User's Guide to Technical Bulletins

Developed in Accordance with the National Flood Insurance Program

NFIP Technical Bulletin 0 / January 2021

FEMA

Comments on the Technical Bulletins should be directed to:

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Acronyms

ACI	American Concrete Institute
BFE	base flood elevation
CFR	Code of Federal Regulations
DFE	design flood elevation
FEMA	Federal Emergency Management Agency
FHBM	Flood Hazard Boundary Map
FIMA	Federal Insurance and Mitigation Administration
FIRM	Flood Insurance Rate Map
FIS	Flood Insurance Study
IBC®	International Building Code®
ICC®	International Code Council®
I-Codes®	International Codes®
IRC®	International Residential Code®
NFIP	National Flood Insurance Program
ORNL	Oak Ridge National Laboratory
SEI	Structural Engineers Institute
SFHA	Special Flood Hazard Area
TB	Technical Bulletin

1 Introduction and Background

Beginning in the early 1990s, the Federal Insurance and Mitigation Administration of FEMA has issued 11 Technical Bulletins that provide guidance on interpreting, enforcing, and complying with the minimum building performance requirements in the National Flood Insurance Program (NFIP) regulations (Title 44 of the Code of Federal Regulations [CFR] Parts 59 and 60). These requirements are intended to reduce the loss of life and property as well as the economic and social hardships that can result from flooding.

The NFIP is a federal program established by the National Flood Insurance Act of 1968, as amended (42 U.S. Code §§ 4011 et seq.). The primary purposes of the Act are to:

- Better indemnify individuals for flood losses through insurance
- Reduce future flood damage through state and community floodplain management regulations
- Reduce federal expenditures for disaster assistance and flood control

To participate in the NFIP, communities must adopt and enforce floodplain management regulations that meet or exceed NFIP floodplain management requirements. Owners of property located in communities that participate can purchase NFIP flood insurance as a protection against the financial impact of flood losses.

NFIP REQUIREMENTS AND HIGHER REGULATORY STANDARDS

State or Local Requirements. State or local requirements that are more restrictive or stringent than the minimum requirements of the NFIP take precedence. The Technical Bulletins and other FEMA publications provide guidance on the minimum requirements of the NFIP and describe best practices. Design professionals, builders, and property owners should contact local officials to determine whether more restrictive provisions apply to buildings or sites in question. All other applicable requirements of the state or local building codes must also be met.

Substantial Improvement and Substantial Damage. As part of issuing permits, local officials must review not only proposals for new construction but also for work on existing buildings to determine whether the work constitutes Substantial Improvement or repair of Substantial Damage. If the work is determined to constitute Substantial Improvement or repair of Substantial Damage, the buildings must be brought into compliance with the NFIP requirements for new construction. Some communities modify the definitions of Substantial Improvement and/or Substantial Damage to be more restrictive than the NFIP minimum requirements. For more information on Substantial Improvement and Substantial Damage, see FEMA P-758, *Substantial Improvement/Substantial Damage Desk Reference* (2010), and FEMA 213, *Answers to Questions About Substantially Improved/Substantially Damaged Buildings* (2018).

Higher Building Elevation Requirements. Some states and communities require that buildings be elevated or dry floodproofed (non-residential in Zone A only) above the NFIP minimum requirement. The additional elevation is called freeboard. Design professionals, builders, and property owners should check with local officials to determine whether a state or community has freeboard requirements. References to building elevations in this Technical Bulletin should be construed as references to the community's elevation requirement in areas where freeboard is required.

The NFIP floodplain management regulations, codified in Title 44 of the Code of Federal Regulations (CFR) Part 60, specifically 44 CFR § 60.3, include minimum building performance criteria that apply to (1) new construction, (2) work determined to be Substantial Improvement such as improvements, alterations, and additions, and (3) the repair of buildings determined to have incurred Substantial Damage and that are in Special Flood Hazard Areas (SFHAs).

1.1 Intended Audience

The Technical Bulletins are intended for use primarily by state and local officials who are responsible for interpreting and enforcing the NFIP floodplain management regulations.

The Technical Bulletins may also be used by design professionals (e.g., architects, engineers), contractors, building owners and operators, planners, and other interested stakeholders to help understand and comply with NFIP floodplain management requirements. Using the information in the Technical Bulletins will improve the design and construction of buildings, including their utility systems, that are in floodprone areas, thereby reducing the potential for damage and increasing building and community resilience.

1.2 Purpose of Technical Bulletins

The Technical Bulletins provide specific FEMA guidance for state and local floodplain management officials on complying with the NFIP's minimum floodplain management criteria. While the primary focus of the Technical Bulletins is on how to meet the minimum NFIP floodplain management requirements, they also include information on:

- Recommended best practices for reducing flood losses
- Considerations related to NFIP flood insurance rates
- Building codes and standards

Additional information on how to use the Technical Bulletins is provided in Section 2.

TECHNICAL BULLETINS AND FLOODPLAIN MANAGEMENT BULLETINS

The NFIP Technical Bulletins provide guidance on complying with the minimum NFIP floodplain management requirements that apply to buildings. FEMA's Floodplain Management Bulletins provide guidance on administering the NFIP requirements that apply to development other than buildings and guidance on some building requirements. The Floodplain Management Bulletins are available at https://www.fema.gov/floodplain-management.

1.3 Synopses of Technical Bulletins (as of January 2021)

Table 1: Technical Bulletin Synopses

TB No.	Title (Date)	Synopsis
0	*User's Guide to Technical Bulletins* (2021)	Introduction and background for the TBs, including the intended audience, purpose, and synopses of available TBs; how to use the TBs; crosswalk of NFIP regulations and the TBs; key concepts and requirements used in the TBs; key terms and useful resources; supplemental information, including how to obtain copies of the TBs; FEMA Headquarters and Regional Office locations; and a key word/subject index for the TBs.

Table 1: Technical Bulletin Synopses (cont.)

TB No.	Title (Date)	Synopsis
1	*Requirements for Flood Openings in Foundation Walls and Walls of Enclosures Below Elevated Buildings in Special Flood Hazard Areas* (2020)	Guidance on the NFIP requirements for flood openings in foundation walls and walls of enclosures below elevated buildings in Zones A, AE, A1-30, AR, AO, and AH, with clarifications for use of non-engineered and engineered openings.
2	*Flood Damage-Resistant Materials Requirements for Buildings Located in Special Flood Hazard Areas* (2008)	Guidance on the NFIP requirements on the use of flood damage-resistant construction materials in building components below the BFE in SFHAs (both Zones A and V).
3	*Requirements for the Design and Certification of Dry Floodproofed Non-Residential and Mixed-Use Buildings Located in Special Flood Hazard Areas* (2021)	Guidance on the NFIP requirements for the design and certification of dry floodproofing systems for new and substantially improved non-residential and mixed-use buildings with lowest floors below the BFE in Zones A, AE, A1-30, AR, AO, and AH. The guidance can also be used as a best practice for improving the flood resilience of existing buildings that are not substantially improved. New in the 2020 edition are appendices with guidance for completing FEMA Form 086-0-34, NFIP Floodproofing Certificate for Non-Residential Structures, and an example calculation for estimating total seepage. FEMA Form 086-0-34 is used to satisfy the requirement for design professionals to certify designs and as-built drawings and inspection and is a requirement for an NFIP flood insurance policy. The total seepage estimation is used to determine if dry floodproofing measures are considered substantially impermeable to floodwaters.
4	*Elevator Installation for Buildings Located in Special Flood Hazard Areas* (2019)	Guidance on the NFIP requirements for elevator machinery and equipment that serve buildings and on the installation of elevators below the Base Flood Elevation (BFE) in Special Flood Hazard Areas (SFHAs) (both Zones A and V).
5	*Free-of-Obstruction Requirements for Buildings Located in Coastal High Hazard Areas* (2020)	Guidance on NFIP requirements concerning obstructions to floodwaters and waves beneath and associated with elevated buildings in Coastal High Hazard Areas (Zones V, VE, V1-30, and VO). Obstructions can include portions of elevated buildings and building site modifications.
6	*Requirements for Dry Floodproofed Below-Grade Parking Areas Under Non-Residential and Mixed-Use Buildings Located in Special Flood Hazard Areas* (2021)	Guidance on the NFIP requirements for the design and construction of dry floodproofing systems below-grade parking area under new and substantially improved non-residential and mixed-use buildings located in Zones A, AE, A1-30, AR, AO, and AH. Used in conjunction with TB 3 to highlight issues specific to dry floodproofed below-grade parking areas.
7	*Wet Floodproofing Requirements for Structures Located in Special Flood Hazard Areas* (1993)	Guidance on the NFIP requirements concerning measures referred to as "wet floodproofing" applied to certain types of structures in Zones A, AE, A1-30, AR, AO, and AH.
8	*Corrosion Protection for Metal Connectors and Fasteners in Coastal Areas* (2019)	Why maintaining the load paths in buildings is important and the important role that the proper corrosion protection of metal connectors and fasteners has in ensuring that buildings in coastal areas are adequately anchored and connected to resist floods and high wind events.

Table 1: Technical Bulletin Synopses (cont.)

TB No.	Title (Date)	Synopsis
9	*Design and Construction Guidance for Breakaway Walls Below Elevated Buildings Located in Coastal High Hazard Areas* (2008)	Prescriptive, simplified, and performance-based design approaches to meeting NFIP requirements in the design and construction of wood-framed breakaway walls beneath elevated buildings in Coastal High Hazard Areas (Zones V, VE, and V1-30).
10	*Ensuring That Structures Built on Fill In or Near Special Flood Hazard Areas Are Reasonably Safe From Flooding* (2001)	Regulatory and technical guidance on ensuring that the construction of the following buildings are reasonably safe from flooding: buildings with various types of foundations, including basements, in areas that have been proposed to be removed from the SFHA through the placement of fill and in areas near the SFHA.
11	*Crawlspace Construction for Buildings Located in Special Flood Hazard Areas* (2001)	Interim guidance on minimum NFIP requirements for below-grade crawlspace construction that may extend 1 or 2 feet below grade.

