**Model Use, Limitations, and Mitigation Measures**

**Flood Model Estimates:** The flood models estimate the building percent and dollar damage values for a 1-percent-annual-chance flood event (100-year flood or base flood). The physical building damage assessments communicate flood risk for individual property owners and communities for the purpose of hazard mitigation planning and action. Property owners at flood risk are encouraged to obtain flood insurance through the National Flood Insurance Program (NFIP) to protect from financial loss. In addition, homeowners should adopt mitigation measures that can be used to protect properties from flooding, save money over time, and potentially reduce flood insurance premiums.

**Building Exposure Estimates:** Building replacement values are primarily derived from building appraisal values of the State’s centralized Computer-Assisted Mass Appraisal (CAMA) known as the Integrated Assessment System (IAS). Default first floor heights are derived from basement and foundation assessment information.

**Water Depths:** Water depths are computed for the 1-percent-annual-chance (1 in 100 chance per year) from model-backed engineering software called HEC-RAS or GIS-based software known as Hazus. The base flood heights derived from HEC-RAS are more accurate than Hazus.

**Building Damage Estimates:** Building and content damages are based on FEMA and US Army Corps of Engineer Flood Depth-Damage Curves. Positive and negative water depth-in-structure values indicate flood levels above or below, respectively, the finished floor. FEMA’s OpenHazus software utility called Flood Structure Assessment Tool (FAST) estimates the building damage loss for a base flood.

**Model Limitations:** Several factors may affect the flood loss estimates, including inconclusive water depth models or elevated structures that have much higher first floor heights. Please adjust damage values as necessary based on historical flood data, [**construction standards**](https://data.wvgis.wvu.edu/pub/temp/FEMA/docs/WV_Floodplain_Model%20Ordinance_20190318.pdf), or the best available information.

**Mitigation Measures:** Riverine flood mitigation measures for individual buildings include elevating the structure. Structural elevation is a well-recognized measure for reducing flood risk and often the most effective measure to reduce both flood damage and insurance premiums. For building owners who cannot elevate their structures, mitigation alternatives include property buyouts, wet or dry flood proofing. Flood-prone communities can become more resilient by adopting a comprehensive floodplain management program that includes regulating new development to higher standards, effective storm water management, and restoring the floodplain to its natural function through open space preservation and green infrastructure. Refer to FEMA’s[**FloodSmart.gov**](https://www.floodsmart.gov/) website for more information.

**Mitigation Benefit-Cost Ratio:** On January 11, 2018 the National Institute of Building Sciences (NIBS) released [**Natural Hazard Mitigation Saves: 2017 Interim Report**](https://www.fema.gov/natural-hazard-mitigation-saves-2017-interim-report), that reported that $1 spent on mitigation saves society an average of $6 in future disaster cost for riverine flooding. The overall hazard benefit-cost ratio of $6 for every $1 invested, whereby building new structures beyond code requirements and above the 100-year flood elevation yields a $5:1 benefit; and where federal grants for mitigation measures like buyouts or wet flood proofing of existing structures yields a $7:1 benefit.

**Community Rating System:** A voluntary program to encourage communities to adopt and implement floodplain management activities that exceed the minimum NFIP standards. **More information**.

**Contacts:** Contact your [**local or state floodplain manager**](https://www.mapwv.gov/flood/content/wvCountyFloodplainManagersList.htm) for additional flood-risk information including flood reduction and protection materials. Online resources include FEMA’s [**FloodSmart.gov**](https://www.floodsmart.gov/) website.

*Resource notes compiled by Kurt Donaldson, West Virginia University, 1/12/2020*

Floodplain Manager List: <https://www.mapwv.gov/flood/content/wvCountyFloodplainManagersList.htm>

FloodSmart: <https://www.floodsmart.gov/>.

Natural Hazard Mitigation Saves: 2017 Interim Report  
<https://www.fema.gov/natural-hazard-mitigation-saves-2017-interim-report>

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**Design and Construction Standards**

**New Construction:** All new construction, relocation, substantial improvements, including repair of substantial damage, of residential structures must have the lowest floor, including basement, ductwork and utilities, elevated above the Base Flood Elevation plus freeboard. In West Virginia, most community **floodplain management ordinances** have an additional freeboard requirement of two feet to compensate for the many unknown factors that could contribute to how high flood waters can rise, such as constricted bridge openings, and the hydrological effect of the urbanization in the watershed.

**Lowest Floor:** The lowest floor means “the lowest floor of the lowest enclosed area, except for unfinished or flood-resistant enclosures used solely for parking of vehicles, building access, or storage.” If the lowest enclosed area is used for anything other than vehicle parking, building access, or storage, the floor of that area is considered the lowest floor. Such prohibited use will violate NFIP requirements, resulting in drastically increased flood insurance premiums. The floor of a basement (where “basement” means the floor is below grade on all sides) will always be the lowest floor, regardless of how the space is used. Basements are prohibited from being constructed in A Zones unless the basement is elevated to or above the flood elevation or a basement exception has been granted.

Communities are required to obtain and maintain a record of the lowest floor elevations for all new

and substantially improved buildings. The Elevation Certificate allows the community to comply with this requirement and provides insurers the necessary information to determine flood insurance premiums.

