.7%	0.7%	0.7%	0.7%

Omaha City, NE						
Single Family	1.9%	2.2%	2.3%	2.3%	2.3%	2.3%
Multiple Family	1.2%	1.5%	1.6%	1.7%	1.7%	1.7%
Non-Residential	2.4%	3.2%	3.7%	3.8%	3.9%	3.9%
Pender Village, NE						
Single Family	1.0%	1.2%	1.3%	1.4%	1.4%	1.5%
Multiple Family	0.8%	1.0%	1.1%	1.3%	1.3%	1.3%
Non-Residential	1.8%	2.1%	2.3%	2.4%	2.5%	2.5%
Woodstock Town, NH						
Single Family	2.1%	2.4%	2.5%	2.5%	2.5%	2.5%
Multiple Family	1.2%	1.4%	1.4%	1.5%	1.5%	1.6%
Non-Residential	2.0%	2.5%	2.6%	2.7%	2.7%	2.8%

Table F.10 (Continued)
Percent Change from Baseline for Average Real Pre-FIRM Property Values from 1997 to 202
Scenario 1: Property Elevation At and Above BFE
Sample Communities

Community	1998	2002	2007	2012	2017	2022
Bloomingdale Borough, NJ						
Single Family	1.5%	1.7%	1.7%	1.7%	1.7%	1.7%
Multiple Family	1.1%	1.3%	1.4%	1.4%	1.5%	1.5%
Non-Residential	2.1%	2.3%	2.2%	2.1%	2.1%	2.0%
Lincoln Park Borough, NJ						
Single Family	1.0%	1.1%	1.1%	1.2%	1.2%	1.2%
Multiple Family	0.9%	1.0%	1.1%	1.2%	1.2%	1.3%
Non-Residential	1.6%	1.7%	1.8%	1.8%	1.8%	1.8%
Niagara Town, NY						
Single Family	1.3%	1.6%	1.7%	1.7%	1.7%	1.7%
Multiple Family	1.8%	2.3%	2.7%	2.9%	3.0%	3.2%
Non-Residential	2.1%	2.4%	2.4%	2.4%	2.3%	2.3%
Waterford Village, NY						
Single Family	1.8%	2.1%	2.2%	2.2%	2.2%	2.2%
Multiple Family	1.3%	1.5%	1.6%	1.6%	1.7%	1.7%
Non-Residential	3.0%	3.5%	3.7%	3.8%	3.8%	3.8%
Carteret County, NC						
Single Family	0.8%	0.9%	1.0%	1.0%	1.0%	1.0%
Multiple Family	0.6%	0.7%	0.8%	0.8%	0.9%	0.9%
Non-Residential	1.2%	1.5%	1.9%	2.1%	2.2%	2.4%
Edenton, NC						
Single Family	0.3%	0.4%	0.4%	0.4%	0.4%	0.4%
Multiple Family	0.3%	0.4%	0.5%	0.5%	0.5%	0.5%
Non-Residential	0.6%	0.7%	0.8%	0.8%	0.8%	0.8%
New Miami Village, OH						
Single Family	1.6%	1.9%	2.0%	2.1%	2.1%	2.1%
Multiple Family	1.3%	1.7%	1.8%	1.9%	2.0%	2.0%
Non-Residential	2.2%	2.8%	3.1%	3.2%	3.3%	3.3%
Washington County, OK						
Single Family	0.9%	1.1%	1.2%	1.3%	1.3%	1.3%
Multiple Family	0.8%	1.0%	1.1%	1.2%	1.2%	1.3%
Non-Residential	1.4%	1.7%	1.8%	1.9%	1.8%	1.8%
Lane County, OR						
Single Family	1.3%	1.6%	1.7%	1.7%	1.7%	1.7%
Multiple Family	0.9%	1.1%	1.3%	1.3%	1.4%	1.4%
Non-Residential	1.7%	2.2%	2.4%	2.4%	2.5%	2.5%
Vernonia City, OR						
Single Family	1.4%	1.6%	1.6%	1.6%	1.6%	1.6%

Multiple Family	0.8%	0.9%	0.9%	0.9%	1.0%	0.9%
Non-Residential	1.8%	2.1%	2.1%	2.1%	2.1%	2.0%
Franklin Township, PA						
Single Family	1.4%	1.7%	1.9%	2.0%	2.0%	2.0%
Multiple Family	1.3%	1.7%	1.9%	2.1%	2.1%	2.2%
Non-Residential	1.5%	1.8%	1.9%	1.9%	1.9%	1.8%
Glen Rock Borough, PA						
Single Family	3.0%	3.2%	3.4%	3.6%	3.7%	3.8%
Multiple Family	2.0%	2.2%	2.4%	2.6%	2.8%	3.0%
Non-Residential	4.9%	4.8%	4.0%	2.6%	1.0%	0.0%
Lower Mt. Bethel Township, PA						
Single Family	6.0%	6.1%	6.1%	6.2%	6.3%	6.3%
Multiple Family	2.8%	2.4%	1.8%	1.3%	0.7%	0.0%
Non-Residential	5.5%	4.4%	3.0%	2.0%	1.0%	0.0%

Table F.10 (Continued)

Percent Change from Baseline for Average Real Pre-FIRM Property Values from 1997 to 2022

Scenario 1: Property Elevation At and Above BFE

Sample Communities

Community	1998	2002	2007	2012	2017	2022
New Cumberland Borough, PA						
Single Family	1.7%	2.0%	2.0%	2.0%	2.1%	2.1%
Multiple Family	1.3%	1.5%	1.6%	1.6%	1.6%	1.6%
Non-Residential	2.5%	2.9%	3.0%	3.0%	3.0%	3.0%
Myrtle Beach City, SC						
Single Family	1.1%	1.1%	1.1%	1.1%	1.1%	1.1%
Multiple Family	1.0%	1.1%	1.1%	1.1%	1.2%	1.2%
Non-Residential	1.9%	2.3%	2.5%	2.6%	2.7%	2.7%
Lawrence County, SD						
Single Family	1.5%	1.8%	1.9%	2.0%	2.0%	2.0%
Multiple Family	1.0%	1.2%	1.3%	1.3%	1.3%	1.3%
Non-Residential	1.9%	2.2%	2.3%	2.4%	2.3%	2.3%
Brookside Village City, TX						
Single Family	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Multiple Family	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Non-Residential	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Garland City, TX						
Single Family	0.6%	0.7%	0.7%	0.7%	0.7%	0.7%
Multiple Family	0.6%	0.8%	0.9%	0.9%	1.0%	1.0%
Non-Residential	1.1%	1.2%	1.2%	1.1%	1.1%	1.0%
League City, TX						
Single Family	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
Multiple Family	0.1%	0.2%	0.2%	0.2%	0.2%	0.2%
Non-Residential	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%
Grundy Town, VA						
Single Family	1.5%	1.6%	1.6%	1.7%	1.7%	1.7%
Multiple Family	1.6%	1.9%	1.9%	1.9%	1.8%	1.6%
Non-Residential	1.7%	1.8%	1.7%	1.7%	1.7%	1.7%
Ephrata City, WA						
Single Family	1.3%	1.5%	1.5%	1.5%	1.5%	1.5%
Multiple Family	1.4%	1.7%	1.9%	2.0%	2.1%	2.1%
Non-Residential	1.7%	2.0%	2.0%	2.0%	2.0%	2.0%
Leavenworth City, WA						
Single Family	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%
Multiple Family	0.2%	0.2%	0.1%	0.1%	0.1%	0.0%
Non-Residential	0.4%	0.4%	0.4%	0.3%	0.2%	0.0%
Marlinton Town, WV						
Single Family	1.1%	1.1%	1.2%	1.3%	1.3%	1.3%
Multiple Family	0.8%	0.9%	0.6%	0.4%	0.2%	0.0%
Non-Residential	1.4%	1.5%	1.7%	1.7%	1.7%	1.7%

Philippi City, WV						
Single Family	1.6%	1.7%	1.7%	1.8%	1.9%	1.9%
Multiple Family	1.0%	1.3%	1.4%	1.4%	1.5%	1.6%
Non-Residential	1.6%	1.9%	1.9%	2.1%	2.1%	2.1%
Wheeling City, WV						
Single Family	1.8%	2.1%	2.2%	2.3%	2.5%	2.5%
Multiple Family	1.3%	1.4%	1.5%	1.6%	1.7%	1.7%
Non-Residential	1.6%	1.8%	1.8%	1.9%	2.0%	2.0%

Table F.11
Percent Change from Baseline for Average Real Pre-FIRM Property Values from 1997 to 2022
Scenario 2: Property Elevation At and Above BFE
Sample Communities

Community	1998	2002	2007	2012	2017	2022
Phoenix City, AZ						
Single Family	1.3%	1.5%	1.5%	1.6%	1.5%	1.6%
Multiple Family	0.9%	1.1%	1.1%	1.2%	1.2%	1.2%
Non-Residential	1.9%	2.1%	2.0%	1.9%	1.8%	1.8%
Bay City, AR						
Single Family	1.3%	1.5%	1.6%	1.6%	1.6%	1.6%
Multiple Family	1.4%	1.8%	2.0%	2.2%	2.2%	2.3%
Non-Residential	1.6%	1.8%	1.8%	1.8%	1.8%	1.7%
Sacramento County, CA						
Single Family	2.0%	2.3%	2.3%	2.3%	2.3%	2.3%
Multiple Family	1.2%	1.4%	1.6%	1.7%	1.7%	1.8%
Non-Residential	2.2%	2.4%	2.4%	2.3%	2.2%	2.2%
Santa Cruz City, CA						
Single Family	1.0%	1.1%	1.2%	1.2%	1.2%	1.1%
Multiple Family	1.1%	1.3%	1.3%	1.4%	1.4%	1.5%
Non-Residential	2.2%	2.5%	2.5%	2.5%	2.5%	2.5%
Dolores Town, CO						
Single Family	1.2%	1.5%	1.5%	1.6%	1.6%	1.6%
Multiple Family	0.9%	1.0%	1.1%	1.1%	1.2%	1.2%
Non-Residential	1.9%	2.4%	2.6%	2.7%	2.7%	2.7%
Otero County, CO						
Single Family	1.2%	1.5%	1.6%	1.7%	1.7%	1.7%
Multiple Family	0.9%	1.1%	1.3%	1.3%	1.3%	1.4%
Non-Residential	1.7%	2.0%	2.1%	2.1%	2.2%	2.1%
Ft. Lauderdale City, FL						
Single Family	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%
Multiple Family	0.4%	0.4%	0.4%	0.4%	0.4%	0.4%
Non-Residential	0.6%	0.6%	0.5%	0.5%	0.5%	0.5%
New Smyrna Beach City, FL						
Single Family	0.2%	0.3%	0.3%	0.3%	0.3%	0.3%
Multiple Family	0.2%	0.2%	0.3%	0.3%	0.3%	0.3%
Non-Residential	0.4%	0.4%	0.4%	0.3%	0.3%	0.3%
St. Petersburg Beach City, FL						
Single Family	2.0%	2.0%	2.1%	2.2%	2.3%	2.4%
Multiple Family	1.1%	1.1%	1.1%	1.2%	1.2%	1.2%
Non-Residential	3.2%	3.2%	3.2%	3.3%	3.3%	3.3%
Hailey City, ID						
Single Family	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Multiple Family	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Non-Residential	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Grundy County, IL						

Single Family	1.4%	1.6%	1.7%	1.8%	1.8%	1.8%
Multiple Family	1.0%	1.3%	1.4%	1.5%	1.5%	1.6%
Non-Residential	2.4%	2.9%	3.2%	3.3%	3.4%	3.4%
Council Bluffs City, IA						
Single Family	2.1%	2.3%	2.5%	2.5%	2.6%	2.7%
Multiple Family	0.9%	1.1%	1.2%	1.2%	1.2%	1.2%
Non-Residential	1.5%	1.6%	1.7%	1.6%	1.7%	1.7%
Augusta City, KY						
Single Family	1.1%	1.3%	1.4%	1.5%	1.5%	1.5%
Multiple Family	1.3%	1.5%	1.6%	1.6%	1.6%	1.6%
Non-Residential	1.6%	1.9%	1.9%	2.0%	2.0%	2.0%

Table F.11 (Continued)

Percent Change from Baseline for Average Real Pre-FIRM Property Values from 1997 to 2022