BFE = base flood elevation
FEMA = Federal Emergency Management Agency
NFIP = National Flood Insurance Program
SFHA = Special Flood Hazard Area
TB = Technical Bulletin

1.4 Organization of Technical Bulletin 0 – User's Guide to Technical Bulletins

This User's Guide to Technical Bulletins contains:

- Information on how to use the Technical Bulletins
- Crosswalk of the NFIP regulations and the Technical Bulletins
- Key concepts and requirements in the Technical Bulletins
- Glossary of acronyms and key terms
- How to obtain copies of Technical Bulletins and submit comments
- FEMA Headquarters and Regional office contact information
- Index of key words and subjects in the Technical Bulletins
- References and resources

2 How to Use the Technical Bulletins

FEMA revises or develops new Technical Bulletins as needed to provide guidance to state and local officials, design professionals, contractors, building owners and operators, planners, and other interested stakeholders to help them comply with NFIP floodplain management requirements.

The Technical Bulletins are focused on minimum NFIP floodplain management criteria. They also provide guidance on best practices for floodplain management and flood hazard-resistant construction, building codes and standards, and NFIP flood insurance considerations.

2.1 Minimum NFIP Floodplain Management Criteria

To participate in the National Flood Insurance Program, communities must adopt regulations that meet or exceed the minimum requirements in 44 CFR § 60.3. The Technical Bulletins provide specific FEMA guidance on complying with minimum NFIP floodplain management requirements. If a community chooses not to use the methods or implement the measures that are described in the Technical Bulletins, the community must demonstrate how it is meeting the requirements of 44 CFR § 60.3.

In addition to the community's responsibility to ensure specific building requirements are met, such as elevating or dry floodproofing buildings, elevating or otherwise protecting utilities, and installing openings in enclosure walls, communities are also required to review development proposals "to determine whether such proposals will be reasonably safe from flooding" (44 CFR § 60.3(a)(4)).

To participate in the NFIP, all communities must adopt a resolution or ordinance that expresses a "commitment to recognize and evaluate flood hazards in all official actions and to take such other official action as reasonably necessary to carry out the objectives of the program" (44 CFR § 59.22(a)(8)). This is in addition to the general requirement that communities "take into account flood hazards to the extent that they are known in all official actions relating to land management and use" (44 CFR § 60.1(c)).

MINIMUM FLOODPLAIN MANAGEMENT CRITERIA

The guidance in the Technical Bulletins represents established, application methodologies for minimum NFIP floodplain management criteria.

REASONABLY SAFE FROM FLOODING

The Technical Bulletins can be used by communities to help them evaluate whether proposed development will be reasonably safe from flooding.

COMMUNITY COMMITMENT TO REDUCING FLOOD LOSSES

Using the guidance in the Technical Bulletins illustrates a community's commitment towards evaluating and addressing flood hazards.

2.2 Best Practices

Some of the best practices for floodplain management and flood hazard-resistant construction that are described in the Technical Bulletins are recommendations for increasing hazard resistance in buildings and their utility systems and for reducing the loss of life and property and economic and social hardships.

FEMA strongly encourages that these best practices be:

- Incorporated into state or community floodplain management ordinances or building codes

USE OF SHALL OR MUST

"Shall" or "must" in the Technical Bulletins indicates official guidance on methods or measures required for compliance with 44 CFR § 60.3. Descriptions of other measures, such as best practices, do not use "shall" or "must." FEMA strongly encourages that best practice measures be considered.

- Implemented by designers, builders, or other stakeholders to reduce risk and improve resilience
- Used to potentially lower NFIP flood insurance premiums

Many of these best practices are based on field-verified data including data from decades of post-disaster building performance assessments.

EXAMPLE OF A BEST PRACTICE FROM TECHNICAL BULLETIN 2, *FLOOD DAMAGE-RESISTANT MATERIALS REQUIREMENTS*

If the lowest floor of a building is elevated higher than the BFE, which is common when the owner wants a full story of elevation to accommodate parking under the building, FEMA recommends that flood damage-resistant materials also be used up to the level of the lowest floor to reduce damage in these areas should flooding exceed the BFE.

2.3 Building Codes and Standards

In addition to complying with the NFIP requirements, all new construction, Substantial Improvements, and repair of Substantial Damage must comply with the applicable building codes and standards that have been adopted and that are enforced by states and communities. Building codes govern the design, construction, alteration, and maintenance of structures. They specify the minimum requirements to adequately safeguard the health, safety, and welfare of building occupants. Rather than create and maintain their own building codes, most states and local jurisdictions adopt the International Codes® (I-Codes®), which are a family of model building codes published by the International Code Council® (ICC®).

I-Codes include the International Residential Code® (IRC®), International Building Code® (IBC®), International Existing Building Code® (IEBC®), and codes that govern the installation of mechanical, plumbing, fuel gas service, and other aspects of building construction. Provisions in state- and community-adopted building codes can vary from these model codes, so coordination with local building officials is necessary to confirm which requirements apply within a given jurisdiction.

The IBC applies to all applicable buildings and structures whereas the scope of the IRC is limited to one- and two-family dwellings and townhomes not more than three stories above grade plane. The IBC can be used to design dwellings, but it is used primarily for buildings and structures other than dwellings within the IRC scope. The flood provisions in the IBC are included by reference to ASCE 24, *Flood Resistant Design and Construction*, a standard developed by the American Society of Civil Engineers (ASCE).

FEMA has deemed that the latest published editions of the I-Codes generally meet or exceed NFIP requirements for buildings and structures. Excerpts of the flood provisions of the I-Codes are available on FEMA's

BUILDING CODES AND STANDARDS COMPARISON WITH NFIP REQUIREMENTS

Each Technical Bulletin provides a comparison of the building codes and standards that are related to the Technical Bulletin's topic and the NFIP requirements. The comparison indicates the aspects of the codes/standards and the NFIP requirements that are equivalent and the aspects of the codes/standards that exceed the NFIP requirements.

BUILDING CODE ADOPTION AND ENFORCEMENT

Building codes are only enforceable if adopted by the State or community but can serve as best practices in communities that have not adopted codes.

Building Science – Flood Publications webpage (https://www.fema.gov/emergency-managers/risk-management/building-science/flood).

The joint ICC and FEMA publication *Reducing Flood Losses Through the International Codes: Coordinating Building Codes and Floodplain Management Regulations, 5th Edition* (2019) recommends that communities coordinate the administration of floodplain management provisions and building codes. Differences in requirements between the regulatory tools can lead to inconsistencies or confusion when administering and enforcing requirements for development in floodprone areas.

2.4 NFIP Flood Insurance Considerations

Each Technical Bulletin addresses NFIP flood insurance considerations related to the topic of the Technical Bulletin. The following stakeholders should be aware of these considerations:

- Local officials, designers, builders, and other stakeholders
- Property owners who are concerned about the impact of design and construction decisions on their NFIP flood insurance premiums

NFIP flood insurance premiums are based on factors that include, but are not limited to, flood risk zone, elevation of the lowest floor above or below the BFE, type of building and foundation, the number of floors, and whether there is a basement or enclosure below the elevated building.

NFIP FLOOD INSURANCE

The Technical Bulletins describe how NFIP flood insurance premiums can be affected by changes in design and construction. For example, some best practices can significantly lower annual NFIP flood insurance premiums.

The Technical Bulletins address situations in which a compliant building might still be subject to higher NFIP flood insurance premiums. As only one example, NFIP Technical Bulletin 3, *Requirements for the Design and Certification of Dry Floodproofed Non-Residential and Mixed-Use Buildings Located in Special Flood Hazard Areas*, notes that the minimum NFIP requirements allow a new or Substantially Improved non-residential building in Zone A to have a lowest floor below the base flood elevation (BFE), provided that the building has been designed, constructed, and certified to be floodproofed to the BFE and meets established criteria. However, the NFIP flood insurance rating procedures provide credit for dry floodproofing only if the dry floodproofing measures are certified to be at least 1 foot above the BFE, even if that level of protection is not required by local floodplain management regulations.

3 Crosswalk of NFIP Regulations and Technical Bulletins

Table 2 is a crosswalk of select NFIP regulations and the Technical Bulletins that provide guidance on them. The table is intended to be a general guide to the Technical Bulletins; it does not include all of the NFIP regulations. See the index in Section 7 for more information on where to find guidance in the Technical Bulletins on specific NFIP regulations.

Table 2: Crosswalk of NFIP Regulations, Technical Bulletins, and Key Concepts

NFIP Regulation	Technical Bulletin Relevant to the NFIP Regulation	Key Concepts in the NFIP Regulations Covered in the Technical Bulletins
44 CFR § 60.3(a)(3) Review all permit applications to determine whether proposed building sites will be reasonably safe from flooding. If a proposed building site is in a flood-prone area, all new construction and substantial improvements shall (i) 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, (ii) be constructed with materials resistant to flood damage, (iii) be constructed by methods and practices that minimize flood damages, and (iv) be constructed with electrical, heating, ventilation, plumbing, and air conditioning equipment and other service facilities that are designed and/or located so as to prevent water from entering or accumulating within the components during conditions of flooding.	**Technical Bulletin 1** *Requirements for Flood Openings in Foundation Walls and Walls of Enclosures Below Elevated Buildings in Special Flood Hazard Areas*	Flood openings in foundation walls and walls of enclosures relieve hydrostatic loads, helping to meet the basic performance requirement to prevent flotation, collapse, or lateral movement due to flood forces.
	Technical Bulletin 2 *Flood Damage-Resistant Materials Requirements for Buildings Located in Special Flood Hazard Areas*	Typical construction materials are classified as acceptable or unacceptable for use below the BFE. Using acceptable materials improves resistance to flood damage.
	Technical Bulletin 3 *Requirements for the Design and Certification of Dry Floodproofed Non-Residential and Mixed-Use Buildings Located in Special Flood Hazard Areas*	When designed to account for flood loads at the flood protection level, dry floodproofed non-residential and the non-residential portions of mixed-use buildings meet the basic performance requirement to be constructed using methods and practices that minimize flood damage.
	Technical Bulletin 4 *Elevator Installation for Buildings Located in Special Flood Hazard Areas*	Installing elevators and associated equipment above the BFE prevents water from entering or accumulating within most elevator components during conditions of flooding.
	Technical Bulletin 5 *Free-of-Obstruction Requirements for Buildings Located in Coastal High Hazard Areas*	Obstructions that divert or obstruct the free flow of floodwater and waves below elevated buildings in Zone V could impose additional flood loads on foundation systems or adjacent buildings.
	Technical Bulletin 6 *Requirements for Dry Floodproofed Below-Grade Parking Areas Under Non-Residential and Mixed-Use Buildings Located in Special Flood Hazard Areas*	Non-residential and mixed-use buildings in Zone A may have dry floodproofed, below-grade parking areas, provided the buildings and garages are designed to account for flood loads and meet the basic performance requirement to be constructed using methods and practices that minimize flood damage.
	Technical Bulletin 7 *Wet Floodproofing Requirements for Structures Located in Special Flood Hazard Areas*	Measures known as “wet floodproofing” may be used for specific types of buildings, including detached garages, storage buildings, some agricultural buildings, and buildings that meet the definition for functionally dependent use. Wet floodproofing reduces hydrostatic loads on buildings by allowing floodwater to enter.

