

Using ASCE 24 for CDBG-MIT Projects

June 11, 2020

2:00pm – 3:30pm

Agenda

Begin 2:00 pm

- **CDBG-MIT Program Overview (Federal Register Notice language on use of ASCE 24)**
- **Overview of the Flood Requirements for a CDBG Mitigation Grant**
- **What is ASCE 24 and what does it cover?**
- **Complying with ASCE 24 for a CDBG Mitigation Grant?**
- **Overview of ASCE 24 use with Residential**
- **Overview of ASCE 24 use with Non-Residential Mitigation Projects**
- **Historic Building Considerations**
- **The Benefits of Using ASCE 24**
- **Getting Access to ASCE 24**
- **FEMA Resources when using ASCE 24**
- **Questions**

End at 3:30 pm

Speakers

Roosevelt Grant, U.S. Department of Homeland Security, Federal Emergency Management Agency
William Clay Lloyd, Department of Housing and Urban Development, CPD Specialist,
Adam J Reeder, PE, CFM , Principal, CDM Smith

Resources

Page 2 – Flood Design Terms

Page 5 – Helpful Acronyms

Page 6 – Using a Digital Flood Insurance Rate Map

Page 10 – Highlights of ASCE 24-14 Flood Resistant Design and Construction

Page 16 – FEMA Floodproofing Certificate

Flood Design Terms

Floodplain Management Terms

Base Flood Elevation (BFE): Water surface elevation resulting from the base flood, which is defined as the flood having a 1-percent chance of being equaled or exceeded in any given year (commonly called the 100-year flood).

Basement: Any area of the building having its floor subgrade (below ground level) on all sides.

Community: governmental body with the statutory authority to enact and enforce development regulations. The authority of each unit of government varies by State. Eligible communities can include cities, villages, towns, townships, counties, parishes, States, and Indian Tribes.

Debris impact: Impact from flood-borne debris. This value is typically assumed to be from an approximately 1,000 pound object, but the impact could be larger depending on the surroundings. The type of debris may change due to flooding characteristics related directly to depth, velocity, rates of rise and fall, and possible obstructions such as tree lines.

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. (CFR 44 §59.1)

Duration: The timeframe throughout which floodwaters exceed normal conditions. This could be hours for flashfloods, days, or months in some areas. With long-duration flooding, certain measures such as dry floodproofing may not be effective, because of the increased chance of seepage and buoyancy forces.

Enclosure: Portion of an elevated building below the lowest elevated floor that is either partially or fully enclosed by rigid walls.

Flood depth and elevation: The depth of flooding is the height of the water with respect to the surrounding ground elevation of the building. The elevation is often used to discuss flood levels or severities across the floodplain. Often these are primary factors in the potential for flood damage and critical information for the design.

Flood Insurance Rate Map (FIRM): Official map of an NFIP community that delineates the Special Flood Hazard Areas and the insurance risk premium zones in the community. This map will indicate both the 1-percent-annual-chance flood hazard and the 0.2-percent-annual-chance flood hazard.

Flood Hazard Boundary Map: The initial insurance map issued by FEMA that identifies based on approximate analyses, the areas of the 1-percent-annual-chance flood hazard within a community.

Flood Insurance Study (FIS): Provides a narrative of the community's flood history and sources of flooding, as well as detailed information on the hydraulics and hydrology in the community.

Floodway: that portion of the floodplain which is effective in carrying flow, within which this carrying capacity must be preserved and where the flood hazard is generally highest, i.e., where water depths and velocities are the greatest. It is that area which provides for the discharge of the base flood so the cumulative increase in water surface elevation is no more than one foot.

Floodway Fringe: lands outside the floodway that are at or below the BFE that store, but do not effectively convey, floodwaters. Lands that compose the flood fringe will be inundated during a 1% chance flood event but, due to physical characteristics of the floodplain, do not effectively convey floodwaters.

Freeboard: An added margin of safety, expressed in feet above the regulatory flood elevation adopted by the local community.

Frequency: Probability that a flood of a specified severity will be equaled or exceeded in any given year. This is currently referenced as a percent-annual-chance event or historically expressed as a recurrence interval (year), which is $1/(\% \text{-annual chance})$ or $1/0.01 = 100$ year flood.

Lowest floor: The lowest floor of the lowest enclosed area (including the 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 an

enclosure is not built so as to render the structure in violation of the applicable non-elevation design requirements.

Mixed-use building: A building that has both residential and commercial uses.

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

Post-FIRM (New Building): A building for which construction or Substantial Improvement occurred after December 31, 1974, or on or after the effective date of an initial FIRM, whichever is later.

Pre-FIRM (Existing Building): A building for which construction or Substantial Improvement occurred on or before December 31, 1974, or before the effective date of an initial FIRM.

Rates of rise and fall: Similar to the duration, it is the rate at which floodwaters rise to a specific elevation and the rate at which floodwaters recede. If an area is subject to flash flooding (high rate of rise), certain retrofitting methods may not be feasible, especially if they require human intervention.