Scenario 2: Property Elevation At and Above BFE

Sample Communities

Community	1998	2002	2007	2012	2017	2022
Lewisport City, KY						
Single Family	0.7%	0.8%	0.8%	0.9%	0.9%	0.9%
Multiple Family	0.7%	0.8%	0.9%	1.0%	1.0%	1.0%
Non-Residential	0.7%	0.8%	0.8%	0.8%	0.8%	0.8%
Louisville/Jefferson, KY						
Single Family	2.0%	2.2%	2.3%	2.3%	2.3%	2.3%
Multiple Family	1.5%	1.8%	2.0%	2.1%	2.2%	2.2%
Non-Residential	3.7%	3.8%	3.4%	3.0%	2.7%	2.4%
Allen Parish, LA						
Single Family	0.7%	0.9%	1.0%	1.0%	1.0%	1.0%
Multiple Family	0.6%	0.8%	0.9%	1.0%	1.1%	1.1%
Non-Residential	0.9%	1.1%	1.3%	1.3%	1.3%	1.3%
Jefferson Parish, LA						
Single Family	0.9%	0.9%	0.8%	0.8%	0.8%	0.8%
Multiple Family	0.7%	0.8%	0.8%	0.9%	0.9%	0.9%
Non-Residential	1.0%	1.0%	0.9%	0.9%	0.8%	0.8%
Shreveport City, LA						
Single Family	0.8%	0.8%	0.8%	0.7%	0.7%	0.7%
Multiple Family	0.4%	0.5%	0.5%	0.5%	0.5%	0.5%
Non-Residential	0.8%	0.7%	0.7%	0.7%	0.7%	0.7%
Cohasset Town, MA						
Single Family	1.3%	1.5%	1.5%	1.5%	1.5%	1.5%
Multiple Family	1.2%	1.5%	1.6%	1.6%	1.7%	1.7%
Non-Residential	2.6%	3.0%	3.3%	3.3%	3.4%	3.4%
Vassar City, MI						
Single Family	1.7%	2.0%	2.1%	2.2%	2.2%	2.2%
Multiple Family	1.1%	1.4%	1.6%	1.6%	1.7%	1.7%
Non-Residential	2.1%	2.4%	2.4%	2.4%	2.3%	2.3%
Petal City, MS						
Single Family	1.5%	1.9%	2.0%	2.1%	2.2%	2.2%
Multiple Family	1.1%	1.4%	1.6%	1.7%	1.8%	1.8%
Non-Residential	1.5%	1.8%	1.9%	1.9%	1.8%	1.8%
Scott County, MO						
Single Family	0.5%	0.6%	0.6%	0.6%	0.6%	0.7%
Multiple Family	0.4%	0.6%	0.6%	0.7%	0.7%	0.7%
Non-Residential	0.6%	0.7%	0.7%	0.7%	0.7%	0.7%
Omaha City, NE						
Single Family	1.9%	2.2%	2.3%	2.3%	2.3%	2.3%
Multiple Family	1.2%	1.5%	1.6%	1.7%	1.7%	1.7%
Non-Residential	2.4%	3.2%	3.7%	3.8%	3.9%	3.9%
Pender Village, NE						

Single Family	1.0%	1.2%	1.3%	1.4%	1.4%	1.5%
Multiple Family	0.8%	1.0%	1.1%	1.2%	1.3%	1.3%
Non-Residential	1.8%	2.1%	2.3%	2.4%	2.5%	2.5%
Woodstock Town, NH						
Single Family	2.1%	2.4%	2.5%	2.5%	2.5%	2.5%
Multiple Family	1.2%	1.4%	1.4%	1.5%	1.5%	1.6%
Non-Residential	2.0%	2.5%	2.6%	2.7%	2.7%	2.8%

Table F.11 (Continued)
Percent Change from Baseline for Average Real Pre-FIRM Property Values from 1997 to 2022
Scenario 2: Property Elevation At and Above BFE
Sample Communities

Community	1998	2002	2007	2012	2017	2022
Bloomingdale Borough, NJ						
Single Family	1.5%	1.7%	1.7%	1.7%	1.7%	1.7%
Multiple Family	1.1%	1.3%	1.4%	1.4%	1.5%	1.5%
Non-Residential	2.1%	2.3%	2.2%	2.1%	2.1%	2.0%
Lincoln Park Borough, NJ						
Single Family	1.0%	1.1%	1.1%	1.2%	1.2%	1.2%
Multiple Family	0.9%	1.0%	1.1%	1.2%	1.2%	1.3%
Non-Residential	1.6%	1.7%	1.8%	1.8%	1.8%	1.8%
Niagara Town, NY						
Single Family	1.3%	1.6%	1.7%	1.7%	1.7%	1.7%
Multiple Family	1.8%	2.3%	2.7%	2.9%	3.0%	3.2%
Non-Residential	2.1%	2.4%	2.4%	2.4%	2.3%	2.3%
Waterford Village, NY						
Single Family	1.8%	2.1%	2.2%	2.2%	2.2%	2.2%
Multiple Family	1.3%	1.5%	1.6%	1.6%	1.7%	1.7%
Non-Residential	3.0%	3.5%	3.7%	3.8%	3.8%	3.8%
Carteret County, NC						
Single Family	0.8%	0.9%	1.0%	1.0%	1.0%	1.0%
Multiple Family	0.6%	0.7%	0.8%	0.8%	0.9%	0.9%
Non-Residential	1.2%	1.5%	1.9%	2.1%	2.2%	2.4%
Edenton, NC						
Single Family	0.3%	0.4%	0.4%	0.4%	0.4%	0.4%
Multiple Family	0.3%	0.4%	0.5%	0.5%	0.5%	0.5%
Non-Residential	0.6%	0.7%	0.8%	0.8%	0.8%	0.8%
New Miami Village, OH						
Single Family	1.6%	1.9%	2.0%	2.1%	2.1%	2.1%
Multiple Family	1.3%	1.7%	1.8%	2.0%	2.0%	2.1%
Non-Residential	2.2%	2.8%	3.1%	3.2%	3.3%	3.3%
Washington County, OK						
Single Family	0.9%	1.1%	1.2%	1.3%	1.3%	1.3%
Multiple Family	0.8%	1.0%	1.1%	1.2%	1.3%	1.3%
Non-Residential	1.4%	1.7%	1.8%	1.9%	1.9%	1.8%
Lane County, OR						
Single Family	1.3%	1.6%	1.7%	1.7%	1.7%	1.7%
Multiple Family	0.9%	1.1%	1.3%	1.4%	1.4%	1.4%
Non-Residential	1.7%	2.2%	2.4%	2.4%	2.5%	2.5%
Vernonia City, OR						
Single Family	1.4%	1.6%	1.6%	1.6%	1.6%	1.6%
Multiple Family	0.8%	0.9%	0.9%	0.9%	1.0%	0.9%
Non-Residential	1.8%	2.1%	2.1%	2.1%	2.1%	2.0%
Franklin Township, PA						
Single Family	1.4%	1.7%	1.9%	2.0%	2.0%	2.0%

Multiple Family	1.3%	1.7%	1.9%	2.1%	2.1%	2.2%
Non-Residential	1.5%	1.8%	1.9%	1.9%	1.9%	1.8%
Glen Rock Borough, PA						
Single Family	3.0%	3.2%	3.4%	3.6%	3.7%	3.8%
Multiple Family	2.0%	2.2%	2.4%	2.6%	2.8%	3.0%
Non-Residential	4.9%	4.7%	3.9%	2.4%	1.0%	0.0%
Lower Mt. Bethel Township, PA						
Single Family	6.0%	6.1%	6.1%	6.3%	6.3%	6.3%
Multiple Family	2.8%	2.4%	2.0%	1.4%	0.7%	0.0%
Non-Residential	5.5%	4.3%	3.3%	2.2%	1.1%	0.0%

Table F.11 (Continued)

Percent Change from Baseline for Average Real Pre-FIRM Property Values from 1997 to 2022

Scenario 2: Property Elevation At and Above BFE

Sample Communities

Community	1998	2002	2007	2012	2017	2022
New Cumberland Borough, PA						
Single Family	1.7%	2.0%	2.0%	2.0%	2.1%	2.1%
Multiple Family	1.3%	1.5%	1.6%	1.6%	1.6%	1.6%
Non-Residential	2.5%	2.9%	2.9%	3.0%	3.0%	3.0%
Myrtle Beach City, SC						
Single Family	1.1%	1.1%	1.1%	1.1%	1.1%	1.0%
Multiple Family	1.0%	1.1%	1.1%	1.1%	1.2%	1.2%
Non-Residential	1.9%	2.3%	2.5%	2.6%	2.7%	2.7%
Lawrence County, SD						
Single Family	1.5%	1.8%	1.9%	2.0%	2.0%	2.0%
Multiple Family	1.0%	1.2%	1.3%	1.3%	1.3%	1.3%
Non-Residential	1.9%	2.2%	2.3%	2.4%	2.3%	2.3%
Brookside Village City, TX						
Single Family	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Multiple Family	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Non-Residential	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Garland City, TX						
Single Family	0.6%	0.7%	0.7%	0.7%	0.7%	0.7%
Multiple Family	0.6%	0.8%	0.9%	0.9%	1.0%	1.0%
Non-Residential	1.1%	1.2%	1.2%	1.1%	1.1%	1.1%
League City, TX						
Single Family	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
Multiple Family	0.1%	0.2%	0.2%	0.2%	0.2%	0.2%
Non-Residential	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%
Grundy Town, VA						
Single Family	1.5%	1.6%	1.6%	1.7%	1.7%	1.7%
Multiple Family	1.6%	1.9%	1.9%	1.9%	1.8%	1.4%
Non-Residential	1.7%	1.8%	1.7%	1.7%	1.7%	1.7%
Ephrata City, WA						
Single Family	1.3%	1.5%	1.5%	1.5%	1.5%	1.5%
Multiple Family	1.4%	1.7%	1.9%	2.0%	2.1%	2.1%
Non-Residential	1.7%	2.0%	2.0%	2.0%	2.0%	2.0%
Leavenworth City, WA						
Single Family	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%
Multiple Family	0.2%	0.2%	0.1%	0.1%	0.1%	0.0%
Non-Residential	0.4%	0.4%	0.4%	0.3%	0.2%	0.0%
Marlinton Town, WV						
Single Family	1.1%	1.1%	1.2%	1.3%	1.3%	1.3%
Multiple Family	0.8%	0.9%	0.6%	0.4%	0.2%	0.0%
Non-Residential	1.4%	1.5%	1.7%	1.7%	1.7%	1.7%
Philippi City, WV						
Single Family	1.6%	1.7%	1.7%	1.8%	1.9%	1.9%
Multiple Family	1.0%	1.3%	1.4%	1.4%	1.5%	1.6%

Non-Residential	1.6%	1.9%	1.9%	2.1%	2.1%	2.1%
Wheeling City, WV						
Single Family	1.8%	2.1%	2.2%	2.3%	2.4%	2.5%
Multiple Family	1.3%	1.4%	1.5%	1.6%	1.7%	1.7%
Non-Residential	1.6%	1.8%	1.8%	1.8%	1.9%	2.0%

Table F.12
Percent Change from Baseline for Average Real Pre-FIRM Property Values from 1997 to 2022
Scenario 3: Property Elevation At and Above BFE
Sample Communities