Table 2: Crosswalk of NFIP Regulations, Technical Bulletins, and Key Concepts (cont.)

NFIP Regulation	Technical Bulletin Relevant to the NFIP Regulation	Key Concepts in the NFIP Regulations Covered in the Technical Bulletins
44 CFR § 60.3(a)(3) (cont.)	**Technical Bulletin 8** *Corrosion Protection for Metal Connectors and Fasteners in Coastal Areas*	Corrosion protection for metal fasteners and connectors in buildings in coastal areas is important in helping to ensure that the buildings are adequately anchored and connected to resist flood loads. In buildings that are exposed to moisture and airborne salt, protecting metal connectors and fasteners from corrosion helps prevent structural failure.
	Technical Bulletin 9 *Design and Construction Guidance for Breakaway Walls Below Elevated Buildings Located in Coastal High Hazard Areas*	Walls designed to break away under flood loads help to prevent the walls from obstructing the floodwater and to minimize the transfer of flood and wave loads to the foundations of elevated buildings.
	Technical Bulletin 10 *Ensuring That Structures Built on Fill In or Near Special Flood Hazard Areas Are Reasonably Safe From Flooding*	Residual flood hazards may exist on sites proposed to be modified by placement of compacted earthen fill material and are subject to the requirement to be reasonably safe from flooding.
	Technical Bulletin 11 *Crawlspace Construction for Buildings Located in Special Flood Hazard Areas*	The ground or floor inside certain crawlspace foundations may be below grade if specific limitations are met including, but not limited to, flood velocities, perimeter wall height, and depth below grade.
Applies to All Zone A		
44 CFR § 60.3(c)(2) Require that all new construction and substantial improvements of residential structures within Zones A1-30, AE, and AH zones on the community's FIRM have the lowest floor (including basement) elevated to or above the base flood level.	**Technical Bulletin 10** *Ensuring That Structures Built on Fill In or Near Special Flood Hazard Areas Are Reasonably Safe From Flooding*	The requirement that the lowest floor, including basement, of new and Substantially Improved residential buildings in Zone A be at or above the BFE may be met by elevating buildings on compacted earthen fill material.
	Technical Bulletin 11 *Crawlspace Construction for Buildings Located in Special Flood Hazard Areas*	Although technically basements, below-grade crawlspaces are permitted if communities modify local regulations to explicitly allow below-grade crawlspaces with specific limitations including, but not limited to, flood velocities, perimeter wall height, and depth below grade.

Table 2: Crosswalk of NFIP Regulations, Technical Bulletins, and Key Concepts (cont.)

NFIP Regulation	Technical Bulletin Relevant to the NFIP Regulation	Key Concepts in the NFIP Regulations Covered in the Technical Bulletins
44 CFR § 60.3(c)(3) Require that all new construction and substantial improvements of non-residential structures within Zones A1-30, AE, and AH zones on the community's FIRM (i) have the lowest floor (including basement) elevated to or above the base flood level, or (ii) together with attendant utility and sanitary facilities, be designed so that below the base flood level the structure is watertight with walls substantially impermeable to the passage of water and with structural components having the capability of resisting hydrostatic and hydrodynamic loads and effects of buoyancy.	**Technical Bulletin 3** *Requirements for the Design and Certification of Dry Floodproofed Non-Residential and Mixed-Use Buildings Located in Special Flood Hazard Areas*	Numerous planning and engineering design considerations factor into whether dry floodproofing systems are viable options. Dry floodproofing features include flood shields for openings (doors, windows, louvers), walls and floors that are substantially impermeable and adequately reinforced to withstand floodwater pressures and impact forces generated by floating debris, use of membranes and sealants, installation of pumps, and utility protection.
	Technical Bulletin 6 *Requirements for Dry Floodproofed Below-Grade Parking Areas Under Non-Residential and Mixed-Use Buildings Located in Special Flood Hazard Areas*	Below-grade parking areas are permitted beneath non-residential and mixed-use buildings in Zone A if buildings and below-grade parking areas are dry floodproofed (watertight and substantially impermeable).
	Technical Bulletin 10 *Ensuring That Structures Built on Fill In or Near Special Flood Hazard Areas Are Reasonably Safe From Flooding*	The requirement that the lowest floor, including a basement, of new and Substantially Improved non-residential buildings in Zone A be at or above the BFE may be met by elevating buildings on compacted earthen fill material.
	Technical Bulletin 11 *Crawlspace Construction for Buildings Located in Special Flood Hazard Areas*	Although technically basements, below-grade crawlspaces are permitted if communities modify local regulations to explicitly allow below-grade crawlspaces with specific limitations including, but not limited to, flood velocities, perimeter wall height, and depth below grade.
44 CFR § 60.3(c)(4) Provide that where a non-residential structure is intended to be made watertight below the base flood level, (i) a registered professional engineer or architect shall develop and/or review structural design, specifications, and plans for the construction, and shall certify that the design and methods of construction are in accordance with the accepted standards of practice for meeting the applicable provisions of paragraphs (c)(3)(ii) or (c)(8)(ii) of this section, and (ii) a record of such certificates which includes the specific elevation (in relation to mean sea level) to which such structures are floodproofed shall be maintained with the official designated by the community.	**Technical Bulletin 3** *Requirements for the Design and Certification of Dry Floodproofed Non-Residential and Mixed-Use Buildings Located in Special Flood Hazard Areas*	FEMA Form 086-0-34, NFIP Floodproofing Certificate for Non-Residential Structures provides information necessary for insurance underwriters to rate dry floodproofed buildings. The same form should be used to satisfy the requirement that design professionals certify designs and as-built drawings and inspection. The certificate contains information on the building, certification of the elevation to which the building is floodproofed, and certification by the design professional that the building has been designed and constructed to the accepted standard of practice (ASCE 24-05, ASCE 24-14, or their equivalent).

Table 2: Crosswalk of NFIP Regulations, Technical Bulletins, and Key Concepts (cont.)

NFIP Regulation	Technical Bulletin Relevant to the NFIP Regulation	Key Concepts in the NFIP Regulations Covered in the Technical Bulletins
44 CFR § 60.3(c)(5) Require, for all new construction and substantial improvements, that 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 the entry and exit of floodwaters. Designs for meeting this requirement must either be certified by a registered professional engineer or architect 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.	**Technical Bulletin 1** *Requirements for Flood Openings in Foundation Walls and Walls of Enclosures Below Elevated Buildings in Special Flood Hazard Areas*	Flood openings in foundation walls and walls of enclosures relieve hydrostatic loads, helping to meet the basic performance requirement to prevent flotation, collapse, or lateral movement due to flood forces. Proper design, selection, and installation of flood openings help meet the basic performance requirement to automatically equalize hydrostatic flood forces on exterior walls and prevent flotation, collapse, or lateral movement due to flood forces.
	Technical Bulletin 7 *Wet Floodproofing Requirements for Structures Located in Special Flood Hazard Areas*	Measures known as "wet floodproofing" may be used for specific types of buildings, including detached garages, storage buildings, some agricultural buildings, and buildings that meet the definition for functionally dependent use. Wet floodproofing reduces hydrostatic loads on buildings by allowing floodwater to enter
	Technical Bulletin 11 *Crawlspace Construction for Buildings Located in Special Flood Hazard Areas*	Crawlspaces, including below-grade crawlspaces, are treated as enclosures below elevated buildings. Below-grade crawlspaces may be permitted if communities modify local regulations to explicitly allow below-grade crawlspaces with specific limitations including, but not limited to, flood velocities, perimeter wall height, and depth below grade.
Applies to Zone AO (in addition to requirements for Zone A)		
44 CFR § 60.3(c)(7) Require within any AO zone on the community's FIRM that all new construction and substantial improvements of residential structures have the lowest floor (including basement) elevated above the highest adjacent grade at least as high as the depth number specified in feet on the community's FIRM (at least two feet if no depth number is specified).	**Technical Bulletin 10** *Ensuring That Structures Built on Fill In or Near Special Flood Hazard Areas Are Reasonably Safe From Flooding*	Placing the lowest floor, including basement, of new and Substantially Improved residential buildings in Zone A at or above the BFE may be accomplished by elevating buildings on compacted earthen fill material.
	Technical Bulletin 11 *Crawlspace Construction for Buildings Located in Special Flood Hazard Areas*	Although technically basements, below-grade crawlspaces are permitted if communities modify local regulations to explicitly allow below-grade crawlspaces with specific limitations including, but not limited to, flood velocities, perimeter wall height, and depth below grade.

Table 2: Crosswalk of NFIP Regulations, Technical Bulletins, and Key Concepts (cont.)

