Technical Documentation of NFIP Actuarial Assumptions and Methods

Supporting Rates Effective October 1, 2013

Description of this document

This document outlines the actuarial assumptions and methods used to develop rates for the National Flood Insurance Program (NFIP) rates that are effective October 1, 2013. NFIP insurance rates are published in two documents, The October 1, 2013 Flood Insurance Manual (FIM) and the October 2013 Specific Rate Guidelines (SRG). The FIM is used to set rates for most of the NFIP's policyholders. The SRG historically has been used by insurers to calculate premiums for a variety of special cases that have a much higher risk of flood damage than typical -- even within the Special Flood Hazard Area. Included in the SRG are the rates for buildings that are not using pre-FIRM subsidized rates and are not using grandfathered zone and elevation based rates but are instead rated based on a lowest floor elevation that is below the Base Flood Elevation (BFE).

This document assumes the reader is familiar with the Flood Insurance Manual, the Specific Rate Guidelines, and the Actuarial Rate Review.

Actuarial Rate Model Description from the Actuarial Rate Review

The Rate Model utilized by the NFIP produces indicated insurance rates to be charged per $100 of insurance coverage purchased. This model is based on the hydrologic model developed by the Army Corps of Engineers.

As designed, the Rate Model estimates the rate for an individual structure located in either an AE- or V-Zone. The model can calculate either the basic limit rate or additional limit rate for all structures that meet any combination of the following variables:

- The occupancy of the structure: single family, 2-4 family, other residential, non-residential and mobile/manufactured homes
- Type of structure and location of contents
    - For building coverage, the type of structure: e.g., one floor no basement
    - For contents coverage, the location of the contents: e.g., lowest floor only
- The elevation of the structure relative to the Base Flood Elevation (BFE)
- The specific flood zone, which varies by topography. For AE-Zones, the flood zones vary from A01 through A30. A01 is a very broad and shallow floodplain. On the opposite extreme, A30 is a steep and narrow mountainous valley. The numbering system is based on an increasing difference between the elevation for which there is a 1%[1] annual chance that a flood will exceed that elevation and the elevation for floods that have a 10% annual chance. For most of the range, the differences represent a half-foot increment. As the zones move into steeper topographies (A21 through A30), the increment increases to 1-foot. For example, in Zone A05, the threshold of the Ten-Year Flood event is 2.5 feet below BFE. For Zone A06, the threshold of the Ten-Year Flood event is 3.0 feet below BFE.

---

[1] The 1% annual chance flood is sometimes referred to as the "Hundred-Year Flood." Likewise, the 10% annual chance flood is sometimes referred to as the "Ten-Year Flood." Both terms are misnomers because they imply a flood of this level will occur every 100 or 10 years, respectively. In the NFIP, these terms are used to refer to the statistical probability of a flood occurring every year and not the time between flood events. The 10% annual chance flood elevation is the water surface elevation that has a 10% chance of being equaled or exceeded. These types of flood events will occur on average once every ten years. But the number of such events that actually occur every ten, twenty, or even fifty years is highly variable. The probability that a community will experience three or more "10-year floods" in a decade is 7%, while the probability that a community could go thirty or more years without experiencing such an event is 4.2%. The term "Ten-Year Flood" may imply a relative certainty of flood frequency during relatively short time periods (e.g., ten to thirty years) that is misplaced.

The terms are also misleading because of the magnitude usually associated with such events. That is, most individuals assume that only relatively small flood events are associated with the ten year event, while much larger flood events are associated with the hundred year event. However, these terms arose from efforts to re-describe the minimum water depth associated with flood probabilities. The ten-year flood covers a wide range of flooding events: events that are just above that elevation, and events that are truly catastrophic, such as Hurricane Katrina or worse. As such, the Hundred Year Flood may be considered a subset of the Ten Year Flood.

Note: While the Rate Model can calculate individual rates for any combination of the four variables above, the published rates do not vary by type of AE zone. Instead, in order to keep the rate tables relatively streamlined and easy for the consumer (insurance agents and their customers), the indicated rates for the various topographies are averaged together to arrive at one published AE-rate. That is, published Post-FIRM AE rates vary only by the first three variables above.

The Rate Model calculates the indicated rate per $100 of insurance coverage for an individual structure. The rate is calculated in two steps. The first step derives the expected average annual flood damage value expressed as a percentage of the amount of insurance purchased. The Rate Model formula then converts that expected average annual flood damage value into an insurance rate by loading expenses and performing other adjustments to assure that the premium derived from the rates will be sufficient to meet expected insured flood damages plus expenses. These two steps are shown in the outline of the actuarial rate formula below

Step One: Calculation of Expected Average Annual Flood Damage

The actuarial rate formula may be expressed as follows:

$$RATE = \left[\sum_{i=Min}^{Max} \left(PELV_i \times DELV_i \right) \right] \times \frac{LADJ \times DED \times UINS}{EXLOSS} \qquad \text{(Formula 1)}$$

where: *Min* = minimum elevation relative to lowest floor at which flood damage occurs, and
Max = elevation relative to lowest floor at which flood damage approaches a maximum.

PELV is the probability that the flood water elevations are in a certain range. DELV is the damage to the property, expressed as a percentage of the total property value, resulting from that volume of flood water. LADJ is a loading factor to account for loss adjustment expenses. DED is a factor designed to eliminate that portion of the loss that will be borne by the policyholder through their deductible. UINS is a factor designed to adjust for how much policyholders have underinsured their property. EXLOSS is the expected loss ratio which serves to provide a loading for underwriting expenses, contingency factor and other factors. All these variables are explained in more detail below.

This formula can be re-written as:

$$RATE = \left[\sum_{i=Min}^{Max} \left(PELV_i \times \left(UINS \times DELV_i \right) \right) \right] \times \frac{LADJ \times DED}{EXLOSS} \qquad \text{(Formula 2)}$$

The value in the brackets of Formula 1 represents the expected average annual flood damage as a percentage of the value of the property, whether that property is a structure or the contents in the structure. The value in the brackets of Formula 2 represents the expected average annual flood damage as a percentage of the amount of insurance purchased. However, since this includes cases where the property is underinsured, either by choice of the insured or due to the maximum amount of insurance available under the NFIP, this calculation includes some flood scenarios where the damage amount exceeds the amount of insurance purchased. These excessive damage scenarios should be capped in order to properly reflect the indicated rate per $100 of insurance coverage provided. This results in the following adjusted formula:

$$RATE = \left[\sum_{i=Min}^{Max} \left(PELV_i \times Min\left(1.00, \left(UINS \times DELV_i \right)\right) \right) \right] \times \frac{LADJ \times DED}{EXLOSS} \qquad \text{(Formula 3)}$$

The following is a more detailed explanation of the variables used to develop the expected average annual flood damage in the Rate Model:

- *Underinsurance Factor.* In the Rate Model formula this is the variable UINS and is a ratio of Property Value to Amount of Insurance.
- *Water Depth Probability Curve (PELV).* This is the annual probability that flood waters will reach or exceed a given depth relative to the BFE. For each Flood Zone (A01 through A30, etc.), a fourth order curve has been fit to the log of the various probabilities. Currently, there are two different sets of probability curves available for use. The first set, the "PELV" curves, was developed by the Army Corps of Engineers in the early years of the NFIP and is revised infrequently. However, during the mid to late 1980's, additional curves, the "PELV500" curves, were developed to reflect the fact that for some communities, the flood data available was very limited, and as a result, there is a downward bias in the flood height estimates. The Rate Model is run twice using both curves and the resulting indicated rates are judgmentally weighted to reflect the NFIP's distribution of business in such communities
- *Water Depth Damage Amounts(DELV).* This is a table of damage amounts (as a percentage of the total building or contents property value) by water depth. These table values come from the Credibility Report drawn from the Actuarial Information System (AIS). The AIS database is updated annually. These damage amounts vary by class (occupancy and type of structure) and by the depth of flood water in the structure.