Community	1998	2002	2007	2012	2017	2022
Phoenix City, AZ						
Single Family	1.3%	1.5%	1.5%	1.6%	1.5%	1.5%
Multiple Family	0.9%	1.1%	1.1%	1.2%	1.2%	1.2%
Non-Residential	1.9%	2.1%	2.0%	1.9%	1.8%	1.8%
Bay City, AR						
Single Family	1.3%	1.5%	1.6%	1.6%	1.6%	1.6%
Multiple Family	1.4%	1.8%	2.0%	2.1%	2.2%	2.3%
Non-Residential	1.6%	1.8%	1.8%	1.8%	1.8%	1.7%
Sacramento County, CA						
Single Family	2.0%	2.3%	2.3%	2.3%	2.3%	2.3%
Multiple Family	1.2%	1.4%	1.6%	1.7%	1.7%	1.8%
Non-Residential	2.2%	2.4%	2.4%	2.3%	2.2%	2.2%
Santa Cruz City, CA						
Single Family	1.0%	1.1%	1.2%	1.2%	1.2%	1.1%
Multiple Family	1.1%	1.3%	1.3%	1.4%	1.4%	1.4%
Non-Residential	2.2%	2.5%	2.5%	2.5%	2.5%	2.5%
Dolores Town, CO						
Single Family	1.2%	1.5%	1.5%	1.6%	1.6%	1.6%
Multiple Family	0.9%	1.0%	1.1%	1.2%	1.2%	1.2%
Non-Residential	1.9%	2.4%	2.5%	2.6%	2.7%	2.7%
Otero County, CO						
Single Family	1.2%	1.5%	1.6%	1.7%	1.7%	1.7%
Multiple Family	0.9%	1.1%	1.2%	1.3%	1.3%	1.3%
Non-Residential	1.7%	2.0%	2.1%	2.1%	2.1%	2.1%
Ft. Lauderdale City, FL						
Single Family	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%
Multiple Family	0.4%	0.4%	0.4%	0.4%	0.4%	0.4%
Non-Residential	0.6%	0.6%	0.5%	0.5%	0.5%	0.5%
New Smyrna Beach City, FL						
Single Family	0.2%	0.3%	0.3%	0.3%	0.3%	0.3%
Multiple Family	0.2%	0.2%	0.3%	0.3%	0.3%	0.3%
Non-Residential	0.4%	0.4%	0.4%	0.3%	0.3%	0.3%
St. Petersburg Beach City, FL						
Single Family	2.0%	2.0%	2.1%	2.2%	2.3%	2.4%
Multiple Family	1.1%	1.1%	1.1%	1.2%	1.2%	1.2%
Non-Residential	3.2%	3.2%	3.2%	3.3%	3.3%	3.3%
Hailey City, ID						
Single Family	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Multiple Family	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Non-Residential	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Grundy County, IL						
Single Family	1.4%	1.6%	1.7%	1.8%	1.8%	1.8%
Multiple Family	1.0%	1.3%	1.4%	1.5%	1.5%	1.6%
Non-Residential	2.4%	2.9%	3.2%	3.3%	3.4%	3.4%

Council Bluffs City, IA						
Single Family	2.1%	2.3%	2.5%	2.5%	2.6%	2.7%
Multiple Family	0.9%	1.1%	1.2%	1.1%	1.2%	1.2%
Non-Residential	1.5%	1.6%	1.7%	1.6%	1.7%	1.7%
Augusta City, KY						
Single Family	1.1%	1.3%	1.4%	1.5%	1.5%	1.5%
Multiple Family	1.3%	1.5%	1.6%	1.6%	1.6%	1.6%
Non-Residential	1.6%	1.9%	2.0%	2.0%	2.0%	2.1%

Table F.12 (Continued)

Percent Change from Baseline for Average Real Pre-FIRM Property Values from 1997 to 2022

Scenario 3: Property Elevation At and Above BFE

Sample Communities

Community	1998	2002	2007	2012	2017	2022
Lewisport City, KY						
Single Family	0.7%	0.8%	0.8%	0.9%	0.9%	0.9%
Multiple Family	0.7%	0.8%	0.9%	1.0%	1.0%	1.0%
Non-Residential	0.7%	0.8%	0.8%	0.8%	0.8%	0.8%
Louisville/Jefferson, KY						
Single Family	2.0%	2.2%	2.3%	2.3%	2.3%	2.4%
Multiple Family	1.5%	1.8%	2.0%	2.1%	2.2%	2.2%
Non-Residential	3.7%	3.8%	3.4%	3.0%	2.7%	2.4%
Allen Parish, LA						
Single Family	0.7%	0.9%	1.0%	1.0%	1.0%	1.0%
Multiple Family	0.6%	0.8%	0.9%	1.0%	1.1%	1.1%
Non-Residential	0.9%	1.1%	1.3%	1.3%	1.4%	1.4%
Jefferson Parish, LA						
Single Family	0.9%	0.9%	0.8%	0.8%	0.8%	0.8%
Multiple Family	0.7%	0.8%	0.8%	0.9%	0.9%	0.9%
Non-Residential	1.0%	1.0%	0.9%	0.9%	0.8%	0.8%
Shreveport City, LA						
Single Family	0.8%	0.8%	0.8%	0.7%	0.7%	0.7%
Multiple Family	0.4%	0.5%	0.5%	0.5%	0.5%	0.5%
Non-Residential	0.8%	0.7%	0.7%	0.7%	0.7%	0.7%
Cohasset Town, MA						
Single Family	1.3%	1.5%	1.5%	1.5%	1.5%	1.5%
Multiple Family	1.2%	1.5%	1.6%	1.6%	1.7%	1.7%
Non-Residential	2.6%	3.0%	3.3%	3.3%	3.4%	3.4%
Vassar City, MI						
Single Family	1.7%	2.0%	2.1%	2.2%	2.2%	2.2%
Multiple Family	1.1%	1.4%	1.6%	1.7%	1.7%	1.7%
Non-Residential	2.1%	2.4%	2.4%	2.4%	2.4%	2.3%
Petal City, MS						
Single Family	1.5%	1.9%	2.0%	2.1%	2.2%	2.2%
Multiple Family	1.1%	1.4%	1.6%	1.7%	1.8%	1.8%
Non-Residential	1.5%	1.8%	1.9%	1.9%	1.9%	1.8%
Scott County, MO						
Single Family	0.5%	0.6%	0.6%	0.6%	0.6%	0.7%
Multiple Family	0.4%	0.6%	0.6%	0.7%	0.7%	0.7%
Non-Residential	0.6%	0.7%	0.7%	0.7%	0.7%	0.7%
Omaha City, NE						
Single Family	1.9%	2.2%	2.3%	2.3%	2.3%	2.3%
Multiple Family	1.2%	1.5%	1.6%	1.7%	1.7%	1.7%
Non-Residential	2.4%	3.2%	3.7%	3.8%	3.9%	3.9%
Pender Village, NE						
Single Family	1.0%	1.2%	1.3%	1.4%	1.4%	1.5%
Multiple Family	0.8%	1.0%	1.1%	1.2%	1.2%	1.3%
Non-Residential	1.8%	2.1%	2.3%	2.4%	2.4%	2.5%
Woodstock Town, NH						

Single Family	2.1%	2.4%	2.5%	2.5%	2.5%	2.5%
Multiple Family	1.2%	1.4%	1.4%	1.5%	1.5%	1.6%
Non-Residential	2.0%	2.5%	2.6%	2.7%	2.7%	2.8%

Table F.12 (Continued)
Percent Change from Baseline for Average Real Pre-FIRM Property Values from 1997 to 2022
Scenario 3: Property Elevation At and Above BFE
Sample Communities

Community	1998	2002	2007	2012	2017	2022
Bloomingdale Borough, NJ						
Single Family	1.5%	1.7%	1.7%	1.7%	1.7%	1.7%
Multiple Family	1.1%	1.3%	1.4%	1.4%	1.5%	1.5%
Non-Residential	2.1%	2.3%	2.2%	2.2%	2.1%	2.1%
Lincoln Park Borough, NJ						
Single Family	1.0%	1.1%	1.1%	1.2%	1.2%	1.2%
Multiple Family	0.9%	1.0%	1.1%	1.2%	1.2%	1.3%
Non-Residential	1.6%	1.7%	1.8%	1.8%	1.8%	1.8%
Niagara Town, NY						
Single Family	1.3%	1.6%	1.7%	1.7%	1.7%	1.7%
Multiple Family	1.8%	2.3%	2.7%	2.8%	3.0%	3.2%
Non-Residential	2.1%	2.4%	2.4%	2.4%	2.3%	2.3%
Waterford Village, NY						
Single Family	1.8%	2.1%	2.2%	2.2%	2.2%	2.2%
Multiple Family	1.3%	1.5%	1.6%	1.6%	1.7%	1.7%
Non-Residential	3.0%	3.5%	3.7%	3.8%	3.8%	3.9%
Carteret County, NC						
Single Family	0.8%	0.9%	1.0%	1.0%	1.0%	1.0%
Multiple Family	0.6%	0.7%	0.8%	0.8%	0.9%	0.9%
Non-Residential	1.2%	1.5%	1.9%	2.1%	2.2%	2.4%
Edenton, NC						
Single Family	0.3%	0.4%	0.4%	0.4%	0.4%	0.4%
Multiple Family	0.3%	0.4%	0.5%	0.5%	0.5%	0.5%
Non-Residential	0.6%	0.7%	0.8%	0.8%	0.8%	0.8%
New Miami Village, OH						
Single Family	1.6%	1.9%	2.0%	2.1%	2.1%	2.1%
Multiple Family	1.3%	1.7%	1.9%	2.0%	2.0%	2.1%
Non-Residential	2.2%	2.8%	3.1%	3.2%	3.3%	3.3%
Washington County, OK						
Single Family	0.9%	1.1%	1.2%	1.3%	1.3%	1.3%
Multiple Family	0.8%	1.0%	1.1%	1.2%	1.2%	1.3%
Non-Residential	1.4%	1.7%	1.8%	1.8%	1.8%	1.8%
Lane County, OR						
Single Family	1.3%	1.6%	1.7%	1.7%	1.7%	1.7%
Multiple Family	0.9%	1.1%	1.3%	1.3%	1.4%	1.4%
Non-Residential	1.7%	2.2%	2.4%	2.4%	2.4%	2.5%
Vernonia City, OR						
Single Family	1.4%	1.6%	1.6%	1.6%	1.6%	1.6%
Multiple Family	0.8%	0.9%	1.0%	0.9%	0.9%	0.8%
Non-Residential	1.8%	2.1%	2.1%	2.1%	2.0%	2.0%
Franklin Township, PA						
Single Family	1.4%	1.7%	1.9%	2.0%	2.0%	2.0%
Multiple Family	1.3%	1.7%	1.9%	2.1%	2.1%	2.2%
Non-Residential	1.5%	1.8%	1.9%	1.9%	1.9%	1.8%
Glen Rock Borough, PA						
Single Family	3.0%	3.2%	3.4%	3.5%	3.7%	3.8%

Multiple Family	2.0%	2.2%	2.4%	2.6%	2.8%	3.0%
Non-Residential	4.9%	4.8%	4.0%	2.6%	1.0%	0.0%
Lower Mt. Bethel Township, PA						
Single Family	6.0%	6.1%	6.1%	6.3%	6.3%	6.4%
Multiple Family	2.8%	2.4%	1.8%	1.3%	0.7%	0.0%
Non-Residential	5.5%	4.4%	3.0%	2.0%	1.0%	0.0%

Table F.12 (Continued)

Percent Change from Baseline for Average Real Pre-FIRM Property Values from 1997 to 2022

Scenario 3: Property Elevation At and Above BFE

Sample Communities

Community	1998	2002	2007	2012	2017	2022
New Cumberland Borough, PA						
Single Family	1.7%	2.0%	2.0%	2.0%	2.1%	2.1%
Multiple Family	1.3%	1.5%	1.6%	1.6%	1.6%	1.6%
Non-Residential	2.5%	2.9%	2.9%	3.0%	3.0%	3.0%
Myrtle Beach City, SC						
Single Family	1.1%	1.1%	1.1%	1.1%	1.1%	1.0%
Multiple Family	1.0%	1.1%	1.1%	1.1%	1.2%	1.2%
Non-Residential	1.9%	2.3%	2.5%	2.6%	2.7%	2.7%
Lawrence County, SD						
Single Family	1.5%	1.8%	1.9%	2.0%	2.0%	2.0%
Multiple Family	1.0%	1.2%	1.3%	1.3%	1.4%	1.4%
Non-Residential	1.9%	2.2%	2.3%	2.3%	2.3%	2.3%
Brookside Village City, TX						
Single Family	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Multiple Family	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Non-Residential	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Garland City, TX						
Single Family	0.6%	0.7%	0.7%	0.7%	0.7%	0.7%
Multiple Family	0.6%	0.8%	0.9%	0.9%	1.0%	1.0%
Non-Residential	1.1%	1.2%	1.2%	1.1%	1.1%	1.0%
League City, TX						
Single Family	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
Multiple Family	0.1%	0.2%	0.2%	0.2%	0.2%	0.2%
Non-Residential	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%
Grundy Town, VA						
Single Family	1.5%	1.7%	1.6%	1.7%	1.7%	1.7%
Multiple Family	1.6%	1.9%	1.9%	1.9%	1.6%	1.3%
Non-Residential	1.7%	1.8%	1.7%	1.7%	1.7%	1.7%
Ephrata City, WA						
Single Family	1.3%	1.5%	1.5%	1.5%	1.5%	1.5%
Multiple Family	1.4%	1.7%	1.9%	2.0%	2.1%	2.1%
Non-Residential	1.7%	2.0%	2.0%	2.0%	2.0%	1.9%
Leavenworth City, WA						
Single Family	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%
Multiple Family	0.2%	0.2%	0.1%	0.1%	0.1%	0.0%
Non-Residential	0.4%	0.4%	0.4%	0.3%	0.2%	0.0%
Marlinton Town, WV						
Single Family	1.1%	1.1%	1.2%	1.3%	1.3%	1.3%
Multiple Family	0.8%	0.9%	0.6%	0.4%	0.2%	0.0%
Non-Residential	1.4%	1.5%	1.7%	1.7%	1.7%	1.7%
Philippi City, WV						
Single Family	1.6%	1.7%	1.7%	1.8%	1.9%	1.9%
Multiple Family	1.0%	1.3%	1.4%	1.4%	1.5%	1.5%
Non-Residential	1.6%	1.9%	1.9%	2.1%	2.1%	2.1%
Wheeling City, WV						
Single Family	1.8%	2.1%	2.2%	2.3%	2.4%	2.5%
Multiple Family	1.3%	1.4%	1.5%	1.6%	1.7%	1.7%