NFIP Regulation	Technical Bulletin Relevant to the NFIP Regulation	Key Concepts in the NFIP Regulations Covered in the Technical Bulletins
44 CFR § 60.3(c)(8) Require within any AO zone on the community's FIRM that all new construction or substantial improvements of nonresidential structures (i) have the lowest floor (including basement) elevated above the highest adjacent grade at least as high as the depth number specified in feet on the community's FIRM (at least two feet if no depth number is specified), or (ii) together with attendant utility and sanitary facilities, be completely floodproofed to that [base flood] level to meet the floodproofing standard specified in paragraph 60.3(c)(3)(ii).	**Technical Bulletin 3** *Requirements for the Design and Certification of Dry Floodproofed Non-Residential and Mixed-Use Buildings Located in Special Flood Hazard Areas*	Numerous planning and engineering design considerations factor into whether dry floodproofing is a viable option. Dry floodproofing features include watertight closures, walls and floors that are substantially impermeable and adequately reinforced to withstand base floodwater pressures and impact forces generated by floating debris, use of membranes and sealants, installation of pumps, and utility protection.
	Technical Bulletin 6 *Requirements for Dry Floodproofed Below-Grade Parking Areas Under Non-Residential and Mixed-Use Buildings Located in Special Flood Hazard Areas*	Below-grade parking areas are permitted beneath non-residential and mixed-use buildings in Zone A if the Below-grade parking area is dry floodproofed.
Applies to All Zone V		
44 CFR § 60.3(e)(4) A community shall require that all new construction and substantial improvements in Zones V1-30, VE, and also Zone V if base flood elevation data is available, on the community's FIRM, are elevated on pilings and columns so that: (i) the bottom of the lowest horizontal structural member of the lowest floor (excluding the pilings or columns) is elevated to or above the base flood level; and (ii) the pile or column foundation and the structure attached thereto is anchored to resist flotation, collapse, and lateral movement due to the combined effects of wind and water loads acting simultaneously on all building components. Water loading values used shall be those associated with the base flood. Wind loading values used shall be those required by applicable State or local building standards. A registered professional engineer or architect shall develop or review the structural design, specifications, and plans for the construction, and shall certify that the design and methods of construction to be used are in accordance with accepted standards of practice for meeting the provisions of paragraphs (e)(4)(i) and (ii) of this section.	**Technical Bulletin 5** *Free-of-Obstruction Requirements for Buildings Located in Coastal High Hazard Areas*	Obstructions that divert or obstruct the free flow of floodwater and waves below elevated buildings in Zone V could impose additional flood loads on foundation systems or adjacent buildings. Free-of-obstruction requirements apply to: access stairs and ramps; attached and detached decks and porches; elevators; enclosed areas at or above grade; equipment and tanks; foundation bracing; grade beams; shear walls; concrete slabs; accessory storage structures; detached garages; erosion control structures; fences and privacy walls; fill; on-site septic systems; restroom buildings and comfort stations; and swimming pools and spas.
	Technical Bulletin 8 *Corrosion Protection for Metal Connectors and Fasteners in Coastal Areas*	Where buildings are exposed to moisture and airborne salt, corrosion of light gauge metal connectors and fasteners contributes to the loss of load path. Corrosion protection for metal fasteners and connectors in buildings in coastal areas is important in helping to ensure that the buildings are adequately anchored to resist flotation, collapse, and lateral movement due to the combined effects of wind and water loads acting simultaneously on all building components

Table 2: Crosswalk of NFIP Regulations, Technical Bulletins, and Key Concepts (cont.)

NFIP Regulation	Technical Bulletin Relevant to the NFIP Regulation	Key Concepts in the NFIP Regulations Covered in the Technical Bulletins
44 CFR § 60.3(e)(5) Provide that all new construction and substantial improvements within Zones V1-30, VE, and V on the community's FIRM have the space below the lowest floor either free of obstruction or constructed with non-supporting breakaway walls, open wood lattice-work, or insect screening intended to collapse under wind and water loads without causing collapse, displacement, or other structural damage to the elevated portion of the building or supporting foundation system. For the purposes of this section, a breakaway wall shall have a design safe loading resistance of not less than 10 and no more than 20 pounds per square foot. Use of breakaway walls which exceed a design safe loading resistance of 20 pounds per square foot (either by design or when so required by local or State codes) may be permitted only if a registered professional engineer or architect certifies that the designs proposed meet the following conditions: (i) Breakaway wall collapse shall result from a water load less than that which would occur during the base flood; and (ii) The elevated portion of the building and supporting foundation system shall not be subject to collapse, displacement, or other structural damage due to the effects of wind and water loads acting simultaneously on all building components (structural and non-structural). Water loading values used shall be those associated with the base flood. Wind loading values used shall be those required by applicable State or local building standards. Such enclosed space shall be useable solely for parking of vehicles, building access, or storage.	**Technical Bulletin 5** *Free-of-Obstruction Requirements for Buildings Located in Coastal High Hazard Areas*	Obstructions that divert or obstruct the free flow of floodwater and waves below elevated buildings in Zone V could impose additional flood loads on foundation systems or adjacent buildings. Free-of-obstruction requirements apply to: access stairs and ramps; attached and detached decks and porches; elevators; enclosed areas at or above grade; equipment and tanks; foundation bracing; grade beams; shear walls; concrete slabs; accessory storage structures; detached garages; erosion control structures; fences and privacy walls; fill; on-site septic systems; restroom buildings and comfort stations; and swimming pools and spas.
	Technical Bulletin 9 *Design and Construction Guidance for Breakaway Walls Below Elevated Buildings Located in Coastal High Hazard Areas*	Walls designed to break away under flood loads help to prevent the walls from obstructing the floodwater and to minimize the transfer of flood and wave loads to the foundations of elevated buildings.

BFE = base flood elevation
CFR = Code of Federal Regulations
FEMA = Federal Emergency Management Agency
FIRM = Flood Insurance Rate Map

4 Key Concepts and Requirements for Structures

Users of the Technical Bulletins should have a basic understanding of the following key concepts:

- Special Flood Hazard Areas (SFHAs)
- Lowest floor, enclosure, and basement
- Substantial Improvement and Substantial Damage
- Open foundations in Zone V

These concepts underlie the requirements that are critical in determining compliance with minimum NFIP floodplain management criteria. Most of these concepts and other key terms used in NFIP regulations are defined in Sections 4 and 5.

4.1 Special Flood Hazard Areas

The SFHA is the land area subject to flooding by the base flood. SFHAs are shown on FIRMs prepared by FEMA as Zones A and V. The base flood is the flood that has a 1 percent chance of being equaled or exceeded in any given year (commonly called the "100 year flood"). FIRMs also show Zone X, which are areas outside the SFHA.

In communities that participate in the NFIP, the minimum floodplain management requirements govern development in SFHAs, including buildings and other structures, subdivisions, new and replacement water supply systems, and new and replacement sanitary sewage systems. Floodplain management requirements for buildings and other structures can differ depending on the flood zone in which a structure is located.

NFIP DEFINITION OF DEVELOPMENT

"Any man-made change to improved or unimproved real estate, including but not limited to buildings or other structures, mining, dredging, filling, grading, paving, excavation or drilling operations, or storage of equipment or materials" (44 CFR § 59.1).

Figure 1 shows the typical flood zones from coastal and riverine flood sources. The criteria for construction in Zones V, VE, V1-30 and VO, which are collectively referred to as Zone V or Coastal High Hazard Areas, are generally more stringent than in Zones A, AE, A1–30, AR, AO, and AH, which are collectively referred to as Zone A. Zone A exists in both coastal and riverine flood source environments.

Zone A. In SFHAs identified as Zone A (Zones A, AE, A1-30, AR, AO, and AH), the principal source of flooding is runoff from rainfall, snowmelt, or coastal storms when the potential base flood wave height is less than 3.0 feet. Zone A has minimum requirements that specify the elevation of the lowest floor, including the basement, in relation to the BFE or depth of the base flood. Specific requirements apply to fully enclosed areas below the lowest floor.

Zone V. Zone V (Zones V, VE, V1-30, and VO), also called Coastal High Hazard Areas, extends from offshore to the inland limit of a primary frontal dune along an open coast, and any other area subject to high-velocity wave

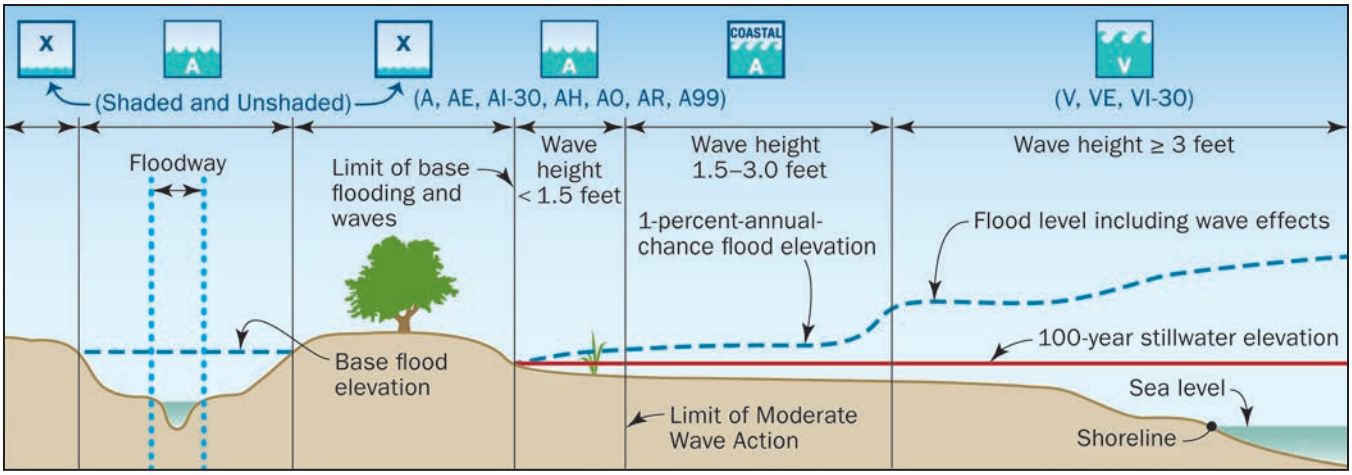

Figure 1: Typical flood zones from coastal and riverine flood sources

action from storms or tsunamis where the potential base flood wave height is 3.0 feet or more. Zone V has minimum requirements pertaining to the siting of buildings, elevation of the lowest horizontal structural member of the lowest floor in relation to the BFE, foundation design, enclosures below the lowest floor, and alterations of sand dunes and mangrove stands.