With these variables defined, the Rate Model is ready to calculate the expected average annual flood damage as a percentage of the amount of insurance purchased. It first divides the interval for which the water-depth probability curve is valid into a hundred separate intervals and then calculates the probability of the crest of the flood water in each individual interval. It also calculates, for each flood event, how much water will be in the structure and the resulting expected average annual flood damage. The product of the probability, the damage amount, and the underinsurance factor is then calculated as shown in Formula 3. The Rate Model formula sums the probability-weighted expected damage from each interval. The final result is the expected average annual flood damage.

Step Two: Calculation of Indicated Flood Insurance Rate per $100 of Insurance Purchased

The final step of the Rate Model formula is the conversion of the expected damage to an indicated flood insurance rate per $100 of insurance. This step applies the impact of deductibles and loads the rate for claims handling and other operating expenses. In the Rate Model formula shown above, these three variables are:

- DED, which is an estimate of the percentage of the damage that will not be covered by insurance because it is below the deductible. The analysis developing this number is based on the reported damage amounts in the historical claims data.
- ALADJ, which is the ratio Allocated Loss Adjustment Expenses to claims dollars paid. This is based on an analysis of trended historical claims data matched against the ALAE Fee Schedule that will be the basis for compensating claims adjusters.
- EXLOSS, which is the expected loss ratio which serves to provide for all other operating (underwriting) expenses, including unallocated loss adjustment expenses. Also reflected is an offset factor in order to assure that the premium discounts provided under the Community Rating System (CRS) are revenue-neutral. This factor is based upon an analysis of future fixed and variable expense levels, a contingency loading (10% for A-Zones and 20% for V-Zones), and a projection of our policy distribution by CRS community.

The output from the Rate Model, based on all the factors provided above, is an indicated flood insurance rate per $100 of insurance purchased. However, since the early 1980's, the NFIP no longer publishes separate tables of rates for the various A01-A30 zones and the various V01-V30 zones. Instead one separate table of AE zone rates is published along with a separate table of VE zone rates.

The current procedure for developing the indicated overall AE zone rate for a class of buildings that are similar in occupancy, building type and elevation relative to the BFE is as follows. Indicated rates are developed for the A01, A04, A09, A12, A15, and A20 zones by running the Rate Model function. The indicated rates for each of those zones are weighted together by the distribution of NFIP policies in these and neighboring zones. This procedure is followed for both of the probabilities curves, PELV and PELV500,

described above. The ultimate indicated rate is currently derived by an 80/20 weighting of the results from the PELV and PELV500 curves.

Technical Summary of Assumptions and Methods

I. Illustrative Rating Example

Before providing the detailed assumptions and methods used in the NFIP's annual rate setting process, we begin with an example to help the reader understand the methodology used to set rates.

Brief description of the rate model

In general, the model starts with a probabilistic estimate of the expected damage to the insured structure. First, the model estimates the probability of various depths of flood water entering the structure. Then it determines the amount of damage from that depth of flood water, on average, would cause. The probabilities come from hydrologic/hydraulics study of the community performed by engineers/scientists, and the expected amount of damage is based on a review of NFIP claims for similar depths of flood water in the structure.

These estimated damage amounts are then adjusted to expected claims payout after accounting for deductibles, capping damage not to exceed the amount of insurance purchased, and adding loss adjustment expenses. These adjustments are not made on a property-by-property basis, but instead are made based on Program-wide averages.

Finally, the premium is determined by adding to these expected claims payouts operating expenses and other standard insurance techniques such as contingency loadings and under-insurance adjustments.

Illustrative example overview

The final rates per $100 of insurance shown in the Rate Manual and the Specific Rate Guidelines are the weighted average of many rate calculations, each of which uses average assumptions about buildings and losses. To help the reader understand the premium resulting from the rate model, the following illustrative example applies the conceptual methodology of the rate model to a specific structure. An example was selected that results in a premium similar to what would be charged based on the rate in the Specific Rate Guidelines.

Example building Characteristics:

- $250,000 of building insurance purchased, building is insured to 85% of value (value of $294,118)
- Single story, single family home without a basement
- Standard $1,000 deductible is selected
- Building is located in an A18 zone with a 9 ft. difference between the 1% and 10% event (10 yr. and 100 yr. return period depth).
- The top of the lowest floor is 8 feet below the BFE
- CRS class 8

Illustrative example frequency of flooding

The example begins with calculation of the frequency of flooding for ranges of depths of water in the structure. These probabilities and return period calculations are based on the PELV formulas described later.

We begin by looking at a specific row, the row associated with flooding 3 feet to 2 feet below the BFE (the ninth row down). Because the structure is 8 ft. below the BFE, there will be 5 to 6 feet of water in the structure when floodwaters are 3 to 2 feet below BFE. Based on the PELV formula, the annual chance of floodwaters reaching or exceeding 3 feet below BFE is 2.1% (47.6 year return period), and the annual chance of floodwaters reaching or exceeding 2 feet below BFE is 1.7% (60.2 year return period). The annual chance of floodwaters in the range from 3 feet below BFE to 2 feet below BFE is 2.1% - 1.7% = 0.4%

Rating Example - Frequency (Probability) of Flooding

Depth relative to BFE (ft)			Depth in Structure (ft)			Return Period (yrs)			Probability range			Probability in range
4.5	and	up	12.5	and	up	501.3	and	up	0.2%	and	less	0.2%
4.0	to	4.5	12.0	to	12.5	399.9	to	501.3	0.3%	to	0.2%	0.1%
3.0	to	4.0	11.0	to	12.0	266.8	to	399.9	0.4%	to	0.3%	0.1%
2.0	to	3.0	10.0	to	11.0	187.6	to	266.8	0.5%	to	0.4%	0.2%
1.0	to	2.0	9.0	to	10.0	137.4	to	187.6	0.7%	to	0.5%	0.2%
0.0	to	1.0	8.0	to	9.0	99.3	to	137.4	1.0%	to	0.7%	0.3%
-1.0	to	0.0	7.0	to	8.0	76.8	to	99.3	1.3%	to	1.0%	0.3%
-2.0	to	-1.0	6.0	to	7.0	60.2	to	76.8	1.7%	to	1.3%	0.4%
-3.0	to	-2.0	5.0	to	6.0	47.6	to	60.2	2.1%	to	1.7%	0.4%
-4.0	to	-3.0	4.0	to	5.0	36.2	to	47.6	2.8%	to	2.1%	0.7%
-5.0	to	-4.0	3.0	to	4.0	28.5	to	36.2	3.5%	to	2.8%	0.7%
-6.0	to	-5.0	2.0	to	3.0	22.4	to	28.5	4.5%	to	3.5%	1.0%
-7.0	to	-6.0	1.0	to	2.0	17.5	to	22.4	5.7%	to	4.5%	1.2%
-8.0	to	-7.0	0.0	to	1.0	13.1	to	17.5	7.6%	to	5.7%	1.9%
-8.5	to	-8.0	-0.5	to	0.0	11.5	to	13.1	8.7%	to	7.6%	1.0%
-8.5	and	below	-0.5	and	below	12.0	and	under	100.0%	to	8.7%	91.3%

Illustrative example severity of flooding

Next we examine the damages expected in each range of flooding. The percent damages shown below are the weighted average damages in the DELV damage tables, which will be described later.