Residential building: A building designated for habitation.

Special Flood Hazard Area (SFHA): The area delineated on a National Flood Insurance Program Map as being subject to the inundation by the 1-percent-annual-chance flood. SFHAs are determined using statistical analyses of records of river flow, storm tides, and rainfall; information obtained through consultation with a community; floodplain topographic surveys; and hydrologic and hydraulic analyses. Areas within the SFHA are designated on the flood insurance rate map as Zone A, AO, A1-A30, AE, A99, AH, AR, AR/A, AR/AE, AR/AH, AR/AO, AR/A1-A30, V1-V30 or V.

Structure: For floodplain management purposes, a walled and roofed building, or gas or liquid storage tank, that is principally above ground, including manufactured homes.

Substantial Damage (SD): 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 Improvement (SI): 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 (or smaller percentage if established by the community) before the "start of construction" of the improvement.

Velocity: The speed at which the floodwater is flowing. Flowing water often causes erosion and scour and imposes hydrodynamic forces on the building. Floodwater can also carry debris that impacts the building.

Flood Protection Terms

Active measures require human intervention and are effective only if there is enough warning time to mobilize the labor and equipment necessary to implement them and then safely evacuate.

Design Flood Elevation (DFE): The elevation of the design flood specified on the flood hazard map adopted by the local community

Dry floodproofing: A combination of measures that results in a structure, including the attendant utilities and equipment, being watertight, with all elements substantially impermeable and with structural components having the capacity to resist flood loads.

Flood Protection Elevation (FPE) or Flood Protection Level (FPL): This is equal to the DFE or BFE+1 foot, whichever is higher. The FPE may exceed these values if the designer and owner decide to include additional freeboard. The DFE is used in this training.

Floodproofing: Any combination of structural or non-structural adjustments, changes, or actions that reduce or eliminate flood damage to a building, contents, and attendant utilities and equipment.

Floodwall: A freestanding, permanent, engineered barrier constructed of flood damage-resistant materials designed to prevent encroachment of floodwater to a specified area. Floodwalls surround a building or area and are offset from the exterior walls of the building.

Passive measures do not require human intervention and are recommended whenever possible.

Retrofitting: Any change to an existing structure to reduce or eliminate the possibility of damage to the structure from flooding, erosion, high winds, earthquakes, or other hazards.

Substantially impermeable: A wall is considered substantially impermeable if it limits water accumulation to 4 inches in a 24-hour period. In addition, sump pumps are required to control any seepage.

Wet floodproofing: Using flood damage-resistant materials and construction techniques to minimize flood damage to areas below the flood protection level of a structure, which is intentionally allowed to flood.

Helpful Acronyms

ASCE – American Society of Civil Engineers

BFE – Base Flood Elevation

CDBG-MIT – Community Development Block Grant Mitigation

CFR – Code of Federal Regulations

CRS – Community Rating System

DFE – Design Flood Elevation

FEMA – Federal Emergency Management Agency

FIM – Flood Insurance Manual

FIRM – Flood Insurance Rate Map

FIS – Flood Insurance Study

FPE – Flood Protection Elevation

FPM – Floodplain Management

FRN – Federal Register Notice

IBC – International Building Code

ICC – International Code Counsel

IEBC – International Existing Building Code

IRC – International Residential Code

HVAC – Heating, Ventilating, and Air Conditioning

MAT – Mitigation Assessment Team

NAVD – North American Vertical Datum

NFIP – National Flood Insurance Program

SD – Substantial Damage

SFHA – Special Flood Hazard Area

SI – Substantial Improvement

SLR – Sea Level Rise

TB – Technical Bulletin (NFIP Product)

Using a Digital Flood Insurance Rate Map (DFIRM)

Purpose: To explain the purpose of Flood Insurance Rate Maps (FIRMs), Digital Flood Insurance Rate Maps (DFIRMs), highlight features that are important to coastal builders, and explain how to obtain FIRMs, DFIRMs, and Flood Insurance Studies (FISs).

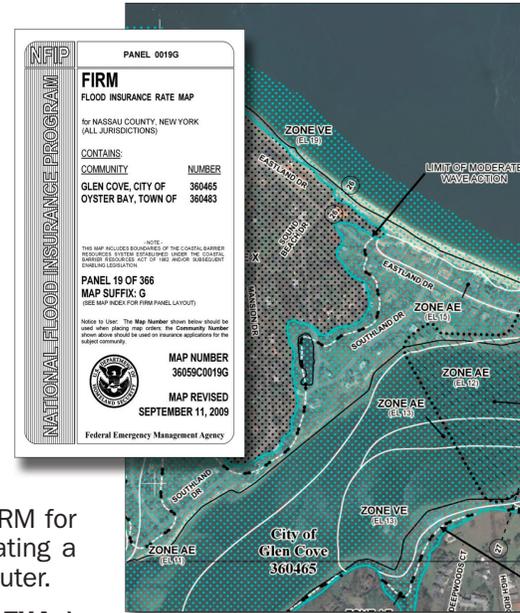
What Is a FIRM?