Zone X. Zone X identifies areas outside the SFHA. Zone X (shaded) identifies two areas of moderate flood hazard: (1) areas subject to inundation by the flood that has a 0.2 percent chance of being equaled or exceeded during any given year (commonly called the "500-year flood") and (2) areas protected by accredited levee systems. Zone X (unshaded) identifies areas of minimal flood hazard, which are outside the 500-year floodplain. The NFIP floodplain management requirements do not apply in Zone X.

Example of Criteria Difference. An example of a difference in criteria for Zone A and Zone V is where the lowest floor is measured (see Figure 2):

- In Zone A, the lowest floor (including basement) of a structure must be elevated to or above the BFE.
- In Zone V, the bottom of the lowest horizontal structural member of the lowest floor of a structure (excluding pilings or columns) must be elevated to or above the BFE.

COASTAL A ZONE

Since 2009, coastal flood studies have examined wave conditions in Zone A. Based on the studies, FEMA delineates an informational line called the Limit of Moderate Wave Action (LiMWA) on FIRMs where wave heights in Zone A are expected to be 1.5 feet or greater during base flood conditions. See Figure 1.

FEMA uses the term "Coastal A Zone" to refer to areas seaward of the LiMWA and landward of the Zone V boundary or landward of the shoreline where Zone V is not identified. The term refers to some areas identified as Zone A that are subject to flooding from a coastal or tidal source. However, Coastal A Zones are not identified on FIRMs, and the NFIP regulations for development in SFHAs and the NFIP regulations that govern the identification of SFHAs on maps do not use the term "Coastal A Zone."

The NFIP floodplain management requirements regulate areas identified as Coastal A Zones to Zone A standards. FEMA's Community Rating System awards credits to communities that regulate Coastal A Zones to Zone V standards. The latest editions of the I-Codes and ASCE 24 require buildings in Coastal A Zones to meet Zone V requirements; FEMA guidance, best practices, and FEMA Mitigation Assessment Team reports support this requirement.

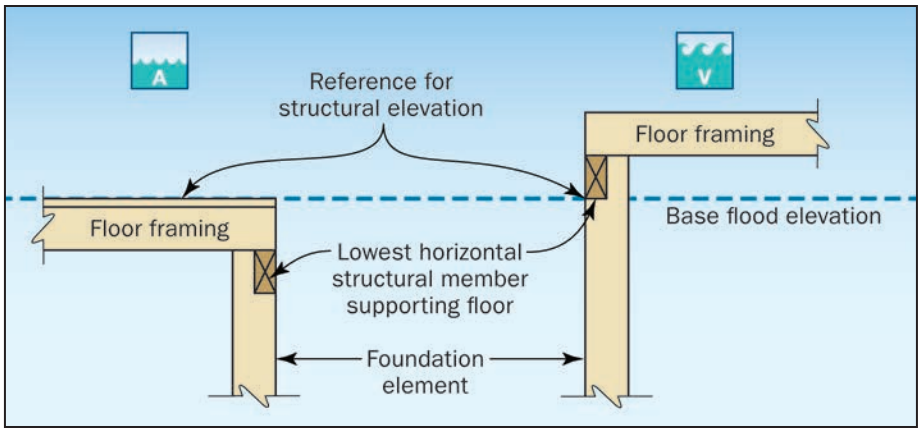

Figure 2: Lowest floor reference point for Zone A (at top of lowest floor) versus Zone V (at bottom of lowest horizontal structural member of lowest floor)

4.2 Lowest Floor, Enclosure, and Basement

Under the NFIP:

- The **lowest floor** is defined as "the lowest floor of the lowest enclosed area (including basement). An unfinished or flood resistant enclosure, usable solely for parking of vehicles, building access or storage in an area other than a basement area is not considered a building's lowest floor; *Provided*, that such enclosure is not built so as to render the structure in violation of the applicable non-elevation design requirements of § 60.3" (44 CFR § 59.1).
- An **enclosure** is an area below an elevated building that is enclosed by walls on all sides.
- A **basement** is defined as "any area of the building having its floor subgrade (below ground level) on all sides" (44 CFR § 59.1).

4.3 Substantial Improvement and Substantial Damage

The repair or improvement of buildings presents an opportunity to reduce future flood damage to structures and to improve their resilience. Local floodplain management regulations based on the NFIP and building codes contain requirements that apply not only to new structures but also to buildings with proposed Substantial Improvements or repair of Substantial Damage (described below).

As part of issuing permits, local officials must review not only proposals for new construction but also for work on existing buildings to determine whether the work constitutes Substantial Improvement or repair of Substantial Damage. If the work is determined to constitute Substantial Improvement or repair of Substantial Damage, the buildings must be brought into compliance with the NFIP requirements for new construction, including the requirement that the lowest floor be elevated to or above the BFE. Meeting this requirement can also be accomplished by demolishing the building followed by constructing a new building that meets the NFIP requirements on the same site or by relocating the building to outside the SFHA. More information on Substantial Improvement and Substantial Damage can be found in FEMA P-758, *Substantial Improvement/Substantial Damage Desk Reference* (2010), and FEMA 213, *Answers to Questions About Substantially Improved/Substantially Damaged Buildings* (2018).

Substantial Improvement is defined in 44 CFR § 59.1 as:

> … Any reconstruction, rehabilitation, addition, or other improvement of a structure, the cost of which equals or exceeds 50 percent of the market value of the structure before the "start of construction" of the improvement. This term includes structures which have incurred "substantial damage," regardless of the actual repair work performed. The term does not, however, include either:
>
> (1) Any project for improvement of a structure to correct existing violations of state or local health, sanitary, or safety code specifications which have been identified by the local code enforcement official and which are the minimum necessary to assure safe living conditions or
>
> (2) Any alteration of a "historic structure," provided that the alteration will not preclude the structure's designation as a "historic structure."

Substantial Damage is defined in 44 CFR § 59.1 as "damage of any origin sustained by a structure whereby the cost of restoring the structure to its before-damaged condition would equal or exceed 50 percent of the market value of the structure before the damage occurred." Substantial Damage can have any cause, not just flooding.

Some communities modify the definitions of Substantial Improvement and Substantial Damage requirements in one of two ways: (1) adopting a lower threshold than 50 percent (e.g., 40 percent, 30 percent) or (2) tracking costs of improvements and costs of repairs over a specific period, referred to as "cumulative Substantial Improvement."

4.4 Open Foundations in Zone V

Coastal waves and flooding can exert strong hydrodynamic forces on any building element that is exposed to waves or the flow of water. Therefore, open foundation systems that offer minimal resistance to waves and floodwaters passing beneath elevated buildings (e.g., pile and column foundations) are required in Zone V.

The NFIP requires that all new construction and Substantially Improved buildings in Zone V be elevated to or above the BFE on open foundations (pilings, columns) that allow floodwater and waves to pass beneath the elevated structure. The NFIP further requires that areas below elevated structures remain free of obstructions that would prevent the free flow of coastal floodwater and waves during a base flood event. The NFIP considers shear walls acceptable in limited circumstances where lateral loads on upper stories of buildings cannot be adequately resisted by piling or column foundations.

COASTAL A ZONE WAVE HAZARD

Coastal A Zones are subject to conditions similar to those in Zone V (Coastal High Hazard Areas), including breaking waves, erosion, and scour.

Although the minimum NFIP requirements for Coastal A Zones are the same as Zone A, it is recommended that structures in Coastal A Zones be designed and constructed to Zone V standards.

5 Acronyms and Key Terms

The acronyms and key terms that are used in the Technical Bulletins are defined in Sections 5.1 and 5.2, respectively.

5.1 Acronyms Used in the Technical Bulletins

ACI	American Concrete Institute
ADA	Americans with Disabilities Act
AF&PA	American Forest & Paper Association
ANSI	American National Standards Institute
ASCE	American Society of Civil Engineers
ASD	Allowable Stress Design
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWC	American Wood Council
BFE	base flood elevation
CAZ	Coastal A Zone
CCA	chromated copper arsenate
CFR	Code of Federal Regulations
CMU	concrete masonry unit
DFE	design flood elevation
DHS	Department of Homeland Security
EIFS	Exterior Insulation Finishing System
FEMA	Federal Emergency Management Agency
FHBM	Flood Hazard Boundary Map
FIA	Federal Insurance Administration
FIMA	Federal Insurance and Mitigation Administration
FIRM	Flood Insurance Rate Map
FIS	Flood Insurance Study
IBC	International Building Code®
ICC	International Code Council
ICC-ES	ICC Evaluation Service
I-Codes	International Codes®
IEBC	International Existing Building Code®
IMOA	International Molybdenum Association
IRC	International Residential Code®
LAG	lowest adjacent grade
LiMWA	Limit of Moderate Wave Action
LOMC	Letter of Map Change
LOMR-F	Letter of Map Revision based on fill
MAT	Mitigation Assessment Team
MRL	machine room-less traction elevators
MSJC	Masonry Standard Joint Committee
NDS	National Design Specification
NEMA	National Emergency Management Agency; National Electrical Manufacturers Association
NFIP	National Flood Insurance Program
NFPA	National Fire Protection Association
NGVD	National Geodetic Vertical Datum
ORNL	Oak Ridge National Laboratory
oz/ft^2	ounces per square foot
PFD	primary frontal dune
PWF	Permanent Wood Foundation
SBX/DOT	sodium borate disodium octaborate tetrahydrate
SEI	Structural Engineering Institute
SERRI	Southeast Region Research Initiative
SFHA	Special Flood Hazard Area
SFIP	Standard Flood Insurance Policy
SSPC	Society for Protective Coatings
TB	Technical Bulletin
TPI	Truss Plate Institute
USACE	U.S. Army Corps of Engineers
VPL	vertical platform lift
WTCA	Wood Truss Council of America

5.2 Glossary of Terms Used in Technical Bulletins

The quoted material from ASCE 24-14 in this glossary is used with permission.

DEFINITION OF TERMS

Readers are cautioned that the definitions of some of the terms that are used in the Technical Bulletins are not the same when used by the NFIP for the purpose of rating flood insurance policies. Definitions specific to NFIP flood insurance can be found in FEMA's *Flood Insurance Manual*.

Accessory structure: A structure on the same parcel of property as a principal structure, the use of which is incidental to the use of the principal structure. Detached garages used for parking of vehicles and limited storage and small sheds used for limited storage are considered accessory structures (see FEMA Policy #104-008-03 and FEMA Floodplain Management Bulletin P-2140, *Floodplain Management Requirements for Agricultural Structures and Accessory Structures* (2020)).