Continuing with the example of the ninth row down, damages are expected to average 48.9% of the structure's value, or $143,936.04, when there are 5 to 6 feet of water in the structure. The damage amount is reduced $1,000 due to the deductible, resulting in average claim payment of $142,936.04 when there are 5 to 6 feet of water in the structure. The claims adjuster would be paid $3,716.34 for the Allocated Loss Adjustment Expense (ALAE) and Unallocated Loss Adjustment Expenses (ULAE) and Special Allocated Loss Adjustment Expenses (SALAE) are expected to be $2,429.91, resulting in a total paid loss and all Loss Adjustment Expenses (LAE) of $149,082.29.

Rating Example - Severity (Damage), Paid Loss, and Adjustment Expenses

Depth in Structure (ft)	Percent Damage	Damage Amount	Less Deductible	ALAE	ULAE and SALAE	Paid Loss and LAE
12.5 and up	78.4%	$ 230,701.57	$ 229,701.57	$ 5,972.24	$ 3,904.93	$ 239,578.74
12.0 to 12.5	73.8%	$ 217,073.69	$ 216,073.69	$ 5,617.92	$ 3,673.25	$ 225,364.86
11.0 to 12.0	73.1%	$ 215,103.73	$ 214,103.73	$ 5,566.70	$ 3,639.76	$ 223,310.19
10.0 to 11.0	70.5%	$ 207,347.61	$ 206,347.61	$ 5,365.04	$ 3,507.91	$ 215,220.56
9.0 to 10.0	68.0%	$ 199,856.35	$ 198,856.35	$ 5,170.27	$ 3,380.56	$ 207,407.18
8.0 to 9.0	63.5%	$ 186,841.53	$ 185,841.53	$ 4,831.88	$ 3,159.31	$ 193,832.71
7.0 to 8.0	59.6%	$ 175,328.49	$ 174,328.49	$ 4,532.54	$ 2,963.58	$ 181,824.61
6.0 to 7.0	54.2%	$ 159,315.80	$ 158,315.80	$ 4,116.21	$ 2,691.37	$ 165,123.38
5.0 to 6.0	48.9%	$ 143,936.04	$ 142,936.04	$ 3,716.34	$ 2,429.91	$ 149,082.29
4.0 to 5.0	41.9%	$ 123,200.58	$ 122,200.58	$ 3,400.00	$ 2,077.41	$ 127,677.99
3.0 to 4.0	33.2%	$ 97,648.74	$ 96,648.74	$ 3,286.06	$ 1,643.03	$ 101,577.83
2.0 to 3.0	28.6%	$ 83,979.90	$ 82,979.90	$ 2,821.32	$ 1,410.66	$ 87,211.87
1.0 to 2.0	23.3%	$ 68,505.15	$ 67,505.15	$ 2,295.18	$ 1,147.59	$ 70,947.91
0.0 to 1.0	16.6%	$ 48,966.01	$ 47,966.01	$ 1,640.00	$ 815.42	$ 50,421.43
-0.5 to 0.0	3.5%	$ 10,294.12	$ 9,294.12	$ 970.00	$ 158.00	$ 10,422.12
-0.5 and below	0.0%	$ -	$ -	$ -	$ -	$ -

Illustrative example expected paid loss

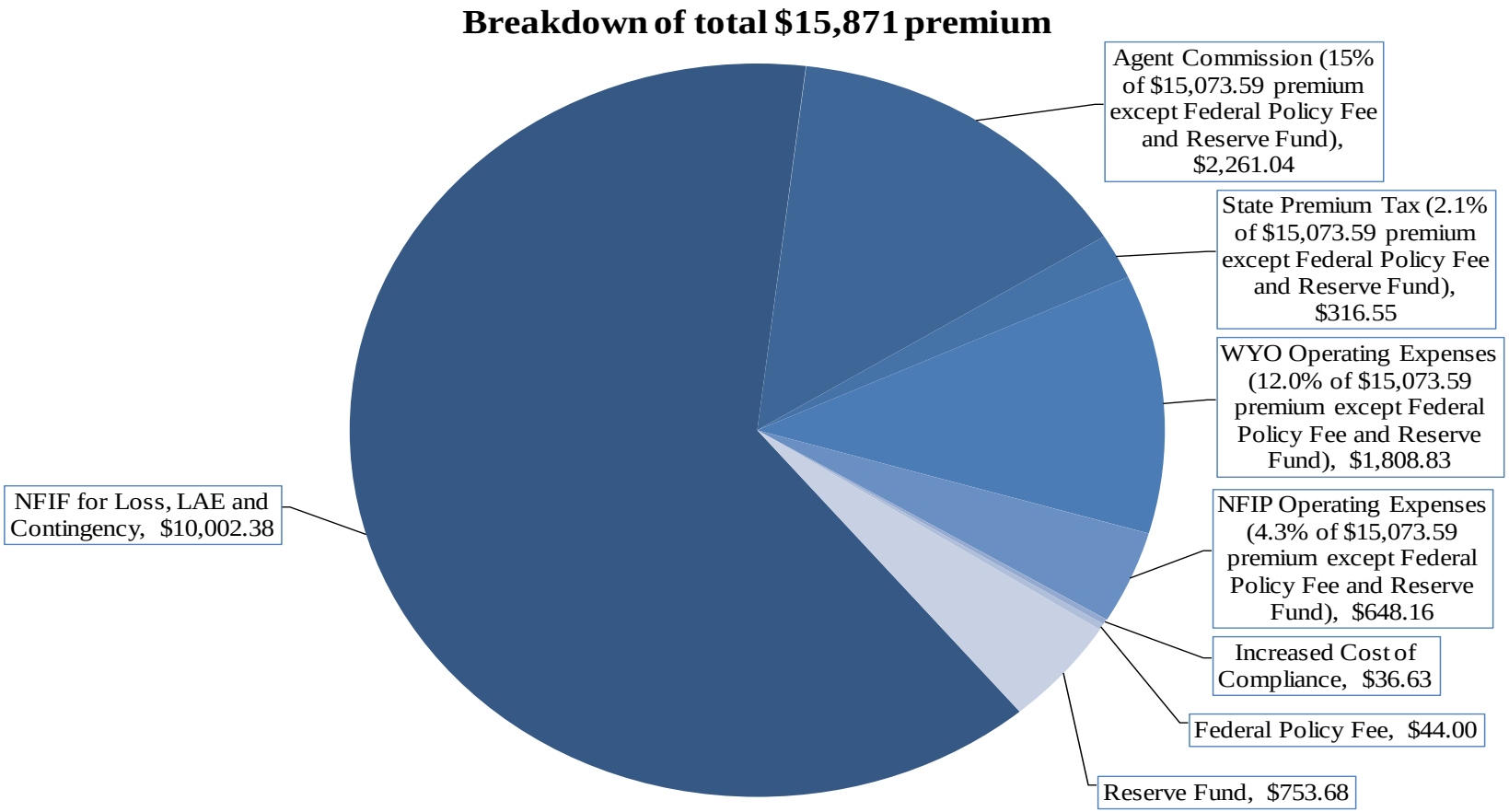
Next we calculate the expected paid loss by considering the probability of flooding with each range and the expected paid loss and LAE within each range.