Flood-prone areas are studied by engineers and hydrologists that specialize in analysis of streams, rivers, tidal shorelines, and their adjacent floodplain or coastal area. These published studies, known as the community's **FIS**, provide detailed information on the study area that facilitates the creation of flood maps. FISs are usually produced for the highest risk streams, most rivers, and almost all coastal reaches.

FEMA has mapped flood hazards for nearly 20,000 communities in the United States, most commonly on FIRMs. Most of the nation's FIRMs were converted during the past five years through the Map Modernization Program into a digital product that depicts flood-prone areas for a community. These are known as **Digital Flood Insurance Rate Maps**, or **DFIRMs**.

Effective October 1, 2009, FEMA discontinued the distribution of paper maps. Paper FIRMs were replaced with DFIRMs. The FIRM for your specific site can be viewed online and reproduced by creating a printable **FIRMette**¹ that can be downloaded to a personal computer.

DFIRMs show the delineation of the **Special Flood Hazard Areas (SFHAs)** – land areas subject to inundation by a flood that has a 1-percent probability of being equaled or exceeded in any given year (hence, the terms “1-percent-annual-chance flood” and “100-year flood”). SFHAs are shaded on the DFIRM and are divided into different flood zones, depending on the nature and severity of the flood hazard. DFIRM datasets have been provided to your local community and are available for viewing at the local National Flood Insurance Program (NFIP) coordinator's office.



FIRMs and DFIRMs Are Used By:

- **Communities**, to regulate new construction* (e.g., foundation type, lowest floor elevation, use of the enclosed areas below the lowest floor).
- **Designers and Builders**, to determine flood hazards and plan new construction per community ordinance and code requirements.
- **Lenders**, to determine whether flood insurance is required for federally backed mortgages.
- **Insurance Agents**, to establish flood insurance premiums.
- **Land surveyors and engineers**, to complete National Flood Insurance Program (NFIP) elevation certificates (see Fact Sheet No. 1.4, *Lowest Floor Elevation*).

* Note that new construction may include some additions, improvements, repairs, and reconstruction. Consult the community about substantial improvement and substantial damage requirements.

1 FIRMettes are user-selected portions of flood maps available through the FEMA Map Service Center.



Why Are FIRMs and DFIRMs Important?

- FIRMs and DFIRMs show the boundaries of modeled flood hazard areas in a community.
- SFHAs shown on the maps are used to set flood insurance rates and premiums.
- The 1-percent-annual-chance flood elevations and flood depths shown on FIRMs and DFIRMs are the minimum regulatory elevations on which community floodplain management ordinances and building codes are based.
- The information shown on these maps can affect the design and construction of new buildings and infrastructure, the improvement and repair of existing buildings, and additions to existing buildings (see Fact Sheet Nos. 1.2, *Summary of Coastal Construction Requirements and Recommendations for Flood Effects*, and 8.3, *Protecting Utilities*).

What Are Flood Zones and Base Flood Elevations, and How Do They Affect Coastal Buildings?

- **BFEs** are typically shown on DFIRMs for riverine flood zones (Zone A, AE, AO, and AH) and coastal flood zones (Zone V and VE). **The BFE is the predicted elevation of flood waters and wave effects during the 1-percent-annual-chance flood (also known as the base flood).** The BFE is referenced to the vertical datum shown on the DFIRM. Most have been updated to the 1988 North American Vertical Datum.
- The minimum **lowest floor elevation and the foundation type and design** for new construction* are determined by the BFE and flood zone, as required in the community's floodplain management ordinance and building code (see Fact Sheet Nos. 1.4, *Lowest Floor Elevation*, and 3.1, *Foundations in Coastal Areas*). This ordinance, along with the most current DFIRM and FIS, are adopted by resolution to meet NFIP participation requirements. Use of these tools supports community planning, zoning, and building inspection programs that require specific structure design and new construction* in high-hazard coastal floodplains.

Some communities have adopted higher standards for coastal construction (e.g., lowest floor elevations above the BFE [freeboard], restrictions on foundation types, and enclosures in Zone A). *Builders should consult their local jurisdiction for details.*

* Note that new construction may include some additions, improvements, repairs, and reconstruction. Consult the community about substantial improvement and substantial damage requirements.

Flood Hazard Zones in Coastal Areas

(See the sample DFIRM that follows)

Zone V: Areas closest to the shoreline including the Primary Frontal Dune (PFD), subject to storm wave action, high-velocity flow, and erosion during 100-year storm events. Elevations are not provided.

Zone VE: Base Flood Elevations (BFEs) are provided on the DFIRM and an additional hazard can be present associated with storm waves greater than 3 feet and including the PFD. BFEs are derived from detailed analyses shown in the FIS.