Active: Dry floodproofing measures or dry floodproofing system components that require human intervention or action before the onset of flooding to be effective (e.g., flood shields that must be installed valves that must be closed).

Area of special flood hazard: "Land in the flood plain within a community subject to a 1 percent or greater chance of flooding in any given year. The area may be designated as Zone A on the Flood Hazard Boundary Map (FHBM). After detailed ratemaking has been completed in preparation for publication of the flood insurance rate map, Zone A usually is refined into Zones A, AO, AH, A1-30, AE, A99, AR, AR/A1-30, AR/AE, AR/AO, AR/AH, AR/A, VO, or V1-30, VE, or V. For purposes of these regulations, the term 'special flood hazard area' is synonymous in meaning with the phrase 'area of special flood hazard' " (44 CFR § 59.1).

Ancillary area: Common area such as a lobby, foyer, office used by building management, exercise space, meeting room, and mail room (FEMA P-2037, *Flood Mitigation Measures for Multi-Family Buildings* [2019])

Base flood: "Flood having a one percent chance of being equaled or exceeded in any given year" (44 CFR § 59.1).

Base flood elevation (BFE): The computed elevation to which floodwater is anticipated to rise during the base flood, including wave height, relative to the datum specified on the Flood Insurance Rate Map. The BFE is shown on the FIRM for Zones AE, AH, A1–30, AR, AR/A, AR/AE, AR/A1–30, V1–30, and VE. For Zones AR/AH and AR/AO, a depth of flooding is provided for the 1 percent annual chance event. SFHAs without BFEs are identified on FIRMs as Zone A or Zone V. When BFEs are not identified, communities must obtain, review and reasonably use any BFE data available from a federal, state, or other source.

Basement: "Area of the building having its floor subgrade (below ground level) on all sides" (44 CFR § 59.1). NFIP regulations do not allow basements to extend below the BFE except in dry-floodproofed, non-residential buildings.

Breakaway wall: "A wall that is not part of the structural support of the building and is intended through its design and construction to collapse under specific lateral loading forces without causing damage to the elevated portion of the building or supporting foundation system" (44 CFR § 59.1).

Coastal A Zone: "Area within *a special flood hazard area*, landward of a *V Zone* or landward of an open coast without mapped *V Zones*. In a Coastal A Zone, the principal source of flooding must be astronomical tides, storm surges, seiches, or tsunamis, not riverine flooding. During the *base flood* conditions, the potential for breaking *wave heights* shall be greater than or equal to 1.5 feet. The inland limit of the Coastal A Zone is (1) the *Limit of Moderate Wave Action* if delineated on a *FIRM*, or (2) designated by the *authority having jurisdiction*" (ASCE 24-14).

Coastal High Hazard Area: "An area of special flood hazard extending from offshore to the inland limit of a primary frontal dune along an open coast and any other area subject to high velocity wave action from storms or seismic sources" (44 CFR § 59.1). The coastal high hazard area is shown on a FIRM or other flood hazard map as Zone V, VO, VE, or V1-30.

Community: "Any State or area or political subdivision thereof, or any Indian tribe or authorized tribal organization, or Alaska Native village or authorized native organization, which has authority to adopt and enforce floodplain management regulations for the areas within its jurisdiction" (44 CFR § 59.1).

Design flood: "The flood associated with the greater of the following two areas: (1) area within a *floodplain* subject to a 1% or greater chance of flooding in any year, or (2) area designated as a *flood hazard area* on a *community's flood hazard map* or otherwise legally designated" (ASCE 24-14).

Design flood elevation (DFE): "Elevation of the *design flood*, including *wave height*, relative to the *datum* specified on the *community's flood hazard map*" (ASCE 24-14). In areas designated as Zone AO, the design flood elevation is the elevation of the highest existing grade of the building's perimeter plus the depth number (in feet) specified on the flood hazard map. In areas designated as Zone AO where a depth is not specified on the map, the depth is taken as equal to 2 feet. The DFE is the locally adopted regulatory flood elevation. If a community regulates based on the FIRM, the DFE is identical to the BFE. If a community chooses to regulate based on a different flood hazard map, a lower frequency flood, or adds freeboard, the DFE must be at least as high as the BFE.

Detailing: Design practice of using structural and architectural drawings and specifications to arrange, configure, and connect structural and nonstructural building components of a building system. Design details convey to the contractor exactly how the structural and nonstructural components of a building should be built.

Development: "Any man-made change to improved or unimproved real estate, including but not limited to buildings or other structures, mining, dredging, filling, grading, paving, excavation or drilling operations or storage of equipment or materials" (44 CFR § 59.1).

Elevation Certificate: An NFIP administrative tool used to document elevation and other information necessary to determine compliance with a community's floodplain management requirements, determine proper insurance premium rates, or support requests for Letters of Map Change (LOMCs). FEMA Form 086-0-33.

Enclosure or enclosed area: An area below an elevated building that is enclosed by walls on all sides. The NFIP does not explicitly define "enclosure," but it is mentioned in the definition of "lowest floor." Enclosures may be formed by foundation perimeter walls (crawlspace), framed walls, or breakaway walls. Also defined in ASCE 24-14 as the "confined area below the *DFE*, formed by walls on all sides of the enclosed space."

Existing construction (may also be referred to as existing construction/structures): For the purposes of determining flood insurance rates, structures for which the "start of construction" commenced before the effective date of the FIRM or before January 1, 1975, for FIRMs effective before that date. "Existing construction" may also be referred to as "existing structures" (44 CFR § 59.1). Also defined in ASCE 24-14 as "any structure for which the *start of construction* commenced before the effective date of the first *floodplain* management code, ordinance, or standard adopted by the *authority having jurisdiction*."

Flood Hazard Boundary Map (FHBM): "Official map of a community, issued by the Federal Insurance Administrator, where the boundaries of the flood, mudslide (i.e., mudflow) related erosion areas having special hazards have been designated as Zones A, M and/or E" (44 CFR § 59.1).

Flood Insurance Rate Map (FIRM): "Official map of a community, on which … [FEMA] has delineated both the special hazard areas and the risk premium zones applicable to the community" (44 CFR § 59.1).

Flood Insurance Study (FIS) (flood elevation study): "An examination, evaluation and determination of flood hazards and, if appropriate, corresponding water surface elevations, or an examination, evaluation and determination of mudslide (i.e., mudflow) and/or flood-related erosion hazards" (44 CFR § 59.1). The FIS is the official report provided by FEMA that contains the FIRM, the Flood Boundary and Floodway Map (if applicable), the water surface elevations of the base flood, and supporting technical data.

Flood protection level: Elevation to which flood protection measures are designed. The flood protection level is the most restrictive of (1) the BFE plus the prescribed amount of freeboard specified in ASCE 24, (2) the design flood elevation (DFE) if a different flood is used for regulatory purposes, and (3) the elevation relative to the BFE specified in local floodplain management regulations.

Flood shield: Removable or permanent, substantially impermeable protective cover or panel for openings in the portions of a dry floodproofed building that are below the flood protection level (e.g., doors, windows, and louvers).

Floodplain or floodprone area: "Any land area susceptible to being inundated by water from any source" (44 CFR § 59.1).

Floodproofing, dry: "Any combination of structural and non-structural additions, changes, or adjustments to structures which reduce or eliminate flood damage to real estate or improved real property, water and sanitary facilities, structures and their contents" (44 CFR § 59.1). Referred to simply as "flood proofing" in 44 CFR § 59.1. Further defined in ASCE 24-14 as "a combination of measures that results in a structure, including the *attendant utilities and equipment*, being water tight, with all elements *substantially impermeable* and with structural components having the capacity to resist flood loads."

Floodproofing, wet: "*Floodproofing* method that relies on the use of *flood damage-resistant materials* and construction techniques in areas of a structure that are below the elevation required by this standard by intentionally allowing those areas to flood" (ASCE 24-14). The NFIP does not define wet floodproofing. Wet floodproofing measures allow areas to flood in such a way that damage to a structure and its contents is minimized by using specific design, construction, and planning measures outlined in Technical Bulletin 7, *Wet Floodproofing Requirements for Structures Located in Special Flood Hazard Areas.*

Floodproofing Certificate for Non-Residential Structures: An NFIP administrative tool that documents certification by a registered professional engineer or architect that the design and methods of construction of a non-residential building are in accordance with accepted standard of practices for meeting a community's floodplain management requirements for floodproofing. This documentation is required for both floodplain management requirements and NFIP flood insurance rating purposes. FEMA Form 086-0-034.

Flow diversion: Change in the course of flood flow when it encounters an object or structure. Diversion can be accompanied by an increase in the local flood level and/or flood velocity when the blockage is large relative to the area through which the flow would otherwise pass.

Hydrodynamic loads: "Loads imposed on an object [such as a building or foundation element] by water flowing against and around it" (ASCE 24-14). Examples are positive frontal pressure against the structure, drag effect along the sides, and negative pressure on the downstream side. The magnitude of hydrodynamic load varies as a function of the square of velocity and other factors.

Hydrostatic loads: "Loads imposed on an object [or a surface, such as a wall or floor slab] by a standing mass of water" (ASCE 24-14). Hydrostatic loads can be caused by slowly moving masses of water. Hydrostatic load increases as water depth increases.

Limit of Moderate Wave Action (LiMWA): "The inland limit of the area affected by [breaking] waves greater than 1.5 feet" (FEMA Procedure Memorandum No. 50). FEMA began delineating the LiMWA on coastal FIRMs in 2009.

Lowest floor: Lowest floor of the lowest enclosed area of a building, including basement. An unfinished or flood-resistant enclosure that is used solely for parking of vehicles, building access, or storage in an area other than a basement area is not considered a building's lowest floor, provided the enclosure is built in compliance with applicable requirements.

Mixed-use building: Building that has both residential and commercial or other non-residential uses. The term does not include multi family residential buildings that have ancillary areas but no non-residential uses.

Net open area: Permanently open area of a non-engineered flood opening.