In the example of the ninth row down, there is a 0.4% probability of water being within the range and an average paid loss and LAE of $149,082.29. The probability weighted expected paid loss for this row is $660.29 (0.4% probability times $149,082.29). Finally a 20% contingency load is added. The total expected loss to the National Flood Insurance Fund, with contingency load, for all ranges of flooding is $10,002.38.

Rating Example - Probability Weighted Expected Paid Loss					
Depth in Structure			Probability in range	Paid Loss and LAE	Expected NFIF Loss	with Contingency Load
12.5	and	up	0.2%	$239,578.74	$ 477.92	$ 573.50
12.0	to	12.5	0.1%	$225,364.86	$ 113.98	$ 136.78
11.0	to	12.0	0.1%	$223,310.19	$ 278.57	$ 334.29
10.0	to	11.0	0.2%	$215,220.56	$ 340.65	$ 408.78
9.0	to	10.0	0.2%	$207,407.18	$ 403.90	$ 484.68
8.0	to	9.0	0.3%	$193,832.71	$ 542.10	$ 650.52
7.0	to	8.0	0.3%	$181,824.61	$ 534.85	$ 641.81
6.0	to	7.0	0.4%	$165,123.38	$ 591.91	$ 710.29
5.0	to	6.0	0.4%	$149,082.29	$ 660.29	$ 792.35
4.0	to	5.0	0.7%	$127,677.99	$ 845.47	$ 1,014.57
3.0	to	4.0	0.7%	$101,577.83	$ 750.23	$ 900.27
2.0	to	3.0	1.0%	$ 87,211.87	$ 832.23	$ 998.68
1.0	to	2.0	1.2%	$ 70,947.91	$ 881.15	$ 1,057.38
0.0	to	1.0	1.9%	$ 50,421.43	$ 974.96	$ 1,169.96
-0.5	to	0.0	1.0%	$ 10,422.12	$ 107.10	$ 128.52
-0.5	and	below	91.3%	$ -	$ -	$ -
Total			100.0%		$ 8,335.32	$ 10,002.38

Illustrative example Premium

Finally, the $10,002.38 expected paid loss with contingency is converted to a total premium by first adding the Increased Cost of Compliance premium (Total ICC premium including expenses is $55, of which $36.63 is available after premium related expenses and taxes). Next agent commission (15% of final premium), State Premium Taxes (2.1% of final premium),WYO Allowance administrative expenses (12.0% of final premium), and NFIP operating expenses (4.3% of final premium) are added. Finally, a 5% reserve fund assessment and a Federal Policy fee are added. For this example, the CRS load and discount are assumed to roughly offset.



II. PELV (Frequency) Related Assumptions and Methods

PELV Formula: The Frequency of flooding is modeled using formulas that determine the probability of water reaching or exceeding a given elevation relative to BFE. Several PELV formulas are used that differ by the difference between the 1% event (sometimes referred to as the 100 yr. event or BFE) and the 10% event (sometimes referred to as the 10 year event).

The PELV curves shown below are based on data from flood studies available when the NFIP was first established. FEMA is in the process of gathering the data necessary to validate and update the formulas, if appropriate. The necessary data will be collected as RiskMap studies are completed.

The PELV formulas are in the form:

$$-\log_{10} p(elev) = C_1 + C_2 elev + C_3 elev^2 + C_4 elev^3 + C_5 elev^4$$

Where:

C_x are the coefficients from the table below

elev is the elevation relative to BFE

p(elev) is the probability water reaches or exceeds *elev*

PELV 500 formulas: FEMA assumes that 20% of policies do not reflect their current flood risk due to grandfathering or older flood studies. This is achieved by blending results using the PELV formulas and the PELV 500 formulas 80%/20% respectively.

V zone probabilities: V zones use the same PELV formulas as A zones with different weights applied. PELV 500 curves are not used. Rather 10% of V zone policies are assumed to be 1ft. lower than the stated elevation.

The tables below show the PELV and PELV 500 formulas used to develop rates in the rate manual. C_x coefficients, the minimum depth, and maximum depth are shown for each formula. The published rates are weighted averages[2] of different formulas based on the difference between the 1% and 10% event depths (the difference between the 10 year and 100 year return period depths). The difference between the 1% and 10% event depths is the basis for the number assigned to the number assigned to A01 – A30 zones. For rates found in the Rate Manual (structures 1 foot below the BFE and greater for A zones and three feet below the BFE and greater for V zones), rates are weighted average of five formulas. For rates in the Specific Rate Guidelines (structures 2 feet below the BFE and lower for A zones and 4 feet below the BFE and lower for V zones), rates are weighted averages of 30 formulas.

[2] The weights used to develop the averages are described later in the subsection *PELV weights*.

The following table summarizes the PELV formulas used to calculate AE and A01-A30 elevation based rates found in the rate manual

PELV Formulas for rates in the Rate Manual (elevations of -1 below BFE and higher)									
Numbered A Zone	**Depth Exceedance Difference between 1% and 10% events**	**PELV Number**	C_1	C_2	C_3	C_4	C_5	**Min Depth (ft.)**	**Max Depth (ft.)**
A01 through A02	0 to 1.25	25	1.99028	2.941550	2.45622000	1.139090000	0.2019980000	-2.2	0.2
A03 through A06	1.25 to 3.25	28	1.99808	0.531039	0.02877270	0.008155350	0.0017725700	-4.0	1.2
A07 through A10	3.25 to 5.25	33	1.99091	0.236907	0.00714333	0.001169790	0.0001018350	-6.4	2.6
A11 through A13	5.25 to 6.75	36	1.99494	0.181604	0.00471243	0.000159033	-0.0000283760	-8.0	3.5
A14 through A17	6.75 to 8.75	39	1.99384	0.143237	0.00391510	0.000623394	0.0000386951	-9.5	4.0
A18 through A30	8.75 and greater	44	1.99669	0.108811	0.00483903	0.000650387	0.0000251549	-13.0	5.0

The following table summarizes the PELV500 formulas, the results of which are weighted 20%/80% with the results of the PELV formulas to calculate AE and A01-A30 elevation based rates found in the rate manual

PELV500 Formulas for rates in the Rate Manual (elevations of -1 below BFE and higher)									
Numbered A Zone	**Depth Exceedance Difference between 1% and 10% events**	**PELV Number**	C_1	C_2	C_3	C_4	C_5	**Min Depth (ft.)**	**Max Depth (ft.)**
A01 through A02	0 to 1.25	25	1.78915	2.365770	1.77562500	0.783071000	0.1356080000	-2.2	0.3
A03 through A06	1.25 to 3.25	28	1.80047	0.427384	0.00696700	0.002012000	0.0007270000	-4.0	2.0
A07 through A10	3.25 to 5.25	33	1.79699	0.190719	0.00209400	0.000267000	0.0000130000	-6.4	4.4
A11 through A13	5.25 to 6.75	36	1.79437	0.142739	0.00232900	0.000165000	-0.0000210000	-8.0	5.8
A14 through A17	6.75 to 8.75	39	1.79925	0.112159	0.00172100	0.000513000	0.0000370000	-9.5	6.0
A18 through A30	8.75 and greater	44	1.79239	0.082063	0.00335100	0.000632000	0.0000270000	-13.0	6.7