Zone A: Areas subject to flooding during the 1-percent-annual-chance flood. Flood conditions are less severe than in Zone V and MOWAs due to lower wave forces. Because detailed analysis has not been performed, BFEs and flood depths are not provided.

Zone AE: Depicts BFEs on the DFIRM. Further details are provided in the FIS on areas where hydrology and hydraulic modeling was performed to determine flood hazard risk.

Area of Moderate Wave Action (MOWA): Area landward of Zone V, or landward of an open coast without a mapped Zone V. During base flood conditions, the potential wave height in this area is between 1.5 and 3 feet above the 1-percent-annual-chance stillwater flood depth. While this area is not specifically labeled on the DFIRM panel, this is the area between the LiMWA and the VE/AE zone boundary. In many codes and standards it is referred to as the "Coastal A Zone."

Zone AO: Areas subject to shallow flooding or sheet flow during the 1-percent-annual-chance flood. If they appear on a coastal DFIRM they will most likely be found on the landward slopes of shoreline dunes and overtopped structures. Flood depths, rather than BFEs, are shown for Zone AO.

Zone AH: Areas subject to inundation by 1-percent-annual-chance shallow flooding (usually areas of ponding) where average depths are between 1 foot and 3 feet.

Zone X: Areas with a lower probability of flooding (<1%); these areas are generally not regulated through community floodplain management ordinances and building codes due to their lower predicted risk of flooding.

Sample DFIRM

This map is a portion of the DFIRM for the Town of Oyster Bay and the City of Glen Cove in Nassau County, New York. Several important things to note are highlighted:

The community identification number is 360465 for Glen Cove and 360483 for Oyster Bay.

The panel number is 19. Note that an Index Map is available showing all DFIRM panels for all communities within Nassau County.

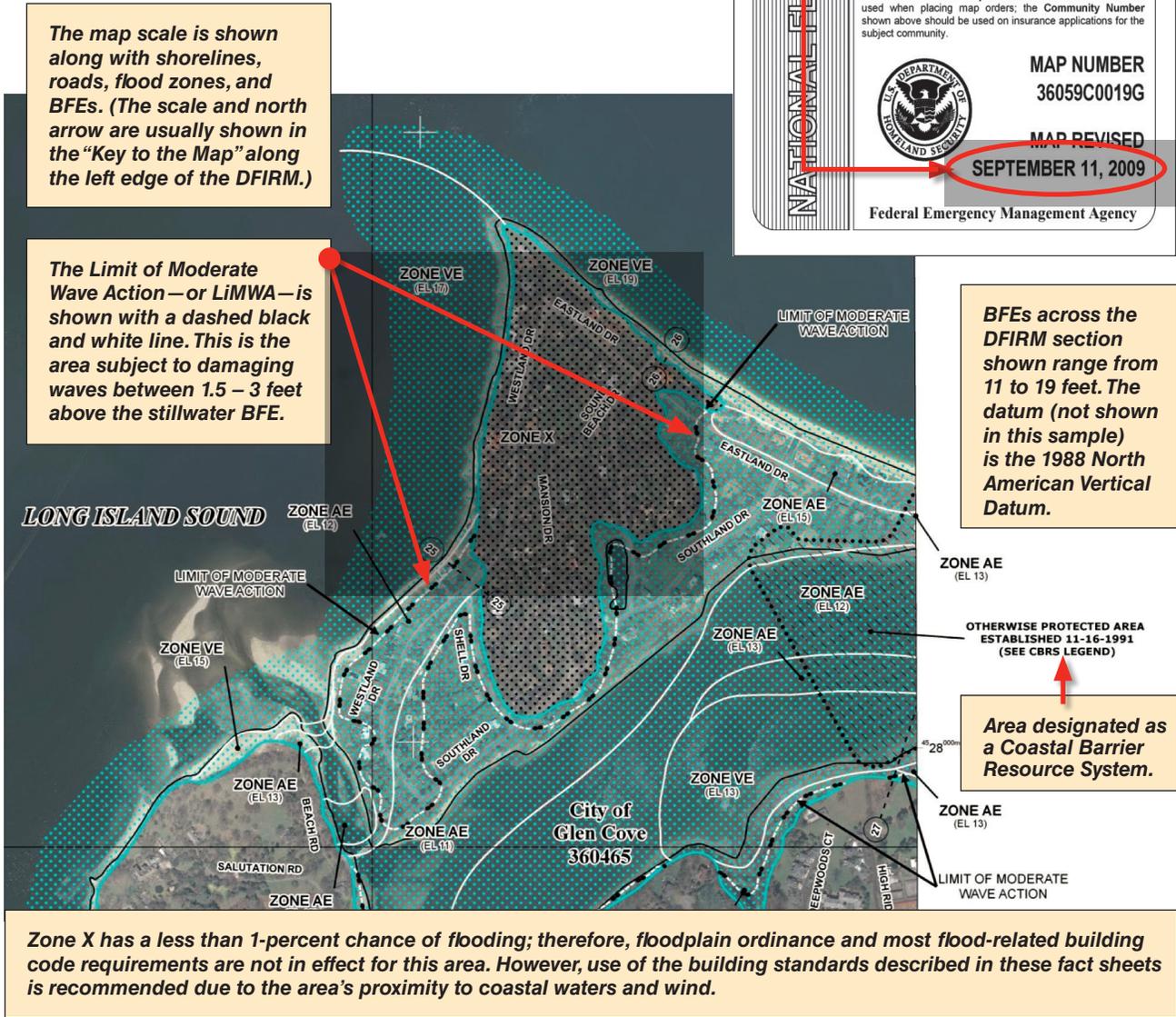
The effective date of the DFIRM is September 11, 2009.