New construction (may also be referred to as new construction/structures): "… For floodplain management purposes, new construction means structures for which the *start of construction* commenced on or after the effective date of a floodplain management regulation adopted by a community and includes any subsequent improvements to such structures" (44 CFR § 59.1). Further defined in ASCE 24-14 as "structures for which the *start of construction* commenced on or after the effective date of the first *floodplain* management code, regulation, ordinance, or standard adopted by the *authority having jurisdiction*, including any subsequent improvements to such structures. New construction includes work determined to be *substantial improvement*."

Non-residential building: Building that has a commercial or other non-residential use.

Opening, engineered: Opening, with moving parts, used to meet the requirement in 44 CFR § 60.3(c)(5) that is "certified by a registered professional engineer or architect" for meeting the requirement in 44 CFR § 60.3(c)(5) to "be designed to automatically equalize hydrostatic flood forces on exterior walls by allowing for the entry and exit of floodwaters."

Opening, non-engineered: Opening, without moving parts, used to meet the prescriptive requirement in 44 CFR § 60.3(c)(5) to provide "a total net area of not less than one square inch for every square foot of enclosed area subject to flooding."

Passive: Dry floodproofing measures or dry floodproofing systems that do not require human intervention or action before the onset of flooding to be effective (e.g., specially designed doors that are sealed when closed, designed window systems, flood shields that are designed to close automatically when triggered by rising floodwater).

Primary frontal dune: "A continuous or nearly continuous mound or ridge of sand with relatively steep seaward and landward slopes immediately landward and adjacent to the beach and subject to erosion and overtopping from high tides and waves during major coastal storms. The inland limit of the primary frontal dune occurs at the point where there is a distinct change from a relatively steep slope to a relatively mild slope" (44 CFR § 59.1).

Registered design professional: Individual who is registered or licensed to practice his or her design profession (e.g., architect, engineer, land surveyor) as defined by the statutory requirements of the professional registration laws of the state or jurisdiction in which a project is to be constructed.

Residential building: Building designated for habitation. Ancillary areas that serve only residents are residential ancillary areas. They include laundry facilities, storage rooms, mail rooms, recreational rooms, parking garages and exercise facilities.

Special Flood Hazard Area (SFHA): Area subject to flooding by the base flood (1-percent-annual chance flood) and shown on Flood Insurance Rate Maps (FIRMs) as Zones A, AO, AH, A1-30, AE, A99, AR, AR/A1-30, AR/AE, AR/AO, AR/AH, AR/A, VO, or V1-30, VE, or V (see "area of special flood hazard" in 44 CFR § 59.1).

Standard residential garage door: A door, typically up to 18 feet wide by up to 8 feet tall, intended for use in a residential garage for vehicular access and normally expected to be operated less than 1,500 cycles per year.

Structure: For floodplain management purposes, "a walled and roofed building, including a gas or liquid storage tank, that is principally above ground, as well as a manufactured home" (44 CFR § 59.1).

Substantial Damage: "Damage of any origin sustained by a structure whereby the cost of restoring the structure to its before damaged condition would equal or exceed 50 percent of the market value of the structure before the damage occurred" (44 CFR § 59.1).

Substantial Improvement: "Any reconstruction, rehabilitation, addition, or other improvement of a structure, the cost of which equals or exceeds 50 percent of the market value of the structure before the "start of construction" of the improvement. This term includes structures that have incurred "substantial damage," regardless of the actual repair work performed. The term does not, however, include either:

(1) Any project for improvement of a structure to correct existing violations of state or local health, sanitary, or safety code specifications which have been identified by the local code enforcement official and which are the minimum necessary to assure safe living conditions or

(2) Any alteration of a 'historic structure,' provided that the alteration will not preclude the structure's continued designation as a 'historic structure.'" (44 CFR § 59.1).

Substantially impermeable: The use of materials and techniques that restrict the passage of water and seepage through pathways (joints, cracks, openings, channels) and points of entry and that limits the accumulation of water during flooding. According to ASCE 24 and the U.S. Army Corps of Engineers (USACE), a structure is considered substantially impermeable if the maximum accumulation of water is not more than 4 inches in a 24-hour period without relying on devices for the removal of the water (USACE, 1995).

Variance: "Grant of relief by a community from the terms of a flood plain management regulation" (44 CFR § 59.1).

Wave reflection: Return or redirection of a wave striking an object.

Wave runup: Rush of water running up a slope or structure.following wave breaking.

Zone A: Flood zones shown on FIRMs as Zone A, AE, A1-30, AH, AO, A99, and AR.

Zone V: Flood zones shown on FIRMs as Zone V, VE, V1-30, and VO.

6 Supplemental Information

6.1 How to Obtain Technical Bulletins

Download Technical Bulletins at no charge from the FEMA website at https://www.fema.gov/emergency-managers/risk-management/building-science/national-flood-insurance-technical-bulletins.

Order Technical Bulletins at no charge from the FEMA Publications Warehouse by:

- Calling 1-800-480-2520, Monday-Friday, 8 a.m.- 5 p.m. Eastern Time
- Faxing a request to 1-719-948-9724
- Sending an email to FEMApubs@gpo.gov

6.2 How to Submit Comments on the Technical Bulletins

FEMA welcomes your comments and recommendations on the Technical Bulletins and may include, for example:

- Requests for clarifications of the guidance in the Technical Bulletins
- Requests for additional guidance
- Recommendations for new Technical Bulletins

Send your comments to:

DHS/FEMA
ATTN: Federal Insurance and Mitigation Administration,
Risk Management Directorate – Building Science Branch
400 C Street, S.W., Sixth Floor
Washington, DC 20472-3020

6.3 How to Get More Information

For questions on any of the Technical Bulletins, email the Building Science Helpline at FEMA-buildingscience help@fema.dhs.gov or call 1-866-927-2104.

For additional guidance on NFIP regulatory requirements, contact your NFIP State Coordinating Agency (www.floods.org) or the FEMA Regional office in your Region (see Section 6.4).

6.4 FEMA Regional Offices

The locations of FEMA Headquarters and the 10 FEMA Regional Offices are shown in Figure 3, and addresses and telephone numbers are listed in Table 3. Staff members of the FEMA Regional Offices for your area can provide you with more information about the NFIP and Technical Bulletins.

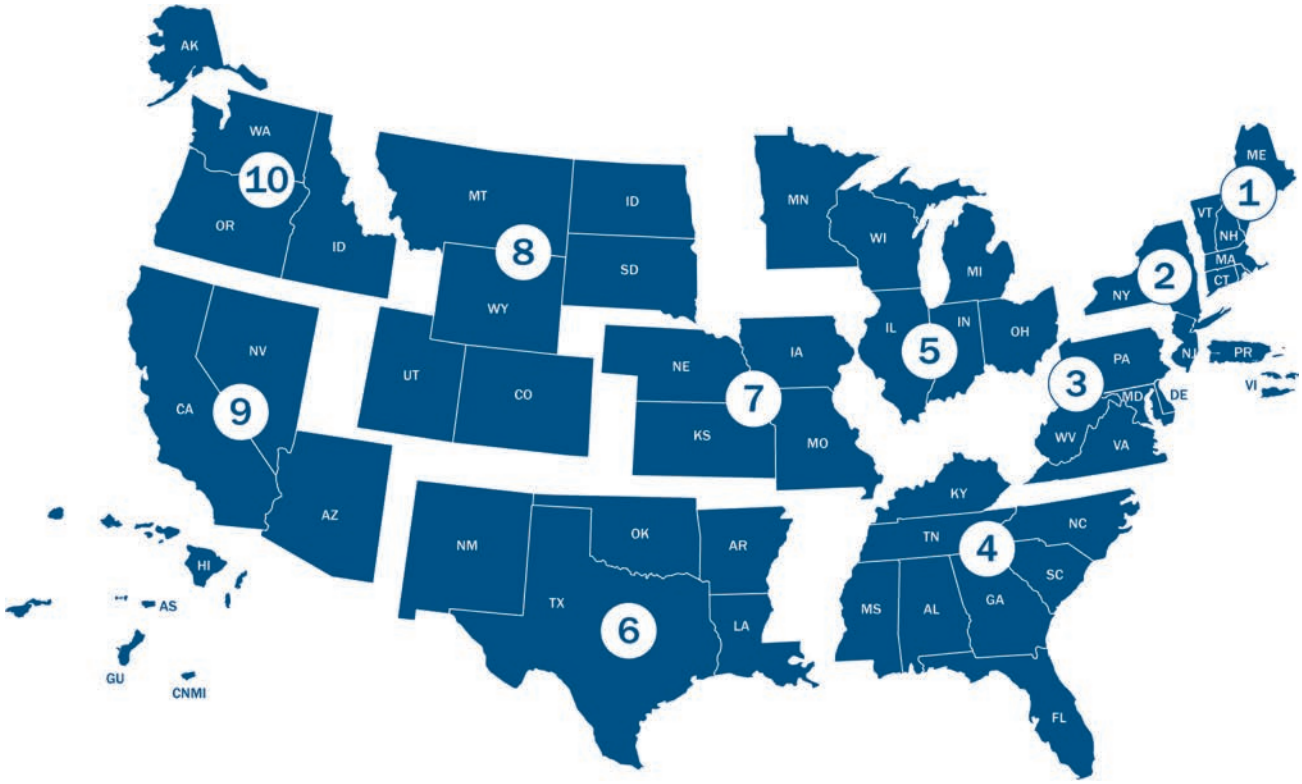

Figure 3: Locations of FEMA Headquarters and 10 FEMA Regional Offices

Table 3: FEMA Headquarters and Regional Office Contact Information

HQ / Region	States/Territories	Address	Phone No.
FEMA / FIMA Headquarters		400 C Street, S.W. Washington, DC 20472-3020	202-646-2500 800-621-FEMA (3362) TTY: 800-462-7585
Region 1	Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont	99 High Street Boston, MA 02110	877-336-2734
Region 2	New Jersey, New York, Puerto Rico, Virgin Islands	One World Trade Center 52nd Floor	212-680-3600
Region 3	Washington, D.C., Delaware, Maryland, Pennsylvania, Virginia, West Virginia	New York, NY 10007-0101 615 Chestnut Street One Independence Mall, 6th Floor Philadelphia, PA 19106-4404	215-931-5500
Region 4	Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee	3003 Chamblee Tucker Road Atlanta, GA 30341-4112	770-220-5200
Region 5	Illinois, Indiana, Michigan, Minnesota, Ohio, Wisconsin	536 South Clark Street, Sixth Floor Chicago, IL 60605-1521	312-408-5500

Table 3: FEMA Headquarters and Regional Office Contact Information (Cont.)