Non-Residential	1.6%	1.8%	1.8%	1.9%	1.9%	2.0%

Table F.13
Percent Change from Baseline for Average Real Pre-FIRM Property Values from 1997 to 2022
Scenario 4: Property Elevation At and Above BFE
Sample Communities

Community	1998	2002	2007	2012	2017	2022
Phoenix City, AZ						
Single Family	1.3%	1.5%	1.5%	1.6%	1.5%	1.5%
Multiple Family	0.9%	1.1%	1.1%	1.2%	1.2%	1.2%
Non-Residential	1.9%	2.1%	2.0%	1.9%	1.8%	1.8%
Bay City, AR						
Single Family	1.3%	1.5%	1.6%	1.6%	1.6%	1.6%
Multiple Family	1.4%	1.8%	2.0%	2.1%	2.2%	2.3%
Non-Residential	1.6%	1.8%	1.8%	1.8%	1.8%	1.7%
Sacramento County, CA						
Single Family	2.0%	2.3%	2.3%	2.3%	2.3%	2.3%
Multiple Family	1.2%	1.4%	1.6%	1.7%	1.7%	1.8%
Non-Residential	2.2%	2.4%	2.4%	2.3%	2.2%	2.2%
Santa Cruz City, CA						
Single Family	1.0%	1.1%	1.2%	1.2%	1.2%	1.1%
Multiple Family	1.1%	1.3%	1.3%	1.4%	1.4%	1.4%
Non-Residential	2.2%	2.5%	2.5%	2.5%	2.5%	2.5%
Dolores Town, CO						
Single Family	1.2%	1.5%	1.5%	1.6%	1.6%	1.6%
Multiple Family	0.9%	1.0%	1.1%	1.2%	1.2%	1.2%
Non-Residential	1.9%	2.4%	2.5%	2.6%	2.7%	2.7%
Otero County, CO						
Single Family	1.2%	1.5%	1.6%	1.7%	1.7%	1.7%
Multiple Family	0.9%	1.1%	1.2%	1.3%	1.3%	1.3%
Non-Residential	1.7%	2.0%	2.1%	2.1%	2.1%	2.1%
Ft. Lauderdale City, FL						
Single Family	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%
Multiple Family	0.4%	0.4%	0.4%	0.4%	0.4%	0.4%
Non-Residential	0.6%	0.6%	0.5%	0.5%	0.5%	0.5%
New Smyrna Beach City, FL						
Single Family	0.2%	0.3%	0.3%	0.3%	0.3%	0.3%
Multiple Family	0.2%	0.2%	0.3%	0.3%	0.3%	0.3%
Non-Residential	0.4%	0.4%	0.4%	0.3%	0.3%	0.3%
St. Petersburg Beach City, FL						
Single Family	2.0%	2.0%	2.1%	2.2%	2.3%	2.4%
Multiple Family	1.1%	1.1%	1.1%	1.2%	1.2%	1.2%
Non-Residential	3.2%	3.2%	3.2%	3.3%	3.3%	3.3%
Hailey City, ID						
Single Family	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Multiple Family	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Non-Residential	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Grundy County, IL						
Single Family	1.4%	1.6%	1.7%	1.8%	1.8%	1.8%
Multiple Family	1.0%	1.3%	1.4%	1.5%	1.5%	1.6%
Non-Residential	2.4%	2.9%	3.2%	3.3%	3.4%	3.4%
Council Bluffs City, IA						
Single Family	2.1%	2.3%	2.5%	2.5%	2.6%	2.7%
Multiple Family	0.9%	1.1%	1.2%	1.1%	1.2%	1.2%
Non-Residential	1.5%	1.6%	1.7%	1.6%	1.7%	1.7%

Augusta City, KY						
Single Family	1.1%	1.3%	1.4%	1.5%	1.5%	1.5%
Multiple Family	1.3%	1.5%	1.6%	1.6%	1.6%	1.6%
Non-Residential	1.6%	1.9%	2.0%	2.0%	2.0%	2.1%

Table F.13 (Continued)

Percent Change from Baseline for Average Real Pre-FIRM Property Values from 1997 to 2022

Scenario 4: Property Elevation At and Above BFE

Sample Communities

Community	1998	2002	2007	2012	2017	2022
Lewisport City, KY						
Single Family	0.7%	0.8%	0.8%	0.9%	0.9%	0.9%
Multiple Family	0.7%	0.8%	0.9%	1.0%	1.0%	1.0%
Non-Residential	0.7%	0.8%	0.8%	0.8%	0.8%	0.8%
Louisville/Jefferson, KY						
Single Family	2.0%	2.2%	2.3%	2.3%	2.3%	2.4%
Multiple Family	1.5%	1.8%	2.0%	2.1%	2.2%	2.2%
Non-Residential	3.7%	3.8%	3.4%	3.0%	2.7%	2.4%
Allen Parish, LA						
Single Family	0.7%	0.9%	1.0%	1.0%	1.0%	1.0%
Multiple Family	0.6%	0.8%	0.9%	1.0%	1.1%	1.1%
Non-Residential	0.9%	1.1%	1.3%	1.3%	1.4%	1.4%
Jefferson Parish, LA						
Single Family	0.9%	0.9%	0.8%	0.8%	0.8%	0.8%
Multiple Family	0.7%	0.8%	0.8%	0.9%	0.9%	0.9%
Non-Residential	1.0%	1.0%	0.9%	0.9%	0.8%	0.8%
Shreveport City, LA						
Single Family	0.8%	0.8%	0.8%	0.7%	0.7%	0.7%
Multiple Family	0.4%	0.5%	0.5%	0.5%	0.5%	0.5%
Non-Residential	0.8%	0.7%	0.7%	0.7%	0.7%	0.7%
Cohasset Town, MA						
Single Family	1.3%	1.5%	1.5%	1.5%	1.5%	1.5%
Multiple Family	1.2%	1.5%	1.6%	1.6%	1.7%	1.7%
Non-Residential	2.6%	3.0%	3.3%	3.3%	3.4%	3.4%
Vassar City, MI						
Single Family	1.7%	2.0%	2.1%	2.2%	2.2%	2.2%
Multiple Family	1.1%	1.4%	1.6%	1.7%	1.7%	1.7%
Non-Residential	2.1%	2.4%	2.4%	2.4%	2.4%	2.3%
Petal City, MS						
Single Family	1.5%	1.9%	2.0%	2.1%	2.2%	2.2%
Multiple Family	1.1%	1.4%	1.6%	1.7%	1.8%	1.8%
Non-Residential	1.5%	1.8%	1.9%	1.9%	1.9%	1.8%
Scott County, MO						
Single Family	0.5%	0.6%	0.6%	0.6%	0.6%	0.7%
Multiple Family	0.4%	0.6%	0.6%	0.7%	0.7%	0.7%
Non-Residential	0.6%	0.7%	0.7%	0.7%	0.7%	0.7%
Omaha City, NE						
Single Family	1.9%	2.2%	2.3%	2.3%	2.3%	2.3%
Multiple Family	1.2%	1.5%	1.6%	1.7%	1.7%	1.7%
Non-Residential	2.4%	3.2%	3.7%	3.8%	3.9%	3.9%
Pender Village, NE						
Single Family	1.0%	1.2%	1.3%	1.4%	1.4%	1.5%
Multiple Family	0.8%	1.0%	1.1%	1.2%	1.2%	1.3%
Non-Residential	1.8%	2.1%	2.3%	2.4%	2.4%	2.5%
Woodstock Town, NH						
Single Family	2.1%	2.4%	2.5%	2.5%	2.5%	2.5%
Multiple Family	1.2%	1.4%	1.4%	1.5%	1.5%	1.6%
Non-Residential	2.0%	2.5%	2.6%	2.7%	2.7%	2.8%

Table F.13 (Continued)
Percent Change from Baseline for Average Real Pre-FIRM Property Values from 1997 to 2022
Scenario 4: Property Elevation At and Above BFE
Sample Communities

Community	1998	2002	2007	2012	2017	2022
Bloomingdale Borough, NJ						
Single Family	1.5%	1.7%	1.7%	1.7%	1.7%	1.7%
Multiple Family	1.1%	1.3%	1.4%	1.4%	1.5%	1.5%
Non-Residential	2.1%	2.3%	2.2%	2.2%	2.1%	2.1%
Lincoln Park Borough, NJ						
Single Family	1.0%	1.1%	1.1%	1.2%	1.2%	1.2%
Multiple Family	0.9%	1.0%	1.1%	1.2%	1.2%	1.3%
Non-Residential	1.6%	1.7%	1.8%	1.8%	1.8%	1.8%
Niagara Town, NY						
Single Family	1.3%	1.6%	1.7%	1.7%	1.7%	1.7%
Multiple Family	1.8%	2.3%	2.7%	2.8%	3.0%	3.2%
Non-Residential	2.1%	2.4%	2.4%	2.4%	2.3%	2.3%
Waterford Village, NY						
Single Family	1.8%	2.1%	2.2%	2.2%	2.2%	2.2%
Multiple Family	1.3%	1.5%	1.6%	1.6%	1.7%	1.7%
Non-Residential	3.0%	3.5%	3.7%	3.8%	3.8%	3.9%
Carteret County, NC						
Single Family	0.8%	0.9%	1.0%	1.0%	1.0%	1.0%
Multiple Family	0.6%	0.7%	0.8%	0.8%	0.9%	0.9%
Non-Residential	1.2%	1.5%	1.9%	2.1%	2.2%	2.4%
Edenton, NC						
Single Family	0.3%	0.4%	0.4%	0.4%	0.4%	0.4%
Multiple Family	0.3%	0.4%	0.5%	0.5%	0.5%	0.5%
Non-Residential	0.6%	0.7%	0.8%	0.8%	0.8%	0.8%
New Miami Village, OH						
Single Family	1.6%	1.9%	2.0%	2.1%	2.1%	2.1%
Multiple Family	1.3%	1.7%	1.9%	2.0%	2.0%	2.1%
Non-Residential	2.2%	2.8%	3.1%	3.2%	3.3%	3.3%
Washington County, OK						
Single Family	0.9%	1.1%	1.2%	1.3%	1.3%	1.3%
Multiple Family	0.8%	1.0%	1.1%	1.2%	1.2%	1.3%
Non-Residential	1.4%	1.7%	1.8%	1.8%	1.8%	1.8%
Lane County, OR						
Single Family	1.3%	1.6%	1.7%	1.7%	1.7%	1.7%
Multiple Family	0.9%	1.1%	1.3%	1.3%	1.4%	1.4%
Non-Residential	1.7%	2.2%	2.4%	2.4%	2.4%	2.5%
Vernonia City, OR						
Single Family	1.4%	1.6%	1.6%	1.6%	1.6%	1.6%
Multiple Family	0.8%	0.9%	1.0%	0.9%	0.9%	0.8%
Non-Residential	1.8%	2.1%	2.1%	2.1%	2.0%	2.0%
Franklin Township, PA						
Single Family	1.4%	1.7%	1.9%	2.0%	2.0%	2.0%
Multiple Family	1.3%	1.7%	1.9%	2.1%	2.1%	2.2%
Non-Residential	1.5%	1.8%	1.9%	1.9%	1.9%	1.8%
Glen Rock Borough, PA						
Single Family	3.0%	3.2%	3.4%	3.5%	3.7%	3.8%
Multiple Family	2.0%	2.2%	2.4%	2.6%	2.8%	3.0%
Non-Residential	4.9%	4.8%	4.0%	2.6%	1.0%	0.0%
Lower Mt. Bethel Township, PA						
Single Family	6.0%	6.1%	6.1%	6.3%	6.3%	6.4%
Multiple Family	2.8%	2.4%	1.8%	1.3%	0.7%	0.0%