The following table summarizes the PELV formulas used to calculate AE and A01-A30 elevation based rates found in the specific rate guidelines

PELV Formulas for rates in the SRG (elevations of -2 below BFE and lower)									
Numbered A Zone	Average Depth Exceedance Difference between 1% and 10% event	PELV Number	C_1	C_2	C_3	C_4	C_5	Min Height	Max Height
A01	0.5	25	1.99028	2.941550	2.45622000	1.139090000	0.2019980000	-2.2	0.2
A02	1.0	26	1.99299	1.103140	0.13327000	-0.012065600	-0.0026480600	-2.9	0.6
A03	1.5	27	1.99121	0.730142	0.04146270	-0.003353830	0.0002243520	-3.5	0.9
A04	2.0	28	1.99808	0.531039	0.02877270	0.008155350	0.0017725700	-4.0	1.2
A05	2.5	29	1.99383	0.437501	0.02037630	0.004721520	0.0008277070	-4.4	1.4
A06	3.0	30	2.00343	0.355882	0.01281370	0.003326000	0.0004955310	-5.0	1.8
A07	3.5	31	1.98783	0.297583	0.01077180	0.003149750	0.0003892300	-5.4	2.0
A08	4.0	32	1.99129	0.265109	0.00796868	0.001647190	0.0001724100	-5.8	2.4
A09	4.5	33	1.99091	0.236907	0.00714333	0.001169790	0.0001018350	-6.4	2.6
A10	5.0	34	2.00540	0.212995	0.00482875	0.000677183	0.0000466816	-7.0	2.5
A11	5.5	35	1.98677	0.198509	0.00521489	0.000386536	0.0000127591	-7.5	3.0
A12	6.0	36	1.99494	0.181604	0.00471243	0.000159033	-0.0000283760	-8.0	3.5
A13	6.5	37	1.99271	0.169062	0.00416359	0.000289299	0.0000075037	-8.5	3.5
A14	7.0	38	1.99138	0.154106	0.00393005	0.000497133	0.0000266437	-9.0	3.5
A15	7.5	39	1.99384	0.143237	0.00391510	0.000623394	0.0000386951	-9.5	4.0
A16	8.0	40	1.99780	0.132837	0.00383452	0.000623703	0.0000322619	-10.5	4.0
A17	8.5	41	2.00654	0.126609	0.00369000	0.000545055	0.0000258405	-11.0	4.0
A18	9.0	42	1.99436	0.119689	0.00472890	0.000659131	0.0000275790	-11.5	4.5
A19	9.5	43	1.99909	0.115214	0.00481349	0.000604028	0.0000224126	-12.5	5.0
A20	10.0	44	1.99669	0.108811	0.00483903	0.000650387	0.0000251549	-13.0	5.0
A21	11.0	46	1.99612	0.107949	0.00502151	0.000469362	0.0000136900	-14.0	5.0
A22	12.0	48	1.99444	0.103101	0.00490502	0.000374550	0.0000085944	-16.0	5.0
A23	13.0	50	1.98220	0.096875	0.00647498	0.000582696	0.0000157358	-17.0	6.0
A24	14.0	52	1.99408	0.094716	0.00556085	0.000403997	0.0000088791	-18.0	6.0
A25	15.0	54	1.99506	0.089769	0.00483907	0.000313120	0.0000061698	-17.0	6.0
A26	16.0	56	1.99440	0.084815	0.00472599	0.000310158	0.0000062578	-18.0	6.0
A27	17.0	58	1.99531	0.080203	0.00459697	0.000276668	0.0000046559	-19.0	6.0
A28	18.0	60	1.99961	0.079480	0.00475066	0.000250936	0.0000032506	-22.0	6.0
A29	19.0	62	1.99537	0.070679	0.00407088	0.000221189	0.0000028952	-22.0	6.0
A30	20.0	64	1.99505	0.064798	0.00371804	0.000216164	0.0000032773	-22.0	6.0

The following table summarizes the PELV500 formulas, the results of which are weighted 20%/80% with the results of the PELV formulas to calculate AE and A01-A30 elevation based rates found in the specific rate guidelines

PELV500 Formulas for rates in the SRG (elevations of -2 below BFE and lower)									
Numbered A Zone	Average Depth Exceedance Difference between 1% and 10% event	PELV Number	C_1	C_2	C_3	C_4	C_5	Min Height	Max Height
A01	0.5	25	1.78625	2.385005	1.63645791	-0.359118122	-1.1504582546	-2.2	0.3
A02	1.0	26	1.78272	0.853846	0.06965411	0.025541331	0.0063604394	-2.9	1.0
A03	1.5	27	1.79335	0.550153	0.01211766	0.026996021	0.0068888341	-3.5	1.4
A04	2.0	28	1.79693	0.413747	0.00982394	0.008387542	0.0020052517	-4.0	1.9
A05	2.5	29	1.79297	0.345893	0.01073168	0.001772366	-0.0010029725	-4.4	2.5
A06	3.0	30	1.79917	0.286415	0.00960695	-0.000720906	-0.0013369552	-5.0	3.6
A07	3.5	31	1.79142	0.233804	0.00243676	0.002681399	0.0005047288	-5.4	3.2
A08	4.0	32	1.79501	0.205760	0.00041085	0.001729915	0.0003729705	-5.8	3.6
A09	4.5	33	1.79671	0.186029	0.00111599	0.000952698	0.0001860171	-6.4	4.1
A10	5.0	34	1.80276	0.169515	0.00230777	0.000066506	-0.0000911965	-7.0	5.3
A11	5.5	35	1.78802	0.158475	0.00277993	-0.000055690	-0.0000658663	-7.5	5.7
A12	6.0	36	1.79747	0.140289	0.00124827	0.000372252	0.0000312193	-8.0	5.5
A13	6.5	37	1.79519	0.132161	0.00115475	0.000315200	0.0000435378	-8.5	5.7
A14	7.0	38	1.79264	0.121547	0.00195834	0.000326246	0.0000089043	-9.0	6.1
A15	7.5	39	1.80264	0.113408	0.00096936	0.000419348	0.0000440867	-9.5	6.2
A16	8.0	40	1.80768	0.101927	0.00081990	0.000633961	0.0000603689	-10.5	6.1
A17	8.5	41	1.80553	0.097448	0.00163677	0.000570835	0.0000425076	-11.0	6.3
A18	9.0	42	1.79954	0.095173	0.00255127	0.000440417	0.0000205410	-11.5	6.6
A19	9.5	43	1.80135	0.088690	0.00254630	0.000532973	0.0000295576	-12.5	6.6
A20	10.0	44	1.79952	0.083215	0.00264039	0.000581582	0.0000315098	-13.0	6.6
A21	11.0	46	1.79908	0.080666	0.00308673	0.000486538	0.0000225731	-14.0	6.8
A22	12.0	48	1.79279	0.077579	0.00321539	0.000411778	0.0000173180	-16.0	7.1
A23	13.0	50	1.79976	0.074002	0.00316110	0.000332721	0.0000116012	-17.0	7.4
A24	14.0	52	1.79919	0.070506	0.00364038	0.000402872	0.0000148479	-18.0	7.3
A25	15.0	54	1.79882	0.068875	0.00320550	0.000261498	0.0000073692	-17.0	7.9
A26	16.0	56	1.79782	0.065271	0.00323892	0.000250689	0.0000062061	-18.0	8.1
A27	17.0	58	1.79594	0.061270	0.00321887	0.000238114	0.0000054965	-19.0	8.4
A28	18.0	60	1.79725	0.059501	0.00348462	0.000251728	0.0000055311	-22.0	8.3
A29	19.0	62	1.79460	0.053654	0.00301234	0.000204714	0.0000038660	-22.0	9.0
A30	20.0	64	1.79394	0.049174	0.00278849	0.000201298	0.0000040877	-22.0	9.4