HQ / Region	States/Territories	Address	Phone No.
Region 6	Arkansas, Louisiana, New Mexico, Oklahoma, Texas	Federal Regional Center 800 North Loop 288 Denton, TX 76209-3698	940-898-5399
Region 7	Iowa, Kansas, Missouri, Nebraska	9221 Ward Parkway, Suite 300 Kansas City, MO 64114-3372	816-283-7061
Region 8	Colorado, Montana, North Dakota, South Dakota, Utah, Wyoming	Denver Federal Center Building 710, Box 25267 Denver, CO 80255-0267	303-235-4800
Region 9	Arizona, California, Hawaii, Nevada, American Samoa, Commonwealth of the Northern Mariana Islands, Federated States of Micronesia, Guam, Republic of the Marshall Islands,	1111 Broadway, Suite 1200 Oakland, CA 94607-4052	510-627-7100 Pacific Area Office: 808-851-7900
Region 10	Alaska, Idaho, Oregon, Washington	Federal Regional Center 130 228th Street, SW Bothell, WA 98021-8627	425-487-4600

Other federal agencies that provide floodplain management assistance include the U.S. Army Corps of Engineers and the U.S. Soil Conservation Service. For their nearest locations, see http://www.usace.army.mil/Locations.aspx and http://www.nrcs.usda.gov/wps/portal/nrcs/sitenav/soils/states/.

7 Index of Key Words and Subjects in the Technical Bulletins

The numbers in the index indicate the Technical Bulletin number.

8 References

Section 8.1 lists the references that are cited in this Technical Bulletin. Section 8.2 lists additional resources related to NFIP requirements.

8.1 References

ASCE/SEI (American Society of Civil Engineers / Structural Engineering Institute). 2014. *Flood Resistant Design and Construction*. ASCE/SEI 24-14. Available at https://ascelibrary.org/doi/book/10.1061/9780784413791.

FEMA (Federal Emergency Management Agency). Various editions. *Flood Insurance Manual*. Available at https://www.fema.gov/flood-insurance/work-with-nfip/manuals#flood-insurance.

FEMA. Various. NFIP Technical Bulletins. Current editions available at https://www.fema.gov/emergency-managers/risk-management/building-science/national-flood-insurance-technical-bulletins.

FEMA. 2010. *Substantial Improvement/Substantial Damage Desk Reference*. FEMA P-758. Available at https://www.fema.gov/emergency-managers/risk-management/building-science/multi-hazard#:~:text=Document-,FEMA%20P-758.

FEMA. 2018. *Answers to Questions About Substantially Improved/Substantially Damaged Buildings*. FEMA 213. Available at https://www.fema.gov/emergency-managers/risk-management/building-science/multi-hazard#:~:text=FEMA 213.

FEMA. 2019. FEMA P-2037, *Flood Mitigation Measures for Multi-Family Buildings*. Available at https://content.govdelivery.com/attachments/USDHSFEMA/2020/06/24/file_attachments/1481529/16-J-0218_Multi-FamilyGuidance_06222020.pdf.

FEMA. 2020. FEMA P-2140, *Floodplain Management Requirements for Agricultural Structures and Accessory Structures*. Available at https://www.fema.gov/media-collection/floodplain-management-requirements-agricultural-and-accessory-structures.

ICC (International Code Council). Various editions. *International Building Code; International Existing Building Code; International Residential Code*. Available at https://www.iccsafe.org/.

ICC and FEMA. 2019. *Reducing Flood Losses Through the International Codes: Coordinating Building Codes and Floodplain Management Regulations*, 5th Edition. Available at https://www.fema.gov/sites/default/files/2020-07/fema_reducing_flood_losses_rfl_5th-ed.pdf.

USACE. 1995. *Flood Proofing Regulations*. Available at https://www.publications.usace.army.mil/Portals/76/Publications/EngineerPamphlets/EP_1165-2-314.pdf.

8.2 Useful Resources

Author	Date	Doc. No.	Title	Website
ASCE (American Society of Civil Engineers)	2005	ASCE 24-05	*Flood Resistant Design and Construction*	https://ascelibrary.org/
	2005	ASCE/SEI 7-05	*Minimum Design Loads for Buildings and Other Structures*	
	2010	ASCE/SEI 7-10	*Minimum Design Loads for Buildings and Other Structures*	
	2014	ASCE 24-14	*Flood Resistant Design and Construction*	
	2016	ASCE/SEI 7-16	*Minimum Design Loads and Associated Criteria for Buildings and Other Structures*	
FEMA (Federal Emergency Management Agency)	Various	—	*Flood Insurance Manual*	https://www.fema.gov/flood-insurance/work-with-nfip/manuals#flood-insurance
	2004	FEMA 467-1	*Floodplain Management Bulletin:Elevation Certificate*	https://www.fema.gov/multimedia-library
	2009	FEMA P-85	*Protecting Manufactured Homes from Floods and Other Hazards*	
	2009	FEMA P-550	*Recommended Residential Construction for Coastal Areas: Building on Strong and Safe Foundations*	
	2009	FEMA P-762	*Local Officials Guide for Coastal Construction*	
	2010	FEMA P-499	*Home Builder's Guide to Coastal Construction Technical Fact Sheet Series*	
	2010	FEMA P-758	*Substantial Improvement / Substantial Damage Desk Reference*	
	2011	FEMA P-55	*Coastal Construction Manual: Principles and Practices of Planning, Siting, Designing, Construction, and Maintaining Residential Buildings in Coastal Areas (Fourth Edition)*	
	2012	FEMA P-259	*Engineering Principles and Practices for Retrofitting Flood-Prone Residential Structures, Third Edition*	
	2013	FEMA P-936	*Floodproofing Non-Residential Buildings*	
	2013	FEMA P-942	*Mitigation Assessment Team Report: Hurricane Sandy in New Jersey and New York*	
	2014	FEMA P-312	*Homeowner's Guide to Retrofitting, 3rd Edition*	
	2014	FEMA P-1019	*Emergency Power Systems for Critical Facilities: A Best Practices Approach to Improving Reliability*	

Author	Date	Doc. No.	Title	Website
FEMA (Federal Emergency Management Agency)	2016	FEMA P-787	*Catalog of FEMA Building Science Branch Publications and Training Courses*	
	2017	FEMA P-348	*Protecting Building Utilities from Flood Damage*	
	2018	FEMA 213	*Answers to Questions About Substantially Improved/Substantially Damaged Buildings*	
	2019	FEMA Form 086-0-33	*NFIP Elevation Certificate and Instructions*	
	2019	FEMA Form 086-0-34	*Floodproofing Certificate for Non-Residential Structures*	
	2021	NFIP TB 0	*User's Guide to Technical Bulletins*	https://www.fema.gov/emergency-managers/risk-management/building-science/national-flood-insurance-technical-bulletins
	2020	NFIP TB 1	*Requirements for Flood Openings in Foundation Walls and Walls of Enclosures Below Elevated Buildings in Special Flood Hazard Areas*	
	2009	NFIP TB 2	*Flood Damage-Resistant Materials Requirements for Buildings Located in Special Flood Hazard Areas*	
	2021	NFIP TB 3	*Requirements for the Design and certification of Dry Floodproofed Non-Residential and Mixed-Use Buildings Located in Special Flood Hazard Areas*	
	2019	NFIP TB 4	*Elevator Installation for Buildings Located in Special Flood Hazard Areas*	
	2020	NFIP TB 5	*Free-of-Obstruction Requirements for Buildings Located in Coastal High Hazard Areas*	
	2021	NFIP TB 6	*Requirements for Dry Floodproofed Below-Grade Parking Areas Under Non-Residential and Mixed-Use Buildings Located in Special Flood Hazard Areas*	
	1993	NFIP TB 7	*Wet Floodproofing Requirements for Structures Located in Special Flood Hazard Areas*	
	2019	NFIP TB 8	*Corrosion Protection for Metal Connectors and Fasteners in Coastal Areas*	
	2008	NFIP TB 9	*Design and Construction Guidance for Breakaway Walls Below Elevated Buildings in Coastal High Hazard Areas*	

Author	Date	Doc. No.	Title	Website
FEMA (Federal Emergency Management Agency)	2001	NFIP TB 10	*Ensuring that Structures Built on Fill In or Near Special Flood Hazard Areas Are Reasonably Safe From Flooding*	
	2001	NFIP TB 11	*Crawlspace Construction for Buildings Located in Special Flood Hazard Areas*	
	Various	—	*Mitigation Assessment Team (MAT) Reports and Recovery Advisories (RAs)*	https://www.fema.gov/fema-mitigation-assessment-team-mat-reports
ICC (International Code Council)	2012, 2015, 2018	—	• International Building Code • International Existing Building Code • International Fuel Gas Code • International Mechanical Code • International Plumbing Code • International Private Sewage Disposal Code • International Residential Code	https://codes.iccsafe.org/category/I-Codes
HUD (U.S. Department of Housing and Development)	2017	—	*Residential Structural Design Guide: A State-of-the-Art Engineering Resource for Light-Frame Homes, Apartments, and Townhouses, Second Edition*	https://www.huduser.gov/publications/pdf/residential.pdf
NFPA (National Fire Protection Association)	2017	NFPA 225	*Model Manufactured Home Installation Standard*	https://www.nfpa.org/
USACE (U.S. Army Corps of Engineers)	1995	EP 1165-2-314	*Flood Proofing Regulations*	https://www.publications.usace.army.mil/portals/76/publications/engineerpamphlets/ep_1165-2-314.pdf
	2002	EM 1110-2-1100	*Coastal Engineering Manual*	https://www.publications.usace.army.mil/USACE-Publications/Engineer-Manuals/u43544q/636F617374616C20656E67696E656572696E67206D616E75616C/

NFIP = National Flood Insurance Program
SEI = Structural Engineering Institute
TB = Technical Bulletin