**Basements and Enclosures:** New or substantially improved buildings must be built with the lowest floor, including basement, above the base flood elevation (BFE). Areas enclosed by solid walls below the BFE (“enclosures”) can be used only for building access, parking, and storage

**Flood Vent Openings:** NFIP regulations require that all enclosures below the BFE in A Zones must either be designed to allow for the equalization of hydrostatic forces during a flood event or be floodproofed. For all new construction, relocation, substantial improvements, and repair of substantial damage, those fully enclosed areas below the lowest floor that are usable solely for parking of vehicles, building access or storage in an area other than a basement and which are subject to flooding shall be designed to automatically equalize hydrostatic flood forces on exterior walls by allowing for entry and exit of floodwaters. Designs for meeting this requirement must either be certified by a registered professional engineer or meet or exceed the following minimum criteria:

* A minimum of two openings having a total net area of not less than one square inch for every square foot of enclosed area subject to flooding, shall be provided
* The bottom of all openings shall be no higher than one foot above grade.
* Openings may be equipped with screens, louvers, valves, or other coverings or devices provided that they permit the automatic entry and exit of floodwaters.

**Manufactured Homes:** Design and construction standards in the WV Model Ordinance specify that all manufactured homes installed within the special flood hazard areas must be installed by a licensed contractor. The lowest floor, ductwork and utilities including HVAC/heat pump elevated above the Base Flood Elevation plus freeboard requirement. Elevation shall be on reinforced piers on a permanent foundation or other foundation elements of at least equivalent strength engineered for use in a flood hazard area. Installation designs incorporating dry stacked block piers shall not be used in special flood hazard areas. All manufactured homes shall be securely anchored to an adequately anchored foundation system in compliance with the West Virginia Code Permanently attached rigid skirts and perimeter wall skirts of brick or block must have openings to prevent collapse and damage to supporting piers.

**Non-Conversion Agreement:** A Non-Conversion Agreement shall be signed by the applicant on all flood-proofed structures and any elevated structures when the Floodplain Administrator determines that the area below the first floor could be converted to a non-conforming use (generally applies to the enclosed areas below base flood elevation that are 5 ft. high or more).

**Appurtenant Structures:** Accessory structures are also referred to as appurtenant structures. An accessory structure is a structure which is on the same parcel of property as a principal structure and the use of which is incidental to the use of the principal structure. For example, a residential structure may have a detached garage or storage shed for garden tools as accessory structures. Other examples of accessory structures include gazebos, picnic pavilions, boathouses, small pole barns, storage sheds, and similar buildings.

When possible, appurtenant structures shall be located out of the special flood hazard area. Where appurtenant structures not connected to the principal structure are to be located on sites below the Base Flood Elevation, flood damage reduction provisions apply that include:

* Use of the structure shall be restricted to parking or limited storage.
* Structures shall be no more than 300 square feet in size and valued at less than $7,000. (Seven thousand dollars).
* Floors shall be at or above grade on at least one side.
* Structures shall be designed (or modified) and adequately anchored to prevent flotation, collapse, or lateral movement of the structure resulting from hydrodynamic and hydrostatic loads, including the effects of buoyancy.
* Flood resistant materials as detailed in FEMA Technical Bulletin 2-93 (FIA-TB-2) shall be used in the construction of the structure from the lowest structural element to two feet above the Base Flood Elevation.
* Machinery, electric devices or appliances, and all utilities shall be located at least two feet above the Base Flood Elevation.
* Structures must have openings to equalize hydrostatic flood forces on exterior walls by allowing for automatic entry and exit of floodwaters.

**Recreational Vehicle Placement:** Recreational vehicles to be placed within any special flood hazard area shall either:

* Be on site for fewer than 180 consecutive days AND
* Be fully licensed and ready for highway use. A recreational vehicle is ready for highway use if it is on its wheels or jacking system, is attached to the site only by quick disconnected utilities, security devices, and has no permanently attached additions. OR,
* Be installed in accordance with the manufactured home placement requirements and all other flood reduction requirements contained in this Ordinance.

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**FEMA’s Community Rating System**

The National Flood Insurance Program (NFIP) provides federally backed flood insurance within communities that enact and enforce floodplain regulations. The [**Community Rating System**](https://www.fema.gov/media-library-data/1507029324530-082938e6607d4d9eba4004890dbad39c/NFIP_CRS_Fact_Sheet_2017_508OK.pdf) (CRS) of the National Flood Insurance Program was implemented in 1990 as a voluntary program to encourage communities to adopt and implement floodplain management activities that exceed the minimum NFIP standards. Under the CRS, flood insurance premium rates are discounted to reward community actions that meet the three goals of the CRS, which are: (1) reduce flood damage to insurable property; (2) strengthen and support the insurance aspects of the NFIP; and (3) encourage a comprehensive approach to floodplain management.

A community accrues points to improve its CRS Class rating and receive increasingly higher discounts. Points are awarded for engaging in any of 19 creditable activities, organized under four categories:

* Public information
* Mapping and regulations
* Flood damage reduction
* Warning and response

Communities should prepare and implement those activities which best deal with their local problems, whether they are creditable under the CRS. In considering whether to undertake a new floodplain management activity, a community must consider all the benefits the activity will provide (not just insurance premium reductions) in order to determine whether it is worth implementing.

Although the premium reduction attracts interest in the CRS, the most important benefits are the enhanced public safety, reduction in damage to property and public infrastructure, avoidance of economic disruption and losses, reduction in human suffering, and protection of the environment provided by the credited activities.

FEMA supports an all-hazards approach to mitigation, as does the CRS. It makes economic sense that mitigation programs address as many hazards as are appropriate. An all-hazards approach also ensures that staff, programs, construction standards, and public information messages are consistent and mutually supportive.

The CRS recognizes that many [**small communities**](https://crsresources.org/files/200/small-communities-in-the-crs.pdf) face challenges that larger ones do not, such as smaller budgets, fewer personnel, part-time staff, and lack of in-house technical expertise like engineering or a geographic information system (GIS). But no matter what its size, if your community keeps track of it building permits in the floodplain, checks Elevation Certificates as they come in, has open space in the floodplain, and enforces at least a few regulations that exceed NFIP minimum requirements, then CRS participation can be straightforward for you and need not need take much time nor be a significant expense.

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