The map scale is shown along with shorelines, roads, flood zones, and BFEs. (The scale and north arrow are usually shown in the "Key to the Map" along the left edge of the DFIRM.)

The Limit of Moderate Wave Action—or LiMWA—is shown with a dashed black and white line. This is the area subject to damaging waves between 1.5 – 3 feet above the stillwater BFE.

BFEs across the DFIRM section shown range from 11 to 19 feet. The datum (not shown in this sample) is the 1988 North American Vertical Datum.

Area designated as a Coastal Barrier Resource System.



Zone X has a less than 1-percent chance of flooding; therefore, floodplain ordinance and most flood-related building code requirements are not in effect for this area. However, use of the building standards described in these fact sheets is recommended due to the area's proximity to coastal waters and wind.

PANEL 0019G

FIRM
FLOOD INSURANCE RATE MAP

for NASSAU COUNTY, NEW YORK
(ALL JURISDICTION)

CONTAINS:
COMMUNITY NUMBER

GLEN COVE, CITY OF	360465
OYSTER BAY, TOWN OF	360483

- NOTE -
THIS MAP INCLUDES BOUNDARIES OF THE COASTAL BARRIER RESOURCES SYSTEM ESTABLISHED UNDER THE COASTAL BARRIER RESOURCES ACT OF 1982 AND/OR SUBSEQUENT ENABLING LEGISLATION.

PANEL 19 OF 366
MAP SUFFIX: G
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

Notice to User: The Map Number shown below should be used when placing map orders; the Community Number shown above should be used on insurance applications for the subject community.

MAP NUMBER
36059C0019G

MAP REVISED
SEPTEMBER 11, 2009

Federal Emergency Management Agency

Is There Anything Else I Should Know About Coastal Flood Hazard Areas and Flood Elevations?

- Many DFIRMs are digital conversions of FIRMs produced during the past few years without improved analysis of flood hazards. While some corrections were made, the maps may not accurately represent coastal flood hazards. Sections 7.8 and 7.9 of FEMA's *Coastal Construction Manual* (FEMA-55, 2005) describe how coastal flood hazards are mapped and how to determine whether coastal FIRMs reflect present-day flood hazards.
- DFIRMs do not incorporate the effects of long-term shoreline erosion. This information should be obtained from other sources.
- Recent post-storm investigations and studies have shown flood forces and damage in Areas of Moderate Water Action (MOWAs) or Coastal A Zones can be very similar to those in Zone V. Some communities have adopted DFIRMs that show MOWAs as a white line on the DFIRM that depicts the LiMWA. Although DFIRMs (and minimum NFIP building standards) do not differentiate between Zone A in coastal areas and Zone A in riverine areas, *builders should consider using Zone V foundation and elevation standards for new construction in the MOWA. These flood zones are depicted as white boundaries on DFIRMs where communities are encouraging use of Zone V standards in MOWAs.*
- Many communities and states require that the lowest floor elevations are above the BFE, offering an additional level of protection known as **Freeboard**. The term used to describe the higher elevation level is **Design Flood Elevation (DFE)**.
- Many property owners have voluntarily constructed their buildings with the lowest floor several feet above the BFE because of the potential for flood waters to exceed the BFE and enter the building. Flood insurance is not available in areas designated as being in the Coastal Barrier Resource System (CBRS). Only structures constructed prior to the designation of the area as being in the CBRS are allowed to purchase federal flood insurance.

Where Can I Get FIRMs, DFIRMs, Flood Studies, and Other Information?

Community floodplain administrator. The community's DFIRMs and its local floodplain management regulations, should be on file and available for viewing at the office of the community floodplain administrator.

FEMA's Map Information eXchange, or FMIX. This service center serves as a one-stop shop for a variety of information, products, services, and tools that support the National Flood Insurance Program. To contact a FEMA Map Specialist, please call 1-877-FEMAMAP (1-877-336-2627) or email FEMAMapSpecialist@riskmapcde.com. DFIRMs and FISs can be accessed at www.msc.fema.gov. Index sheets and specific FIRM panels can be viewed online at the FEMA Map Service Center website by entering either a parcel address or the specific DFIRM panel number, if known. A user-selected portion of flood maps (called a FIRMette) such as the previous sample can be created, saved, and printed. An effective tutorial on interpretation and use of the old FIRM product is available at www.FloodSmart.gov. While not specific to the newer DFIRM platform, the tutorial defines basic flood hazard map terminology and will be helpful to those less experienced with using flood hazard maps.