PELV *Weights:* When calculating the rate for structures with a given elevation difference from BFE, the PELV formulas are weighted according to the distribution of policies within the different PELV formulas. Because not all policies are identified by a numbered zone which indicates the associated PELV formula, the PELV weights are determined by first analyzing all policies with a numbered zone within each state and then imputing this distribution on the policies without numbered zone information within the state. Then these implied weightings for each state are used to determine the national PELV weightings.

The tables below shows the PELV formula weights of current NFIP policies in AE and A01 - A30 zones with rates based on the structure's elevation difference used to calculate rates in the Rate Manual.

A Zone PELV Weights for rates in the Rate Manual (elevation differences of -1 below BFE and higher)

Numbered A Zone	Depth Exceedence Difference between 1% and 10%	PELV Number	Elevation Difference from BFE					
			4	3	2	1	0	-1
A01 through A02	0 to 1.25	25	10%	10%	20%	19%	16%	11%
A03 through A06	1.25 to 3.25	28	32%	32%	29%	24%	22%	34%
A07 through A10	3.25 to 5.25	33	35%	35%	36%	39%	39%	35%
A11 through A13	5.25 to 6.75	36	15%	15%	9%	12%	15%	13%
A14 through A17	6.75 to 8.75	39	7%	7%	5%	5%	7%	6%
A18 through A30	8.75 and greater	44	1%	1%	1%	1%	1%	1%
Total			100%	100%	100%	100%	100%	100%

The tables below shows the PELV formula weights of current NFIP policies in VE and V01 - V30 zones with rates based on the structure's elevation difference used to calculate rates in the Rate Manual.

V Zone PELV Weights for rates in the Rate Manual (elevation differences of -3 below BFE and higher)

Numbered V Zone	Depth Exceedence Difference between 1% and 10%	PELV Number	Elevation Difference from BFE							
			4	3	2	1	0	-1	-2	-3
V01 through V02	0 to 1.25	25	1%	1%	1%	1%	1%	2%	0%	0%
V03 through V06	1.25 to 3.25	28	8%	8%	7%	8%	6%	8%	2%	4%
V07 through V10	3.25 to 5.25	33	33%	33%	26%	19%	19%	27%	50%	18%
V11 through V13	5.25 to 6.75	36	26%	26%	23%	20%	20%	23%	23%	23%
V14 through V17	6.75 to 8.75	39	17%	17%	20%	22%	27%	27%	15%	30%
V18 through V30	8.75 and greater	44	15%	15%	24%	30%	26%	13%	11%	25%
Total			100%	100%	100%	100%	100%	100%	100%	100%

The tables below shows the PELV formula weights of current NFIP policies in AE and A01 - A30 zones with rates based on the structure's elevation difference used to calculate rates in the Specific Rate Guidelines.

PELV Weights for rates in the SRG
(elevation differences of -2 below BFE and lower)

Numbered A Zone	Average Depth Exceedence Difference between 1% and 10%	PELV Number	Elevation Difference from BFE						
			-8	-7	-6	-5	-4	-3	-2
A01	0.5	25	0.00%	5.66%	0.00%	1.52%	1.77%	1.80%	4.01%
A02	1.0	26	0.00%	7.84%	1.87%	0.37%	1.86%	3.15%	4.31%
A03	1.5	27	3.45%	0.00%	0.44%	0.74%	1.28%	4.40%	4.86%
A04	2.0	28	5.17%	3.59%	1.77%	0.68%	4.23%	3.04%	6.73%
A05	2.5	29	1.72%	7.14%	2.42%	2.86%	3.82%	4.70%	5.79%
A06	3.0	30	6.90%	2.21%	1.62%	3.65%	2.39%	7.32%	4.74%
A07	3.5	31	0.00%	8.58%	10.06%	8.90%	9.71%	10.02%	9.73%
A08	4.0	32	3.45%	8.50%	1.03%	9.36%	9.07%	8.29%	9.22%
A09	4.5	33	5.39%	0.98%	4.19%	6.05%	6.19%	7.73%	5.52%
A10	5.0	34	13.43%	6.05%	6.06%	8.78%	10.99%	9.72%	11.49%
A11	5.5	35	0.00%	2.72%	6.61%	6.67%	7.99%	8.12%	4.91%
A12	6.0	36	21.12%	16.34%	16.10%	11.15%	13.06%	10.25%	7.93%
A13	6.5	37	17.31%	10.89%	23.15%	16.70%	12.57%	8.87%	8.57%
A14	7.0	38	14.58%	8.17%	11.67%	6.74%	5.97%	3.52%	3.67%
A15	7.5	39	5.75%	5.45%	4.92%	5.99%	3.59%	4.14%	3.88%
A16	8.0	40	0.00%	0.00%	2.32%	2.06%	1.04%	1.18%	0.65%
A17	8.5	41	0.00%	0.00%	0.44%	0.88%	2.14%	0.71%	0.96%
A18	9.0	42	1.72%	0.00%	3.24%	4.43%	1.18%	1.12%	1.09%
A19	9.5	43	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
A20	10.0	44	0.00%	0.00%	1.33%	0.29%	0.00%	0.66%	0.36%
A21	11.0	46	0.00%	0.00%	0.00%	0.00%	0.00%	0.36%	0.36%
A22	12.0	48	0.00%	5.88%	0.74%	0.80%	0.00%	0.51%	0.12%
A23	13.0	50	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.97%
A24	14.0	52	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
A25	15.0	54	0.00%	0.00%	0.00%	0.68%	1.17%	0.00%	0.12%
A26	16.0	56	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.03%
A27	17.0	58	0.00%	0.00%	0.00%	0.68%	0.00%	0.38%	0.00%
A28	18.0	60	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
A29	19.0	62	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
A30	19.0	64	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Total			100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

Note: There was not enough data to determine distributions for elevation differences of -9 and lower. A hypothetical distribution of 50% distributed in zones A01 through A15, and 5% in each zone A16 through A25 was used.

The tables below shows the PELV formula weights of current NFIP policies in VE and V01 - V30 zones with rates based on the structure’s elevation difference used to calculate rates in the Specific Rate Guidelines.