Non-Residential	5.5%	4.4%	3.0%	2.0%	1.0%	0.0%

Table F.13 (Continued)

Percent Change from Baseline for Average Real Pre-FIRM Property Values from 1997 to 2022

Scenario 4: Property Elevation At and Above BFE

Sample Communities

Community	1998	2002	2007	2012	2017	2022
New Cumberland Borough, PA						
Single Family	1.7%	2.0%	2.0%	2.0%	2.1%	2.1%
Multiple Family	1.3%	1.5%	1.6%	1.6%	1.6%	1.6%
Non-Residential	2.5%	2.9%	2.9%	3.0%	3.0%	3.0%
Myrtle Beach City, SC						
Single Family	1.1%	1.1%	1.1%	1.1%	1.1%	1.0%
Multiple Family	1.0%	1.1%	1.1%	1.1%	1.2%	1.2%
Non-Residential	1.9%	2.3%	2.5%	2.6%	2.7%	2.7%
Lawrence County, SD						
Single Family	1.5%	1.8%	1.9%	2.0%	2.0%	2.0%
Multiple Family	1.0%	1.2%	1.3%	1.3%	1.4%	1.4%
Non-Residential	1.9%	2.2%	2.3%	2.3%	2.3%	2.3%
Brookside Village City, TX						
Single Family	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Multiple Family	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Non-Residential	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Garland City, TX						
Single Family	0.6%	0.7%	0.7%	0.7%	0.7%	0.7%
Multiple Family	0.6%	0.8%	0.9%	0.9%	1.0%	1.0%
Non-Residential	1.1%	1.2%	1.2%	1.1%	1.1%	1.0%
League City, TX						
Single Family	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
Multiple Family	0.1%	0.2%	0.2%	0.2%	0.2%	0.2%
Non-Residential	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%
Grundy Town, VA						
Single Family	1.5%	1.7%	1.6%	1.7%	1.7%	1.7%
Multiple Family	1.6%	1.9%	1.9%	1.9%	1.6%	1.3%
Non-Residential	1.7%	1.8%	1.7%	1.7%	1.7%	1.7%
Ephrata City, WA						
Single Family	1.3%	1.5%	1.5%	1.5%	1.5%	1.5%
Multiple Family	1.4%	1.7%	1.9%	2.0%	2.1%	2.1%
Non-Residential	1.7%	2.0%	2.0%	2.0%	2.0%	1.9%
Leavenworth City, WA						
Single Family	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%
Multiple Family	0.2%	0.2%	0.1%	0.1%	0.1%	0.0%
Non-Residential	0.4%	0.4%	0.4%	0.3%	0.2%	0.0%
Marlinton Town, WV						
Single Family	1.1%	1.1%	1.2%	1.3%	1.3%	1.3%
Multiple Family	0.8%	0.9%	0.6%	0.4%	0.2%	0.0%
Non-Residential	1.4%	1.5%	1.7%	1.7%	1.7%	1.7%
Philippi City, WV						
Single Family	1.6%	1.7%	1.7%	1.8%	1.9%	1.9%
Multiple Family	1.0%	1.3%	1.4%	1.4%	1.5%	1.5%
Non-Residential	1.6%	1.9%	1.9%	2.1%	2.1%	2.1%
Wheeling City, WV						
Single Family	1.8%	2.1%	2.2%	2.3%	2.4%	2.5%
Multiple Family	1.3%	1.4%	1.5%	1.6%	1.7%	1.7%
Non-Residential	1.6%	1.8%	1.8%	1.9%	1.9%	2.0%

Table F.14
Percent Change from Baseline for Average Real Pre-FIRM Property Values from 1997 to 2022
Scenario 5: Property Elevation At and Above BFE
Sample Communities

Community	1998	2002	2007	2012	2017	2022
Phoenix City, AZ						
Single Family	1.3%	1.5%	1.5%	1.6%	1.5%	1.5%
Multiple Family	0.9%	1.1%	1.1%	1.2%	1.2%	1.2%
Non-Residential	1.9%	2.1%	2.0%	1.9%	1.8%	1.8%
Bay City, AR						
Single Family	1.3%	1.5%	1.6%	1.6%	1.6%	1.6%
Multiple Family	1.4%	1.8%	2.0%	2.1%	2.2%	2.3%
Non-Residential	1.6%	1.8%	1.8%	1.8%	1.8%	1.7%
Sacramento County, CA						
Single Family	2.0%	2.3%	2.3%	2.3%	2.3%	2.3%
Multiple Family	1.2%	1.4%	1.6%	1.7%	1.7%	1.8%
Non-Residential	2.2%	2.4%	2.4%	2.3%	2.2%	2.2%
Santa Cruz City, CA						
Single Family	1.0%	1.1%	1.2%	1.2%	1.2%	1.1%
Multiple Family	1.1%	1.3%	1.3%	1.4%	1.4%	1.4%
Non-Residential	2.2%	2.5%	2.5%	2.5%	2.5%	2.5%
Dolores Town, CO						
Single Family	1.2%	1.5%	1.5%	1.6%	1.6%	1.6%
Multiple Family	0.9%	1.0%	1.1%	1.2%	1.2%	1.2%
Non-Residential	1.9%	2.4%	2.5%	2.6%	2.7%	2.7%
Otero County, CO						
Single Family	1.2%	1.5%	1.6%	1.7%	1.7%	1.7%
Multiple Family	0.9%	1.1%	1.2%	1.3%	1.3%	1.3%
Non-Residential	1.7%	2.0%	2.1%	2.1%	2.1%	2.1%
Ft. Lauderdale City, FL						
Single Family	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%
Multiple Family	0.4%	0.4%	0.4%	0.4%	0.4%	0.4%
Non-Residential	0.6%	0.6%	0.5%	0.5%	0.5%	0.5%
New Smyrna Beach City, FL						
Single Family	0.2%	0.3%	0.3%	0.3%	0.3%	0.3%
Multiple Family	0.2%	0.2%	0.3%	0.3%	0.3%	0.3%
Non-Residential	0.4%	0.4%	0.4%	0.3%	0.3%	0.3%
St. Petersburg Beach City, FL						
Single Family	2.0%	2.0%	2.1%	2.2%	2.3%	2.4%
Multiple Family	1.1%	1.1%	1.1%	1.2%	1.2%	1.2%
Non-Residential	3.2%	3.2%	3.2%	3.3%	3.3%	3.3%
Hailey City, ID						
Single Family	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Multiple Family	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Non-Residential	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Grundy County, IL						
Single Family	1.4%	1.6%	1.7%	1.8%	1.8%	1.8%
Multiple Family	1.0%	1.3%	1.4%	1.5%	1.5%	1.6%
Non-Residential	2.4%	2.9%	3.2%	3.3%	3.4%	3.4%
Council Bluffs City, IA						
Single Family	2.1%	2.3%	2.5%	2.5%	2.6%	2.7%
Multiple Family	0.9%	1.1%	1.2%	1.2%	1.2%	1.2%
Non-Residential	1.5%	1.6%	1.7%	1.6%	1.7%	1.7%
Augusta City, KY						
Single Family	1.1%	1.3%	1.4%	1.5%	1.5%	1.5%
Multiple Family	1.3%	1.5%	1.6%	1.6%	1.6%	1.6%
Non-Residential	1.6%	1.9%	2.0%	2.0%	2.0%	2.1%

Table F.14 (Continued)
Percent Change from Baseline for Average Real Pre-FIRM Property Values from 1997 to 2022

Scenario 5: Property Elevation At and Above BFE
Sample Communities

Community	1998	2002	2007	2012	2017	2022
Lewisport City, KY						
Single Family	0.7%	0.8%	0.8%	0.9%	0.9%	0.9%
Multiple Family	0.7%	0.8%	0.9%	1.0%	1.0%	1.0%
Non-Residential	0.7%	0.8%	0.8%	0.8%	0.8%	0.8%
Louisville/Jefferson, KY						
Single Family	2.0%	2.2%	2.3%	2.3%	2.3%	2.3%
Multiple Family	1.5%	1.8%	2.0%	2.1%	2.2%	2.2%
Non-Residential	3.7%	3.8%	3.4%	3.1%	2.7%	2.4%
Allen Parish, LA						
Single Family	0.7%	0.9%	1.0%	1.0%	1.0%	1.0%
Multiple Family	0.6%	0.8%	0.9%	1.0%	1.1%	1.1%
Non-Residential	0.9%	1.1%	1.3%	1.3%	1.3%	1.4%
Jefferson Parish, LA						
Single Family	0.9%	0.9%	0.8%	0.8%	0.8%	0.8%
Multiple Family	0.7%	0.8%	0.8%	0.9%	0.9%	0.9%
Non-Residential	1.0%	1.0%	0.9%	0.9%	0.8%	0.8%
Shreveport City, LA						
Single Family	0.8%	0.8%	0.8%	0.7%	0.7%	0.7%
Multiple Family	0.4%	0.5%	0.5%	0.5%	0.5%	0.5%
Non-Residential	0.8%	0.7%	0.7%	0.7%	0.7%	0.7%
Cohasset Town, MA						
Single Family	1.3%	1.5%	1.5%	1.5%	1.5%	1.5%
Multiple Family	1.2%	1.5%	1.6%	1.6%	1.7%	1.7%
Non-Residential	2.6%	3.0%	3.3%	3.3%	3.4%	3.4%
Vassar City, MI						
Single Family	1.7%	2.0%	2.1%	2.2%	2.2%	2.2%
Multiple Family	1.1%	1.4%	1.6%	1.7%	1.7%	1.7%
Non-Residential	2.1%	2.4%	2.4%	2.4%	2.4%	2.3%
Petal City, MS						
Single Family	1.5%	1.9%	2.0%	2.1%	2.2%	2.2%
Multiple Family	1.1%	1.4%	1.6%	1.7%	1.8%	1.8%
Non-Residential	1.5%	1.8%	1.9%	1.9%	1.9%	1.8%
Scott County, MO						
Single Family	0.5%	0.6%	0.6%	0.6%	0.6%	0.7%
Multiple Family	0.4%	0.6%	0.6%	0.7%	0.7%	0.7%
Non-Residential	0.6%	0.7%	0.7%	0.7%	0.7%	0.7%
Omaha City, NE						
Single Family	1.9%	2.2%	2.3%	2.3%	2.3%	2.3%
Multiple Family	1.2%	1.5%	1.6%	1.7%	1.7%	1.7%
Non-Residential	2.4%	3.2%	3.7%	3.8%	3.9%	3.9%
Pender Village, NE						
Single Family	1.0%	1.2%	1.3%	1.4%	1.4%	1.5%
Multiple Family	0.8%	1.0%	1.1%	1.2%	1.2%	1.3%
Non-Residential	1.8%	2.1%	2.3%	2.3%	2.4%	2.4%
Woodstock Town, NH						
Single Family	2.1%	2.4%	2.5%	2.5%	2.5%	2.5%
Multiple Family	1.2%	1.4%	1.4%	1.5%	1.5%	1.6%
Non-Residential	2.0%	2.5%	2.6%	2.7%	2.7%	2.8%

Table F.14 (Continued)
Percent Change from Baseline for Average Real Pre-FIRM Property Values from 1997 to 2022
Scenario 5: Property Elevation At and Above BFE