Information regarding FIRMs, DFIRMs, FISs, and related products can also be obtained from FEMA through FMIX at:

1-877-FEMAMAP (1-877-336-2627)

Or

FEMAMapSpecialist@riskmap.cde.com

Developed in association with the National Association of Home Builders Research Center



HIGHLIGHTS OF ASCE 24-14 *Flood Resistant Design and Construction*

Published by the American Society of Civil Engineers (ASCE), *Flood Resistant Design and Construction*, ASCE 24, is a referenced standard in the *International Codes*[®] (I-Codes[®]). ASCE 24 states the minimum requirements and expected performance for the siting and design and construction of buildings and structures in flood hazard areas that are subject to building code requirements. Types of buildings and structures are described in ASCE 24-14, Table 1-1 (see page 5 of these Highlights), and include commercial, residential, industrial, educational, healthcare, critical facilities, and other occupancy types. Buildings and structures designed according to ASCE 24 are better able to resist flood loads and flood damage.



FEMA deems ASCE 24 to meet or exceed the minimum National Flood Insurance Program (NFIP) requirements for buildings and structures. ASCE 24 includes additional specificity, some additional requirements, and some limitations that are not in NFIP regulations.

Buildings and structures within the scope of the IBC and proposed to be located in any flood hazard area must be designed in accordance with ASCE 24. The 2015 I-Codes reference ASCE 24-14, while the 2006 through 2012 I-Codes reference ASCE 24-05. The *International Residential Code*[®] requires dwellings in floodways to be designed in accordance with ASCE 24, and the 2015 edition of the IRC allows use of ASCE 24 for dwellings in any flood hazard area (the 2012 and 2009 editions allow use of ASCE 24 in Coastal High Hazard Areas).

Highlights of ASCE 24-14 that complement the NFIP minimum requirements are described below.

A summary of significant technical revisions from ASCE 24-05 to ASCE 24-14 is reproduced on page 6 of these Highlights.

Building Performance

- Flood loads and other loads and load combinations are specified in ASCE 7-10, *Minimum Design Loads for Buildings and Other Structures*. Performance of foundations exposed to flooding is specified in ASCE 24. Soil characteristics and underlying strata, including soil consolidation, expansion or movement, erosion and scour, liquefaction and subsidence must be considered, as applicable.
- Flood Design Classes replace Occupancy/Risk Categories for the purpose of establishing elevations of lowest floors, flood-resistant materials, equipment and floodproofing. The 2015 *International Building Code* requires designers to identify the Flood Design Class assigned in accordance with ASCE 24-14.
- Elevation and Freeboard (additional height above the NFIP's base flood elevation) are specified as a function of the Flood Design Class and the nature of the flood hazard areas (see table on page 4 of these Highlights). Essential facilities (Flood Design Class 4) must be elevated or protected to the BFE + 2 ft or 500-year flood elevation, whichever is higher.
- Elevation requirements in Zone V and Coastal A Zones are independent of orientation of the lowest horizontal structural member (relative to direction of wave approach) as a factor in determining the required freeboard (ASCE 24-05 made elevation a function of orientation of the lowest horizontal structural member relative to the direction of wave approach).

ASCE 24 uses 'design flood' and 'design flood elevation' to acknowledge that some communities adopt flood hazard maps that depict flood hazard areas in addition to Special Flood Hazard Areas shown on FEMA's Flood Insurance Rate Maps (FIRM).

The design flood elevation (DFE) equals the base flood elevation (BFE) in communities that regulate based on FIRMs. The DFE is always equal to or higher than the BFE.