PELV Weights for rates in the SRG (elevations of -4 below BFE and higher)									
Numbered V Zone	Average Depth Exceedence Difference between 1% and 10%	PELV Number	-10	-9	-8	-7	-6	-5	-4
V01	0.5	25	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	2.56%
V02	1.0	26	0.00%	0.00%	0.00%	0.00%	0.00%	4.26%	0.00%
V03	1.5	27	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
V04	2.0	28	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
V05	2.5	29	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
V06	3.0	30	8.33%	0.00%	0.00%	3.03%	0.00%	0.00%	0.00%
V07	3.5	31	8.33%	0.00%	0.00%	6.82%	2.83%	0.00%	0.00%
V08	4.0	32	0.00%	0.00%	3.33%	3.03%	5.66%	4.26%	0.00%
V09	4.5	33	0.00%	0.00%	0.00%	0.00%	0.00%	6.60%	2.56%
V10	5.0	34	0.00%	0.00%	3.33%	0.00%	1.89%	7.80%	4.62%
V11	5.5	35	0.00%	0.00%	6.67%	7.58%	19.81%	8.51%	17.95%
V12	6.0	36	0.00%	0.00%	5.83%	7.90%	7.55%	0.00%	2.56%
V13	6.5	37	0.00%	0.00%	22.50%	4.13%	18.46%	18.87%	36.92%
V14	7.0	38	8.33%	0.00%	3.33%	0.00%	0.00%	32.98%	0.00%
V15	7.5	39	25.00%	8.00%	0.00%	15.46%	10.38%	6.60%	0.00%
V16	8.0	40	0.00%	32.00%	15.00%	6.73%	6.60%	0.00%	0.00%
V17	8.5	41	0.00%	18.00%	7.50%	18.40%	9.70%	10.14%	15.38%
V18	9.0	42	0.00%	0.00%	5.83%	0.00%	0.00%	0.00%	0.00%
V19	9.5	43	8.33%	0.00%	11.67%	0.00%	0.00%	0.00%	0.00%
V20	10.0	44	29.17%	42.00%	15.00%	24.32%	9.57%	0.00%	4.62%
V21	11.0	46	12.50%	0.00%	0.00%	0.00%	3.77%	0.00%	12.82%
V22	12.0	48	0.00%	0.00%	0.00%	2.60%	3.77%	0.00%	0.00%
Total			100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

Other Frequency Assumptions

Damages below the 10% return period level: The rate model assumes structures are not built below the 10% return period level.

Catastrophic flooding: The maximum depths for each PELV formula is approximately the 0.2% event (500 year return period). For the variety of extreme events that are possible in excess of the 0,2% event, the average depth is assumed to be twice depth of the 0.2% event.

III.Damage (Severity) Related Assumptions and Methods

DELV Tables: Damage tables indicate the average damage associated with water reaching certain depths relative to the reference floor of the structure. Non-V zone average damage assumptions are based on an analysis of NFIP loss data credibility weighted with United States Army Corps of Engineers data.

Damages are expressed as average percents. Actual damages for different depths vary widely around these averages.

V zone average damage assumptions were developed when V zones were first introduced and are periodically.

The table below shows the average percent damage assumed in AE and A01-A30 zones when floodwaters reach different depths relative to the structure's reference floor.

Non-V Zone Average Damage Tables (Percent)

	Building Damage				Residential Contents			Nonresidential Contents		
Depth of flooding releative to top of reference floor	One Floor No Basement	Two Floors No Basement	Mobile Home	First Floor Only	First Floor Only	First Floor and Above	Mobile Home	First Floor Only	First Floor and Above	Mobile Home
from -0.5 to 0	3.5	2.5	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0	18.5	13.9	12.3	12.3	7.8	3.4	3.4	10.5	7.2	3.0
1	19.3	14.1	43.1	25.1	11.3	26.7	26.7	17.7	9.8	27.0
2	27.0	19.7	62.2	34.7	18.7	49.1	49.1	23.8	17.8	49.9
3	30.9	24.9	72.1	36.3	23.0	64.0	64.0	29.6	22.6	64.9
4	37.3	30.2	77.4	38.0	28.4	70.3	70.3	35.4	28.3	70.9
5	46.9	35.6	79.1	41.2	33.1	75.5	75.5	40.0	33.1	75.9
6	50.8	39.4	80.4	45.0	38.9	77.6	77.6	45.0	39.2	78.0
7	59.1	44.4	81.6	49.9	43.9	78.8	78.8	50.0	44.0	79.0
8	60.8	47.8		54.7	49.8	80.7	80.7	55.0	50.0	81.0
9	67.5	51.8		59.8	49.8	82.9	82.9	60.0	50.0	83.0
10	68.6	55.4		59.8	57.9			59.9	58.0	
11	73.2	58.2								
12	73.2	60.0								
13	76.6	63.3								
14	76.7	65.2								
15	78.4	67.1								
16	78.4	68.6								
17	79.2	68.8								

The table below shows the average percent damage assumed in VE and V01-V30 zones when floodwaters reach different depths relative to the structure's reference floor.

V Zone Average Damage Tables (Percent)				
Depth of flooding releative to bottom of reference floor	**No Obstruction**	**With Obstruction**	**Non-Elevated**	**Contents**
-2	11.0	16.0	20.0	0.0
-1	13.0	17.8	21.5	0.0
0	16.5	21.0	24.0	0.0
1	24.0	27.0	29.0	24.0
2	39.5	40.5	50.5	39.5
3	57.5	59.5	61.5	57.5
4	66.5	67.8	69.1	66.5
5	71.5	72.3	73.1	71.5
6	75.3	76.0	76.7	75.3
7	78.3	78.5	78.7	78.3
8	81.0	81.0	81.0	81.0
9	83.0	83.0	83.0	83.0
10	85.0	85.0	85.0	85.0
11	87.0	87.0	87.0	87.0
12	89.0	89.0	89.0	89.0
13	90.3	90.3	90.3	90.3
14	91.5	91.5	91.5	91.5
15	92.0	92.0	92.0	92.0
16	92.5	92.5	92.5	92.5
17	93.0	93.0	93.0	93.0
18	93.5	93.5	93.5	93.5

Other Damage Assumptions:

Vulnerability of posts, piles, and piers in V zones: The average damage tables shown above for V zone structures begin 2 feet below the lowest horizontal member of the first elevated floor. However, structures subject to coastal flooding may be vulnerable to damage, including structural failure, during less severe flooding events. An additional load for V zone properties is added to account for this vulnerability. For this load, damage is assumed to begin at the 5% event (sometimes referred to as the 20 year return period event). Damage is then assumed to increase by a multiple for each foot increase in depth until flood levels reach two feet below the lowest horizontal member of the first elevated floor.

For example, consider a structure with a compliant obstruction. Between 0 ft. and 1 ft. of water above the 5% event (20 year event), 3% average damage is assumed. Between 1 ft. and 2 ft. of water above the 5% event 6% average damage is assumed. Between 2 ft. and 3ft. 9% damage is assumed until the assumed damage reaches 16%. Then the assumed damage remains 16% until the water reaches 2 ft. below the structure's lowest horizontal member. Then the DELV tables are used.

V Zone Loading for damages to posts, piles, and piers

for flood depths in excess of 5% event (20 year event) and lower than 2 feet below the structure's lowest horizontal member of the first elevated floor

Depth of flooding relative to the 5% event	No Obstruction	With Obstruction	Non-Elevated
Damage Factor for each foot in excess of the 5% event	1%	3%	4%
Maximum damage assumption	11%	16%	20%

Erosion Load in V zones: Based on a Heinz center study, rates are loaded 63 cents per hundred dollars of insurance to account for catastrophic erosion losses.