Sample Communities

Community	1998	2002	2007	2012	2017	2022
Bloomingdale Borough, NJ						
Single Family	1.5%	1.7%	1.7%	1.7%	1.7%	1.7%
Multiple Family	1.1%	1.3%	1.4%	1.4%	1.5%	1.5%
Non-Residential	2.1%	2.3%	2.2%	2.2%	2.1%	2.1%
Lincoln Park Borough, NJ						
Single Family	1.0%	1.1%	1.1%	1.2%	1.2%	1.2%
Multiple Family	0.9%	1.0%	1.1%	1.2%	1.2%	1.3%
Non-Residential	1.6%	1.7%	1.8%	1.8%	1.8%	1.8%
Niagara Town, NY						
Single Family	1.3%	1.6%	1.7%	1.7%	1.7%	1.7%
Multiple Family	1.8%	2.3%	2.7%	2.8%	3.0%	3.2%
Non-Residential	2.1%	2.4%	2.4%	2.4%	2.3%	2.3%
Waterford Village, NY						
Single Family	1.8%	2.1%	2.2%	2.2%	2.2%	2.2%
Multiple Family	1.3%	1.5%	1.6%	1.6%	1.7%	1.7%
Non-Residential	3.0%	3.5%	3.7%	3.8%	3.8%	3.9%
Carteret County, NC						
Single Family	0.8%	0.9%	1.0%	1.0%	1.0%	1.0%
Multiple Family	0.6%	0.7%	0.8%	0.8%	0.9%	0.9%
Non-Residential	1.2%	1.5%	1.9%	2.1%	2.2%	2.4%
Edenton, NC						
Single Family	0.3%	0.4%	0.4%	0.4%	0.4%	0.4%
Multiple Family	0.3%	0.4%	0.5%	0.5%	0.5%	0.5%
Non-Residential	0.6%	0.7%	0.8%	0.8%	0.8%	0.8%
New Miami Village, OH						
Single Family	1.6%	1.9%	2.0%	2.1%	2.1%	2.1%
Multiple Family	1.3%	1.7%	1.9%	2.0%	2.0%	2.1%
Non-Residential	2.2%	2.8%	3.1%	3.2%	3.3%	3.3%
Washington County, OK						
Single Family	0.9%	1.1%	1.2%	1.3%	1.3%	1.3%
Multiple Family	0.8%	1.0%	1.1%	1.2%	1.2%	1.3%
Non-Residential	1.4%	1.7%	1.8%	1.8%	1.8%	1.8%
Lane County, OR						
Single Family	1.3%	1.6%	1.7%	1.7%	1.7%	1.7%
Multiple Family	0.9%	1.1%	1.3%	1.3%	1.4%	1.4%
Non-Residential	1.7%	2.2%	2.4%	2.4%	2.4%	2.5%
Vernonia City, OR						
Single Family	1.4%	1.6%	1.6%	1.6%	1.6%	1.6%
Multiple Family	0.8%	0.9%	1.0%	0.9%	0.9%	0.8%
Non-Residential	1.8%	2.1%	2.1%	2.1%	2.0%	2.0%
Franklin Township, PA						
Single Family	1.4%	1.7%	1.9%	2.0%	2.0%	2.0%
Multiple Family	1.3%	1.7%	1.9%	2.1%	2.1%	2.2%
Non-Residential	1.5%	1.8%	1.9%	1.9%	1.9%	1.8%
Glen Rock Borough, PA						
Single Family	3.0%	3.2%	3.4%	3.5%	3.7%	3.8%
Multiple Family	2.0%	2.2%	2.4%	2.6%	2.8%	3.0%
Non-Residential	4.9%	4.8%	4.0%	2.6%	1.0%	0.0%
Lower Mt. Bethel Township, PA						
Single Family	6.0%	6.1%	6.1%	6.3%	6.3%	6.4%
Multiple Family	2.8%	2.4%	1.8%	1.3%	0.7%	0.0%
Non-Residential	5.5%	4.4%	3.0%	2.0%	1.0%	0.0%

Table F.14 (Continued)
Percent Change from Baseline for Average Real Pre-FIRM Property Values from 1997 to 2022
Scenario 5: Property Elevation At and Above BFE
Sample Communities

Community	1998	2002	2007	2012	2017	2022
New Cumberland Borough, PA						
Single Family	1.7%	2.0%	2.0%	2.0%	2.1%	2.1%
Multiple Family	1.3%	1.5%	1.6%	1.6%	1.6%	1.6%
Non-Residential	2.5%	2.9%	3.0%	3.0%	3.0%	3.1%
Myrtle Beach City, SC						
Single Family	1.1%	1.1%	1.1%	1.1%	1.1%	1.0%
Multiple Family	1.0%	1.1%	1.1%	1.1%	1.2%	1.2%
Non-Residential	1.9%	2.3%	2.5%	2.6%	2.7%	2.8%
Lawrence County, SD						
Single Family	1.5%	1.8%	1.9%	2.0%	2.0%	2.0%
Multiple Family	1.0%	1.2%	1.3%	1.3%	1.4%	1.4%
Non-Residential	1.9%	2.2%	2.3%	2.3%	2.3%	2.3%
Brookside Village City, TX						
Single Family	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Multiple Family	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Non-Residential	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Garland City, TX						
Single Family	0.6%	0.7%	0.7%	0.7%	0.7%	0.7%
Multiple Family	0.6%	0.8%	0.9%	0.9%	1.0%	1.0%
Non-Residential	1.1%	1.2%	1.2%	1.1%	1.1%	1.0%
League City, TX						
Single Family	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
Multiple Family	0.1%	0.2%	0.2%	0.2%	0.2%	0.2%
Non-Residential	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%
Grundy Town, VA						
Single Family	1.5%	1.6%	1.6%	1.7%	1.7%	1.7%
Multiple Family	1.6%	1.9%	1.9%	1.9%	1.7%	1.4%
Non-Residential	1.7%	1.8%	1.7%	1.7%	1.7%	1.7%
Ephrata City, WA						
Single Family	1.3%	1.5%	1.5%	1.5%	1.5%	1.5%
Multiple Family	1.4%	1.7%	1.9%	2.0%	2.1%	2.1%
Non-Residential	1.7%	2.0%	2.0%	2.0%	2.0%	1.9%
Leavenworth City, WA						
Single Family	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%
Multiple Family	0.2%	0.2%	0.1%	0.1%	0.1%	0.0%
Non-Residential	0.4%	0.4%	0.4%	0.3%	0.2%	0.0%
Marlinton Town, WV						
Single Family	1.1%	1.1%	1.2%	1.3%	1.3%	1.3%
Multiple Family	0.8%	0.9%	0.6%	0.4%	0.2%	0.0%
Non-Residential	1.4%	1.5%	1.7%	1.7%	1.7%	1.7%
Philippi City, WV						
Single Family	1.6%	1.7%	1.7%	1.8%	1.9%	1.9%
Multiple Family	1.0%	1.3%	1.4%	1.4%	1.5%	1.6%
Non-Residential	1.6%	1.9%	1.9%	2.1%	2.1%	2.1%
Wheeling City, WV						
Single Family	1.8%	2.1%	2.2%	2.3%	2.4%	2.5%
Multiple Family	1.3%	1.4%	1.5%	1.6%	1.7%	1.7%
Non-Residential	1.6%	1.8%	1.8%	1.8%	1.9%	2.0%

Table F.15
Percent Change from Baseline for Average Real Pre-FIRM Property Values from 1997 to 2022
Scenario 6: Property Elevation At and Above BFE
Sample Communities

Community	1998	2002	2007	2012	2017	2022

Phoenix City, AZ						
Single Family	1.3%	1.5%	1.5%	1.6%	1.5%	1.5%
Multiple Family	0.9%	1.1%	1.1%	1.2%	1.2%	1.2%
Non-Residential	1.9%	2.1%	2.0%	1.9%	1.8%	1.8%
Bay City, AR						
Single Family	1.3%	1.5%	1.6%	1.6%	1.6%	1.6%
Multiple Family	1.4%	1.8%	2.0%	2.1%	2.2%	2.3%
Non-Residential	1.6%	1.8%	1.8%	1.8%	1.8%	1.7%
Sacramento County, CA						
Single Family	2.0%	2.3%	2.3%	2.3%	2.3%	2.3%
Multiple Family	1.2%	1.4%	1.6%	1.7%	1.7%	1.8%
Non-Residential	2.2%	2.4%	2.4%	2.3%	2.2%	2.2%
Santa Cruz City, CA						
Single Family	1.0%	1.1%	1.2%	1.2%	1.2%	1.1%
Multiple Family	1.1%	1.3%	1.3%	1.4%	1.4%	1.4%
Non-Residential	2.2%	2.5%	2.5%	2.5%	2.5%	2.5%
Dolores Town, CO						
Single Family	1.2%	1.5%	1.5%	1.6%	1.6%	1.6%
Multiple Family	0.9%	1.0%	1.1%	1.2%	1.2%	1.2%
Non-Residential	1.9%	2.4%	2.5%	2.6%	2.7%	2.7%
Otero County, CO						
Single Family	1.2%	1.5%	1.6%	1.7%	1.7%	1.7%
Multiple Family	0.9%	1.1%	1.2%	1.3%	1.3%	1.3%
Non-Residential	1.7%	2.0%	2.1%	2.1%	2.1%	2.1%
Ft. Lauderdale City, FL						
Single Family	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%
Multiple Family	0.4%	0.4%	0.4%	0.4%	0.4%	0.4%
Non-Residential	0.6%	0.6%	0.5%	0.5%	0.5%	0.5%
New Smyrna Beach City, FL						
Single Family	0.2%	0.3%	0.3%	0.3%	0.3%	0.3%
Multiple Family	0.2%	0.2%	0.3%	0.3%	0.3%	0.3%
Non-Residential	0.4%	0.4%	0.4%	0.3%	0.3%	0.3%
St. Petersburg Beach City, FL						
Single Family	2.0%	2.0%	2.1%	2.2%	2.3%	2.4%
Multiple Family	1.1%	1.1%	1.1%	1.2%	1.2%	1.2%
Non-Residential	3.2%	3.2%	3.2%	3.3%	3.3%	3.3%
Hailey City, ID						
Single Family	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Multiple Family	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Non-Residential	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Grundy County, IL						
Single Family	1.4%	1.6%	1.7%	1.8%	1.8%	1.8%
Multiple Family	1.0%	1.3%	1.4%	1.5%	1.5%	1.6%
Non-Residential	2.4%	2.9%	3.2%	3.3%	3.4%	3.4%
Council Bluffs City, IA						
Single Family	2.1%	2.3%	2.5%	2.5%	2.6%	2.7%
Multiple Family	0.9%	1.1%	1.2%	1.2%	1.2%	1.2%
Non-Residential	1.5%	1.6%	1.7%	1.6%	1.7%	1.7%
Augusta City, KY						
Single Family	1.1%	1.3%	1.4%	1.5%	1.5%	1.5%
Multiple Family	1.3%	1.5%	1.6%	1.6%	1.6%	1.6%
Non-Residential	1.6%	1.9%	2.0%	2.0%	2.0%	2.1%

Table F.15 (Continued)
Percent Change from Baseline for Average Real Pre-FIRM Property Values from 1997 to 2022
Scenario 6: Property Elevation At and Above BFE
Sample Communities

Community	1998	2002	2007	2012	2017	2022
Lewisport City, KY						
Single Family	0.7%	0.8%	0.8%	0.9%	0.9%	0.9%