- Fill is required to be stable under conditions of flooding, including rapid rise and rapid drawdown, prolonged inundation, and erosion and scour. Compaction of structural fill is specified unless otherwise required by the building code or in a geotechnical or engineering report. Fill side slopes must be no steeper than 1:1.5.
- Two methods are specified to meet the requirements for flood openings in walls of enclosures below elevated buildings, to allow for the automatic entry and exit of floodwater: nonengineered openings that do not require certification (1 sq in per sq ft of enclosed area) and engineered openings that must be certified by a registered design professional. The performance of engineered openings must account for the presence of louvers, blades, screens, grilles, faceplates, or other covers and devices and must ensure that the difference between the exterior and interior floodwater levels does not exceed 1 foot. Installation of all flood openings must be in at least two walls and must be no more than 1 foot above the higher of the interior grade or floor and the finished exterior grade immediately under each opening.
- All breakaway walls in all flood hazard areas must have flood openings (ASCE 24-05 did not require flood openings in Zone V breakaway walls).
- Provisions are included for attached and detached decks and porches, and for garages, carports, and accessory storage structures.
- Provisions are listed for concrete slabs-on-grade, depending on the purpose and location of the slabs.
- Stairways and ramps must be designed and constructed to resist flood loads and to minimize transfer of flood loads to foundations, or to break away without causing damage to the main structure, or to be retractable/able to be raised.
- Where stairways are located inside areas enclosed with breakaway walls, exterior doors are required at the main building entry at the top of the stairs, to minimize entry of wind-driven rain and wave splash after breakaway walls have failed.
- In Coastal High Hazard Areas (Zone V) and Coastal A Zones:
 - Coastal A Zones are treated like Coastal High Hazard Areas if FEMA has delineated a Limit of Moderate Wave Action, or if the community has designated a Coastal A Zone.
 - Buildings must be supported on piles, drilled shafts, caissons, or other deep foundations (including columns, and shear walls) and foundation depth must take into account erosion and local scour.
 - Stem walls supporting floors and backfilled with soil or gravel are allowed in Coastal A Zones if designs provide for the effects of local scour and erosion.
 - Requirements are included for shallow foundations in circumstances where soil conditions prevent deep foundations.
 - Provisions are provided for pile foundations, attachment to piles, and different types of piles (wood, steel H, concrete-filled steel pipe, prestressed concrete, precast concrete, cast-in-place concrete).
 - Provisions are provided for pile design (capacity, capacity of supporting soils, minimum penetration, spacing, connections, splicing, and mixed and multiple types of piles).
 - Provisions are provided for footings, mats, rafts, slabs-on-grade, pile caps, grade beams, bracing, and shear walls.
 - Walls designed to break away must not produce debris that is capable of damaging structures.
 - Erosion control structures (bulkheads, seawalls, revetments) must not be attached to buildings or direct floodwater into or increase flood forces or erosion impacts on structures.
 - Pools must be elevated, or designed to breakaway without producing damaging debris, or designed to remain in the ground without obstructing flow that causes damage. Pools must be structurally independent of buildings and structures unless pools are located in or on elevated floors or roofs that are above the design flood elevation.

- Dry floodproofed nonresidential buildings and non-residential portions of mixed-use buildings:
 - The terms “mixed use” and “residential portions of mixed use” now are defined in Commentary.
 - Dry floodproofing measures are not permitted in Coastal High Hazard Areas, Coastal A Zones, High Risk Flood Hazard Areas, where flood velocities exceed 5 ft/sec, and where conformance with certain human intervention limits cannot be achieved.
 - At least one exit door or emergency escape/rescue opening must be provided above the elevation specified for dry floodproofing.
 - If dry floodproofing measures specified require human intervention to activate or implement, there must be a minimum warning time of 12 hours unless a community warning system provides a warning time sufficient to accomplish certain activities. If removable shields are approved as part of design, flood emergency plans must address specified elements and actions and must be posted in at least two conspicuous locations.

Flood Damage-Resistant Materials

- Flood damage-resistant materials must be used below specified elevations (see table on page 4).
- Metal connectors and fasteners exposed to salt water, salt spray or other corrosive agents must be stainless steel or equivalent corrosion resistant material, or hot-dipped galvanized after fabrication.
- Where preservative treated wood is required, treatment must be in accordance with AWPA requirements.

Attendant Utilities and Equipment

- Attendant utilities and equipment must be at or above specified elevations (see table on page 4), or must be specifically designed, constructed, and installed to prevent floodwaters from entering or accumulating within components.
- Fuel supply lines must be equipped with float operated automatic shut-off valves.
- Where required to meet life safety provisions of the code, certain exterior electrical components may be installed below the design flood elevation, provided they are installed on a non-breakaway structural element on the landward or downstream side of structures.
- Tanks that are below the design flood elevation and that are attached to or beneath buildings must be installed and anchored to resist at least 1.5 times the potential buoyant and other flood forces assumed to act on empty tanks.
- Elevator cabs that descend below the design flood elevation must be equipped with controls that prevent the cab from descending into floodwaters. Elevator shafts must be designed to resist flood loads, but are not required to have flood openings or breakaway walls.

Siting Considerations

- New buildings must not be built (1) seaward of the reach of mean high tide, or (2) in areas subject to flash flooding (floodwaters rise to 3 feet or more above banks in less than 2 hours). Unless protected, new buildings must not be built (1) in erosion-prone areas (determined by analysis); or (2) in mudslide areas (determined by analysis); or (3) in certain portions of alluvial fan areas; or (4) in high velocity flow areas (faster than 10 ft/sec); or (5) in ice jam and debris areas.
- Buildings in proximity to flood protective works (dams, levees, floodwalls, diversions, channels, flood control structures) must not have adverse effects on, or conflict with, maintenance and repairs of those protective works.

Prepared by FEMA Building Science Branch. Content from ASCE 24-14 used with permission from ASCE. Purchase ASCE 24 at www.asce.org.