Basement Damages: It is assumed that 16.7% of the value of buildings without machinery and equipment in the basement are exposed to basement flooding, and 22% of the value of buildings with machinery and equipment in the basement are exposed to basement flooding. For a $180,000 structure, this equates to $30,000 for a building without machinery and equipment and $40,000 for a building with machinery and equipment exposed to basement flooding.

The table below shows the average percent damage assumed for structures with basements in AE and A01-A30 zones when floodwaters reach different depths relative to the bottom of the structure's basements.

Basement Average Damages

Depth of flooding relative to the bottom of the basement	Average basement damage	Average damage to remainder of structure
from -0.5 to 0	3.5	0.0
0	20.0	0.0
1	30.0	0.0
2	40.0	0.0
3	50.0	0.0
4	60.0	0.0
5	70.0	0.0
6	80.0	0.0
7	90.0	0.0
7.5	95.0	10.0
8	100.0	18.5
9	100.0	19.3
10	100.0	27.0
11	100.0	30.9
12	100.0	37.3
13	100.0	46.9
14	100.0	50.8
15	100.0	59.1
16	100.0	60.8
17	100.0	67.5
18	100.0	68.6
19	100.0	73.2
20	100.0	73.2
21	100.0	76.6
22	100.0	76.7
23	100.0	78.4
24	100.0	78.4
25	100.0	79.2

IV. Other Assumptions

Deductible Factors

Deductible factors are developed by analyzing historical losses, trended to current dollars. Deductible factors are expressed as a percentage of gross loss.

Deductible Factors as a percent of gross loss			
Residential Buildings	**Residential Contents**	**Non-residential Buildings**	**Non-residential Contents**
4.50%	7.65%	2.10%	2.00%

Allocated Loss Adjustment Expense (ALAE) Factor

The ALAE factor is developed by analyzing historical losses, trended to current dollars, and determining the Allocated Loss Adjustment Expenses that would be paid based on the current Allocated Loss Adjustment Expense schedule. The ALAE factor is expressed as a percent of the gross claim.

The current ALAE factor is 4.6%.

Note that Unallocated Loss Adjustment Expenses and Special Allocated Loss Adjustment Expenses are included in the variable expense load discussed later.

A zone Underinsurance Factors

Although structure value is sometimes reported when a policy is first underwritten, the NFIP does not audit structure values reported by agents and this data is not reliable for determining underinsurance. Instead, the NFIP analyzes the detailed structure value assessments from claims data, trended to today's dollars, to determine underinsurance loading factors.

Underinsurance factors are determined separately for basic rates and additional rates which apply to different amounts of insurance. The basic and additional amounts of insurance are summarized below.

Basic and Additional Rate Amounts of Insurance			
Coverage	**Basic Insurance Limits**	**Additional Insurance Limits**	**Total Insurance Limits**
Building Coverage			
Single Family Dwelling	$ 60,000	$ 190,000	$ 250,000
2-4 family dwelling	$ 60,000	$ 190,000	$ 250,000
Other Residential	$ 175,000	$ 75,000	$ 250,000
Non-Residential	$ 175,000	$ 325,000	$ 500,000
Contents Coverage			
Residental	$ 25,000	$ 75,000	$ 100,000
Non-Residential	$ 150,000	$ 350,000	$ 500,000

The underinsurance factors are calculated using the following equations:

$$UINS.BL = \frac{\sum_{i=1}^{n} \frac{BasicAmountofInsurance}{\Pr opertyValue}}{n}$$

$$UINS.AL = \frac{\sum_{i=1}^{m} \frac{TotalInsuredValue - BasicLimit}{\Pr opertyValue}}{m}$$

$$BL / PV = \frac{\sum_{i=1}^{m} \frac{BasicLimit}{\Pr opertyValue}}{m}$$

Where *n* is the total number of structures analyzed and *m* is the number of structures analyzed with amounts of insurance in excess of the basic limits.

When calculating the basic rate, the rate is multiplied by the inverse of UINS.BL to account for underinsurance. When calculating the additional rate, BL/PV is first subtracted from the expected damage percent, and then the rate is multiplied by the inverse of UINS.AL to account for underinsurance.

A Zone Underinsurance Factors				
	Residential		Commercial	
	Building	Contents	Building	Contents
UINS.BL	0.3600	0.4800	0.4300	0.5500
UINS.AL	0.4864	0.4407	0.2545	0.2944
BL/PV	0.3474	0.4102	0.3311	0.4842

V zone Underinsurance Factors

V zone rates do not use basic/additional rates like A zone rates. Instead, a single rate is used, and rates vary by replacement cost ratio. Three categories of replacement cost ratio are used:

V zone Underinsurance Factors	
Replacement Cost Ratio	Initial Underinsurance Load
.75 or greater	1.20
.50 to .75	1.60
.50 or less	2.40

Replacement cost information is collected when a policy is first underwritten. Updating the replacement cost ratio is not part of the usual renewal process, and so replacement cost ratios may fall behind. To correct for this, an additional underinsurance load of 10% is added to V zone rates in the rate manual. No additional load is currently added to V zone rates in the SRG.

Contingency Load

The Casualty Actuary Society's Statement of Principles Regarding Property and Casualty Insurance Ratemaking states:

> The rate should include a charge for the risk of random variation from the expected costs. This risk charge should be reflected in the determination of the appropriate total return consistent with the cost of capital and, therefore, influences the underwriting profit provision. The rate should also include a charge for any systematic variation of the estimated costs from the expected costs. This charge should be reflected in the determination of the contingency provision.

NFIP rates do not reflect a cost of capital. The Contingency load is due to many factors, including but not limited to:

- Policyholder concentrations,
- The likelihood that large events can occur early before sufficient surplus is built,
- Uncertainty of modeling assumptions

Contingency Loads	
	Load
non-V zones, elevation difference of -1 and higher	10%
V zones, elevation difference of -3 and higher	20%
non-V zones, elevation difference of -2 and lower	20%
V zones, elevation difference of -4 and lower	25%

CRS Load

The Community Rating System (CRS) provides discounts for premiums who exceed the minimum standards required for participation in the NFIP. Although the ordinances and activities benefit and potentially reduce the risk of the community as a whole, they do not necessarily reduce the expected losses of specific structures. Therefore, the average CRS discount is loaded into the rates for all policyholders.

The CRS load is 12.7%

Variable Expenses

Variable expenses include the WYO allowance, (which includes agent commission, premium tax, administrative expenses other than agent commission and premium tax, Unallocated Loss Adjustment Expenses, and a possible growth bonus), Agent commission for the NFIP direct, and loss related Unallocated Loss Adjustment Expenses and Special Allocated Loss Adjustment Expenses.

Variable Expense Load			
	WYO	NFIP Direct	Weighted Average
Assumed Distribution	84.0%	16.0%	100.0%
Agent Commission	15.0%	15.0%	15.0%
ULAE (% of Premium)	0.9%	0.0%	0.8%
Premium Tax	2.5%	0.0%	2.1%
WYO Allowance ex Agt Comm & PremTax	12.9%	0.0%	10.8%
WYO Growth Bonus	0.5%	0.0%	0.4%
ULAE & SALAE	1.7%	1.7%	1.7%
Total	33.5%	16.7%	30.8%

Fixed Expenses

Fixed expenses include the NFIP Direct contract,

Fixed expenses are $23.76 per policy. When calculating rates, an average policy premium of $555 is assumed, resulting in a percentage load of 4.3%.