Multiple Family	0.7%	0.8%	0.9%	1.0%	1.0%	1.0%
Non-Residential	0.7%	0.8%	0.8%	0.8%	0.8%	0.8%
Louisville/Jefferson, KY						
Single Family	2.0%	2.2%	2.3%	2.3%	2.3%	2.3%
Multiple Family	1.5%	1.8%	2.0%	2.1%	2.2%	2.2%
Non-Residential	3.7%	3.8%	3.4%	3.1%	2.7%	2.4%
Allen Parish, LA						
Single Family	0.7%	0.9%	1.0%	1.0%	1.0%	1.0%
Multiple Family	0.6%	0.8%	0.9%	1.0%	1.1%	1.1%
Non-Residential	0.9%	1.1%	1.3%	1.3%	1.4%	1.4%
Jefferson Parish, LA						
Single Family	0.9%	0.9%	0.8%	0.8%	0.8%	0.8%
Multiple Family	0.7%	0.8%	0.8%	0.9%	0.9%	0.9%
Non-Residential	1.0%	1.0%	0.9%	0.9%	0.8%	0.8%
Shreveport City, LA						
Single Family	0.8%	0.8%	0.8%	0.7%	0.7%	0.7%
Multiple Family	0.4%	0.5%	0.5%	0.5%	0.5%	0.5%
Non-Residential	0.8%	0.7%	0.7%	0.7%	0.7%	0.7%
Cohasset Town, MA						
Single Family	1.3%	1.5%	1.5%	1.5%	1.5%	1.5%
Multiple Family	1.2%	1.5%	1.6%	1.6%	1.7%	1.7%
Non-Residential	2.6%	3.0%	3.3%	3.3%	3.4%	3.4%
Vassar City, MI						
Single Family	1.7%	2.0%	2.1%	2.2%	2.2%	2.2%
Multiple Family	1.1%	1.4%	1.6%	1.7%	1.7%	1.7%
Non-Residential	2.1%	2.4%	2.4%	2.4%	2.4%	2.3%
Petal City, MS						
Single Family	1.5%	1.9%	2.0%	2.1%	2.2%	2.2%
Multiple Family	1.1%	1.4%	1.6%	1.7%	1.8%	1.8%
Non-Residential	1.5%	1.8%	1.9%	1.9%	1.9%	1.8%
Scott County, MO						
Single Family	0.5%	0.6%	0.6%	0.6%	0.6%	0.7%
Multiple Family	0.4%	0.6%	0.6%	0.7%	0.7%	0.7%
Non-Residential	0.6%	0.7%	0.7%	0.7%	0.7%	0.7%
Omaha City, NE						
Single Family	1.9%	2.2%	2.3%	2.3%	2.3%	2.3%
Multiple Family	1.2%	1.5%	1.6%	1.7%	1.7%	1.7%
Non-Residential	2.4%	3.2%	3.7%	3.8%	3.9%	3.9%
Pender Village, NE						
Single Family	1.0%	1.2%	1.3%	1.4%	1.4%	1.5%
Multiple Family	0.8%	1.0%	1.1%	1.2%	1.2%	1.3%
Non-Residential	1.8%	2.1%	2.3%	2.4%	2.4%	2.4%
Woodstock Town, NH						
Single Family	2.1%	2.4%	2.5%	2.5%	2.5%	2.5%
Multiple Family	1.2%	1.4%	1.4%	1.5%	1.5%	1.6%
Non-Residential	2.0%	2.5%	2.6%	2.7%	2.7%	2.8%

Table F.15 (Continued)
Percent Change from Baseline for Average Real Pre-FIRM Property Values from 1997 to 2022
Scenario 6: Property Elevation At and Above BFE
Sample Communities

Community	1998	2002	2007	2012	2017	2022
Bloomingdale Borough, NJ						
Single Family	1.5%	1.7%	1.7%	1.7%	1.7%	1.7%
Multiple Family	1.1%	1.3%	1.4%	1.4%	1.5%	1.5%
Non-Residential	2.1%	2.3%	2.2%	2.2%	2.1%	2.1%

Lincoln Park Borough, NJ						
Single Family	1.0%	1.1%	1.1%	1.2%	1.2%	1.2%
Multiple Family	0.9%	1.0%	1.1%	1.2%	1.2%	1.3%
Non-Residential	1.6%	1.7%	1.8%	1.8%	1.8%	1.8%
Niagara Town, NY						
Single Family	1.3%	1.6%	1.7%	1.7%	1.7%	1.7%
Multiple Family	1.8%	2.3%	2.7%	2.8%	3.0%	3.2%
Non-Residential	2.1%	2.4%	2.4%	2.4%	2.3%	2.3%
Waterford Village, NY						
Single Family	1.8%	2.1%	2.2%	2.2%	2.2%	2.2%
Multiple Family	1.3%	1.5%	1.6%	1.6%	1.7%	1.7%
Non-Residential	3.0%	3.5%	3.7%	3.8%	3.8%	3.9%
Carteret County, NC						
Single Family	0.8%	0.9%	1.0%	1.0%	1.0%	1.0%
Multiple Family	0.6%	0.7%	0.8%	0.8%	0.9%	0.9%
Non-Residential	1.2%	1.5%	1.9%	2.1%	2.2%	2.4%
Edenton, NC						
Single Family	0.3%	0.4%	0.4%	0.4%	0.4%	0.4%
Multiple Family	0.3%	0.4%	0.5%	0.5%	0.5%	0.5%
Non-Residential	0.6%	0.7%	0.8%	0.8%	0.8%	0.8%
New Miami Village, OH						
Single Family	1.6%	1.9%	2.0%	2.1%	2.1%	2.1%
Multiple Family	1.3%	1.7%	1.9%	2.0%	2.0%	2.1%
Non-Residential	2.2%	2.8%	3.1%	3.2%	3.3%	3.3%
Washington County, OK						
Single Family	0.9%	1.1%	1.2%	1.3%	1.3%	1.3%
Multiple Family	0.8%	1.0%	1.1%	1.2%	1.2%	1.3%
Non-Residential	1.4%	1.7%	1.8%	1.8%	1.8%	1.8%
Lane County, OR						
Single Family	1.3%	1.6%	1.7%	1.7%	1.7%	1.7%
Multiple Family	0.9%	1.1%	1.3%	1.3%	1.4%	1.4%
Non-Residential	1.7%	2.2%	2.4%	2.4%	2.4%	2.5%
Vernonia City, OR						
Single Family	1.4%	1.6%	1.6%	1.6%	1.6%	1.6%
Multiple Family	0.8%	0.9%	1.0%	0.9%	0.9%	0.8%
Non-Residential	1.8%	2.1%	2.1%	2.1%	2.0%	2.0%
Franklin Township, PA						
Single Family	1.4%	1.7%	1.9%	2.0%	2.0%	2.0%
Multiple Family	1.3%	1.7%	1.9%	2.1%	2.1%	2.2%
Non-Residential	1.5%	1.8%	1.9%	1.9%	1.9%	1.8%
Glen Rock Borough, PA						
Single Family	3.0%	3.2%	3.4%	3.5%	3.7%	3.8%
Multiple Family	2.0%	2.2%	2.4%	2.6%	2.8%	3.0%
Non-Residential	4.9%	4.8%	4.0%	2.6%	1.0%	0.0%
Lower Mt. Bethel Township, PA						
Single Family	6.0%	6.1%	6.1%	6.3%	6.3%	6.4%
Multiple Family	2.8%	2.4%	1.8%	1.3%	0.7%	0.0%
Non-Residential	5.5%	4.4%	3.0%	2.0%	1.0%	0.0%

Table F.15 (Continued)
Percent Change from Baseline for Average Real Pre-FIRM Property Values from 1997 to 2022
Scenario 6: Property Elevation At and Above BFE
Sample Communities

Community	1998	2002	2007	2012	2017	2022
New Cumberland Borough, PA						
Single Family	1.7%	2.0%	2.0%	2.0%	2.1%	2.1%
Multiple Family	1.3%	1.5%	1.6%	1.6%	1.6%	1.6%
Non-Residential	2.5%	2.9%	3.0%	3.0%	3.0%	3.1%
Myrtle Beach City, SC						
Single Family	1.1%	1.1%	1.1%	1.1%	1.1%	1.0%

Multiple Family	1.0%	1.1%	1.1%	1.1%	1.2%	1.2%
Non-Residential	1.9%	2.3%	2.5%	2.6%	2.7%	2.8%
Lawrence County, SD						
Single Family	1.5%	1.8%	1.9%	2.0%	2.0%	2.0%
Multiple Family	1.0%	1.2%	1.3%	1.3%	1.4%	1.4%
Non-Residential	1.9%	2.2%	2.3%	2.3%	2.3%	2.3%
Brookside Village City, TX						
Single Family	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Multiple Family	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Non-Residential	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Garland City, TX						
Single Family	0.6%	0.7%	0.7%	0.7%	0.7%	0.7%
Multiple Family	0.6%	0.8%	0.9%	0.9%	1.0%	1.0%
Non-Residential	1.1%	1.2%	1.2%	1.1%	1.1%	1.0%
League City, TX						
Single Family	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
Multiple Family	0.1%	0.2%	0.2%	0.2%	0.2%	0.2%
Non-Residential	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%
Grundy Town, VA						
Single Family	1.5%	1.6%	1.6%	1.7%	1.7%	1.7%
Multiple Family	1.6%	1.9%	1.9%	1.9%	1.7%	1.4%
Non-Residential	1.7%	1.8%	1.7%	1.7%	1.7%	1.7%
Ephrata City, WA						
Single Family	1.3%	1.5%	1.5%	1.5%	1.5%	1.5%
Multiple Family	1.4%	1.7%	1.9%	2.0%	2.1%	2.1%
Non-Residential	1.7%	2.0%	2.0%	2.0%	2.0%	1.9%
Leavenworth City, WA						
Single Family	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%
Multiple Family	0.2%	0.2%	0.1%	0.1%	0.1%	0.0%
Non-Residential	0.4%	0.4%	0.4%	0.3%	0.2%	0.0%
Marlinton Town, WV						
Single Family	1.1%	1.1%	1.2%	1.3%	1.3%	1.3%
Multiple Family	0.8%	0.9%	0.6%	0.4%	0.2%	0.0%
Non-Residential	1.4%	1.5%	1.7%	1.7%	1.7%	1.7%
Philippi City, WV						
Single Family	1.6%	1.7%	1.7%	1.8%	1.9%	1.9%
Multiple Family	1.0%	1.3%	1.4%	1.4%	1.5%	1.6%
Non-Residential	1.6%	1.9%	1.9%	2.1%	2.1%	2.1%
Wheeling City, WV						
Single Family	1.8%	2.1%	2.2%	2.3%	2.5%	2.5%
Multiple Family	1.3%	1.4%	1.5%	1.6%	1.7%	1.7%
Non-Residential	1.6%	1.8%	1.8%	1.8%	1.9%	2.0%

Table F.16
Percent Change from Baseline for Average Real Pre-FIRM Property Values from 1997 to 202
Scenario 7: Property Elevation At and Above BFE
Sample Communities

Community	1998	2002	2007	2012	2017	2022
Phoenix City, AZ						
Single Family	1.3%	1.5%	1.5%	1.6%	1.5%	1.5%
Multiple Family	0.9%	1.1%	1.1%	1.2%	1.2%	1.2%
Non-Residential	1.9%	2.1%	2.0%	1.9%	1.8%	1.8%
Bay City, AR						
Single Family	1.3%	1.5%	1.6%	1.6%	1.6%	1.6%
Multiple Family	1.4%	1.8%	2.0%	2.1%	2.2%	2.3%
Non-Residential	1.6%	1.8%	1.8%	1.8%	1.8%	1.7%

Sacramento County, CA						
Single Family	2.0%	2.3%	2.3%	2.3%	2.3%	2.3%
Multiple Family	1.2%	1.4%	1.6%	1.7%	1.7%	1.8%
Non-Residential	2.2%	2.4%	2.4%	2.3%	2.2%	2.2%
Santa Cruz City, CA						
Single Family	1.0%	1.1%	1.2%	1.2%	1.2%	1.1%
Multiple Family	1.1%	1.3%	1.3%	1.4%	1.4%	1.4%
Non-Residential	2.2%	2.5%	2.5%	2.5%	2.5%	2.5%
Dolores Town, CO						
Single Family	1.2%	1.5%	1.5%	1.6%	1.6%	1.6%
Multiple Family	0.9%	1.0%	1.1%	1.2%	1.2%	1.2%
Non-Residential	1.9%	2.4%	2.5%	2.6%	2.7%	2.7%
Otero County, CO						
Single Family	1.2%	1.5%	1.6%	1.7%	1.7%	1.7%
Multiple Family	0.9%	1.1%	1.2%	1.3%	1.3%	1.3%
Non-Residential	1.7%	2.0%	2.1%	2.1%	2.1%	2.1%
Ft. Lauderdale City, FL						
Single Family	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%
Multiple Family	0.4%	0.4%	0.4%	0.4%	0.4%	0.4%
Non-Residential	0.6%	0.6%	0.5%	0.5%	0.5%	0.5%
New Smyrna Beach City, FL						
Single Family	0.2%	0.3%	0.3%	0.3%	0.3%	0.3%
Multiple Family	0.2%	0.2%	0.3%	0.3%	0.3%	0.3%
Non-Residential	0.4%	0.4%	0.4%	0.3%	0.3%	0.3%
St. Petersburg Beach City, FL						
Single Family	2.0%	2.0%	2.1%	2.2%	2.3%	2.4%
Multiple Family	1.1%	1.1%	1.1%	1.2%	1.2%	1.2%
Non-Residential	3.2%	3.2%	3.2%	3.3%	3.3%	3.3%
Hailey City, ID						
Single Family	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Multiple Family	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Non-Residential	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Grundy County, IL						
Single Family	1.4%	1.6%	1.7%	1.8%	1.8%	1.8%
Multiple Family	1.0%	1.3%	1.4%	1.5%	1.5%	1.6%
Non-Residential	2.4%	2.9%	3.2%	3.3%	3.4%	3.4%
Council Bluffs City, IA						
Single Family	2.1%	2.3%	2.5%	2.5%	2.6%	2.7%
Multiple Family	0.9%	1.1%	1.2%	1.2%	1.2%	1.2%
Non-Residential	1.5%	1.6%	1.7%	1.6%	1.7%	1.7%
Augusta City, KY						
Single Family	1.1%	1.3%	1.4%	1.5%	1.5%	1.5%
Multiple Family	1.3%	1.5%	1.6%	1.6%	1.6%	1.6%
Non-Residential	1.6%	1.9%	2.0%	2.0%	2.0%	2.1%

Table F.16 (Continued)
Percent Change from Baseline for Average Real Pre-FIRM Property Values from 1997 to 2022
Scenario 7: Property Elevation At and Above BFE
Sample Communities

Community	1998	2002	2007	2012	2017	2022
Lewisport City, KY						
Single Family	0.7%	0.8%	0.8%	0.9%	0.9%	0.9%
Multiple Family	0.7%	0.8%	0.9%	1.0%	1.0%	1.0%
Non-Residential	0.7%	0.8%	0.8%	0.8%	0.8%	0.8%
Louisville/Jefferson, KY						
Single Family	2.0%	2.2%	2.3%	2.3%	2.3%	2.3%
Multiple Family	1.5%	1.8%	2.0%	2.1%	2.2%	2.2%
Non-Residential	3.7%	3.8%	3.4%	3.1%	2.7%	2.4%
Allen Parish, LA						
Single Family	0.7%	0.9%	1.0%	1.0%	1.0%	1.0%

Multiple Family	0.6%	0.8%	0.9%	1.0%	1.1%	1.1%
Non-Residential	0.9%	1.1%	1.3%	1.3%	1.4%	1.4%
Jefferson Parish, LA						
Single Family	0.9%	0.9%	0.8%	0.8%	0.8%	0.8%
Multiple Family	0.7%	0.8%	0.8%	0.9%	0.9%	0.9%
Non-Residential	1.0%	1.0%	0.9%	0.9%	0.8%	0.8%
Shreveport City, LA						
Single Family	0.8%	0.8%	0.8%	0.7%	0.7%	0.7%
Multiple Family	0.4%	0.5%	0.5%	0.5%	0.5%	0.5%
Non-Residential	0.8%	0.7%	0.7%	0.7%	0.7%	0.7%
Cohasset Town, MA						
Single Family	1.3%	1.5%	1.5%	1.5%	1.5%	1.5%
Multiple Family	1.2%	1.5%	1.6%	1.6%	1.7%	1.7%
Non-Residential	2.6%	3.0%	3.3%	3.3%	3.4%	3.4%
Vassar City, MI						
Single Family	1.7%	2.0%	2.1%	2.2%	2.2%	2.2%
Multiple Family	1.1%	1.4%	1.6%	1.7%	1.7%	1.7%
Non-Residential	2.1%	2.4%	2.4%	2.4%	2.4%	2.3%
Petal City, MS						
Single Family	1.5%	1.9%	2.0%	2.1%	2.2%	2.2%
Multiple Family	1.1%	1.4%	1.6%	1.7%	1.8%	1.8%
Non-Residential	1.5%	1.8%	1.9%	1.9%	1.9%	1.8%
Scott County, MO						
Single Family	0.5%	0.6%	0.6%	0.6%	0.6%	0.7%
Multiple Family	0.4%	0.6%	0.6%	0.7%	0.7%	0.7%
Non-Residential	0.6%	0.7%	0.7%	0.7%	0.7%	0.7%
Omaha City, NE						
Single Family	1.9%	2.2%	2.3%	2.3%	2.3%	2.3%
Multiple Family	1.2%	1.5%	1.6%	1.7%	1.7%	1.7%
Non-Residential	2.4%	3.2%	3.7%	3.8%	3.9%	3.9%
Pender Village, NE						
Single Family	1.0%	1.2%	1.3%	1.4%	1.4%	1.5%
Multiple Family	0.8%	1.0%	1.1%	1.2%	1.2%	1.3%
Non-Residential	1.8%	2.1%	2.3%	2.4%	2.4%	2.4%
Woodstock Town, NH						
Single Family	2.1%	2.4%	2.5%	2.5%	2.5%	2.5%
Multiple Family	1.2%	1.4%	1.4%	1.5%	1.5%	1.6%
Non-Residential	2.0%	2.5%	2.6%	2.7%	2.7%	2.8%

Table F.16 (Continued)
Percent Change from Baseline for Average Real Pre-FIRM Property Values from 1997 to 202
Scenario 7: Property Elevation At and Above BFE
Sample Communities

Community	1998	2002	2007	2012	2017	2022
Bloomingdale Borough, NJ						
Single Family	1.5%	1.7%	1.7%	1.7%	1.7%	1.7%
Multiple Family	1.1%	1.3%	1.4%	1.4%	1.5%	1.5%
Non-Residential	2.1%	2.3%	2.2%	2.2%	2.1%	2.1%
Lincoln Park Borough, NJ						
Single Family	1.0%	1.1%	1.1%	1.2%	1.2%	1.2%
Multiple Family	0.9%	1.0%	1.1%	1.2%	1.2%	1.3%
Non-Residential	1.6%	1.7%	1.8%	1.8%	1.8%	1.8%
Niagara Town, NY						
Single Family	1.3%	1.6%	1.7%	1.7%	1.7%	1.7%
Multiple Family	1.8%	2.3%	2.7%	2.8%	3.0%	3.2%
Non-Residential	2.1%	2.4%	2.4%	2.4%	2.3%	2.3%

Waterford Village, NY						
Single Family	1.8%	2.1%	2.2%	2.2%	2.2%	2.2%
Multiple Family	1.3%	1.5%	1.6%	1.6%	1.7%	1.7%
Non-Residential	3.0%	3.5%	3.7%	3.8%	3.8%	3.9%
Carteret County, NC						
Single Family	0.8%	0.9%	1.0%	1.0%	1.0%	1.0%
Multiple Family	0.6%	0.7%	0.8%	0.8%	0.9%	0.9%
Non-Residential	1.2%	1.5%	1.9%	2.1%	2.2%	2.4%
Edenton, NC						
Single Family	0.3%	0.4%	0.4%	0.4%	0.4%	0.4%
Multiple Family	0.3%	0.4%	0.5%	0.5%	0.5%	0.5%
Non-Residential	0.6%	0.7%	0.8%	0.8%	0.8%	0.8%
New Miami Village, OH						
Single Family	1.6%	1.9%	2.0%	2.1%	2.1%	2.1%
Multiple Family	1.3%	1.7%	1.9%	2.0%	2.0%	2.1%
Non-Residential	2.2%	2.8%	3.1%	3.2%	3.3%	3.3%
Washington County, OK						
Single Family	0.9%	1.1%	1.2%	1.3%	1.3%	1.3%
Multiple Family	0.8%	1.0%	1.1%	1.2%	1.2%	1.3%
Non-Residential	1.4%	1.7%	1.8%	1.8%	1.8%	1.8%
Lane County, OR						
Single Family	1.3%	1.6%	1.7%	1.7%	1.7%	1.7%
Multiple Family	0.9%	1.1%	1.3%	1.3%	1.4%	1.4%
Non-Residential	1.7%	2.2%	2.4%	2.4%	2.4%	2.5%
Vernonia City, OR						
Single Family	1.4%	1.6%	1.6%	1.6%	1.6%	1.6%
Multiple Family	0.8%	0.9%	1.0%	0.9%	0.9%	0.8%
Non-Residential	1.8%	2.1%	2.1%	2.1%	2.0%	2.0%
Franklin Township, PA						
Single Family	1.4%	1.7%	1.9%	2.0%	2.0%	2.0%
Multiple Family	1.3%	1.7%	1.9%	2.1%	2.1%	2.2%
Non-Residential	1.5%	1.8%	1.9%	1.9%	1.9%	1.8%
Glen Rock Borough, PA						
Single Family	3.0%	3.2%	3.4%	3.5%	3.7%	3.8%
Multiple Family	2.0%	2.2%	2.4%	2.6%	2.8%	3.0%
Non-Residential	4.9%	4.8%	4.0%	2.6%	1.0%	0.0%
Lower Mt. Bethel Township, PA						
Single Family	6.0%	6.1%	6.1%	6.3%	6.3%	6.4%
Multiple Family	2.8%	2.4%	1.8%	1.3%	0.7%	0.0%
Non-Residential	5.5%	4.4%	3.0%	2.0%	1.0%	0.0%

Table F.16 (Continued)
Percent Change from Baseline for Average Real Pre-FIRM Property Values from 1997 to 202
Scenario 7: Property Elevation At and Above BFE
Sample Communities

Community	1998	2002	2007	2012	2017	2022
New Cumberland Borough, PA						
Single Family	1.7%	2.0%	2.0%	2.0%	2.1%	2.1%
Multiple Family	1.3%	1.5%	1.6%	1.6%	1.6%	1.6%
Non-Residential	2.5%	2.9%	3.0%	3.0%	3.0%	3.1%
Myrtle Beach City, SC						
Single Family	1.1%	1.1%	1.1%	1.1%	1.1%	1.0%
Multiple Family	1.0%	1.1%	1.1%	1.1%	1.2%	1.2%
Non-Residential	1.9%	2.3%	2.5%	2.6%	2.7%	2.8%
Lawrence County, SD						
Single Family	1.5%	1.8%	1.9%	2.0%	2.0%	2.0%
Multiple Family	1.0%	1.2%	1.3%	1.3%	1.4%	1.4%
Non-Residential	1.9%	2.2%	2.3%	2.3%	2.3%	2.3%
Brookside Village City, TX						
Single Family	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Multiple Family	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Non-Residential	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Garland City, TX						
Single Family	0.6%	0.7%	0.7%	0.7%	0.7%	0.7%
Multiple Family	0.6%	0.8%	0.9%	0.9%	1.0%	1.0%
Non-Residential	1.1%	1.2%	1.2%	1.1%	1.1%	1.0%
League City, TX						
Single Family	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
Multiple Family	0.1%	0.2%	0.2%	0.2%	0.2%	0.2%
Non-Residential	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%
Grundy Town, VA						
Single Family	1.5%	1.6%	1.6%	1.7%	1.7%	1.7%
Multiple Family	1.6%	1.9%	1.9%	1.9%	1.7%	1.4%
Non-Residential	1.7%	1.8%	1.7%	1.7%	1.7%	1.7%
Ephrata City, WA						
Single Family	1.3%	1.5%	1.5%	1.5%	1.5%	1.5%
Multiple Family	1.4%	1.7%	1.9%	2.0%	2.1%	2.1%
Non-Residential	1.7%	2.0%	2.0%	2.0%	2.0%	1.9%
Leavenworth City, WA						
Single Family	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%
Multiple Family	0.2%	0.2%	0.1%	0.1%	0.1%	0.0%
Non-Residential	0.4%	0.4%	0.4%	0.3%	0.2%	0.0%
Marlinton Town, WV						
Single Family	1.1%	1.1%	1.2%	1.3%	1.3%	1.3%
Multiple Family	0.8%	0.9%	0.6%	0.4%	0.2%	0.0%
Non-Residential	1.4%	1.5%	1.7%	1.7%	1.7%	1.7%
Philippi City, WV						
Single Family	1.6%	1.7%	1.7%	1.8%	1.9%	1.9%
Multiple Family	1.0%	1.3%	1.4%	1.4%	1.5%	1.6%
Non-Residential	1.6%	1.9%	1.9%	2.1%	2.1%	2.1%
Wheeling City, WV						
Single Family	1.8%	2.1%	2.2%	2.3%	2.5%	2.5%
Multiple Family	1.3%	1.4%	1.5%	1.6%	1.7%	1.7%
Non-Residential	1.6%	1.8%	1.8%	1.8%	1.9%	2.0%