See next page for description of Flood Design Classes →

		Flood Design Class 1	Flood Design Class 2	Flood Design Class 3	Flood Design Class 4
Minimum Elevation* of Lowest Floor (Zone A: ASCE 24-14 Table 2-1)	Zone A not identified as Coastal A Zone	DFE	BFE +1 ft or DFE, whichever is higher	BFE +1 ft or DFE, whichever is higher	BFE +2 ft or DFE, or 500-year flood elevation, whichever is higher
Minimum Elevation of Bottom of Lowest Horizontal Structural Member (Zone V: ASCE 24-14 Table 4-1)	Coastal High Hazard Areas (Zone V) and Coastal A Zone	DFE	BFE +1 ft or DFE, whichever is higher	BFE +2 ft or DFE, whichever is higher	BFE +2 ft or DFE, or 500-year flood elevation, whichever is higher
Minimum Elevation Below Which Flood-Damage-Resistant Materials Shall be Used (Table ASCE 24-14 5-1)	Zone A not identified as Coastal A Zone	DFE	BFE +1 ft or DFE, whichever is higher	BFE +1 ft or DFE, whichever is higher	BFE +2 ft or DFE, or 500-year flood elevation, whichever is higher
	Coastal High Hazard Areas (Zone V) and Coastal A Zone	DFE	BFE +1 ft or DFE, whichever is higher	BFE +2 ft or DFE, whichever is higher	BFE +2 ft or DFE, or 500-year flood elevation, whichever is higher
Minimum Elevation** of Utilities and Equipment (ASCE 24-14 Table 7-1)	Zone A not identified as Coastal A Zone	DFE	BFE +1 ft or DFE, whichever is higher	BFE +1 ft or DFE, whichever is higher	BFE +2 ft or DFE, or 500-year flood elevation, whichever is higher
	Coastal High Hazard Areas (Zone V) and Coastal A Zone	DFE	BFE +1 ft or DFE, whichever is higher	BFE +2 ft or DFE, whichever is higher	BFE +2 ft or DFE, or 500-year flood elevation, whichever is higher
Minimum Elevation of Dry Floodproofing of non-residential structures and non-residential portions of mixed-use buildings (ASCE 24-14 Table 6-1)	Zone A not identified as Coastal A Zone	BFE +1 ft or DFE, whichever is higher	BFE +1 ft or DFE, whichever is higher	BFE +1 ft or DFE, whichever is higher	BFE +2 ft or DFE, or 500-year flood elevation, whichever is higher
	Coastal High Hazard Areas (Zone V) and Coastal A Zone	Not permitted	Not permitted	Not permitted	Not permitted
Minimum Elevation of Wet Floodproofing*** (ASCE 24-14 Table 6-1)	Zone A not identified as Coastal A Zone; Coastal A Zone; Coastal High Hazard Areas (Zone V)	BFE +1 ft or DFE, whichever is higher	BFE +1 ft or DFE, whichever is higher	BFE +1 ft or DFE, whichever is higher	BFE +2 ft or DFE, or 500-year flood elevation, whichever is higher
<p>* Flood Design Class 1 structures shall be allowed below the minimum elevation if the structure meets the wet floodproofing requirements of ASCE 24-14 Section 6.3. ** Unless otherwise permitted by ASCE 24-14 Chapter 7 *** Only if permitted by ASCE 24-14 Section 6.3.1</p>					

ASCE 24-14 Table 1-1 Flood Design Class of Buildings and Structures	
Use or Occupancy of Buildings and Structures	Flood Design Class
Buildings and structures that normally are unoccupied and pose minimal risk to the public or minimal disruption to the community should they be damaged or fail due to flooding. Flood Design Class 1 includes (1) temporary structures that are in place for less than 180 days, (2) accessory storage buildings and minor storage facilities (does not include commercial storage facilities), (3) small structures used for parking of vehicles, and (4) certain agricultural structures. [Note (a)]	1
Buildings and structures that pose a moderate risk to the public or moderate disruption to the community should they be damaged or fail due to flooding, except those listed as Flood Design Classes 1, 3, and 4. Flood Design Class 2 includes the vast majority of buildings and structures that are not specifically assigned another Flood Design Class, including most residential, commercial, and industrial buildings.	2
Buildings and structures that pose a high risk to the public or significant disruption to the community should they be damaged, be unable to perform their intended functions after flooding, or fail due to flooding. Flood Design Class 3 includes (1) buildings and structures in which a large number of persons may assemble in one place, such as theaters, lecture halls, concert halls, and religious institutions with large areas used for worship; (2) museums; (3) community centers and other recreational facilities; (4) athletic facilities with seating for spectators; (5) elementary schools, secondary schools, and buildings with college or adult education classrooms; (6) jails, correctional facilities, and detention facilities; (7) healthcare facilities not having surgery or emergency treatment capabilities; (8) care facilities where residents have limited mobility or ability, including nursing homes but not including care facilities for five or fewer persons; (9) preschool and child care facilities not located in one- and two-family dwellings; (10) buildings and structures associated with power generating stations, water and sewage treatment plants, telecommunication facilities, and other utilities which, if their operations were interrupted by a flood, would cause significant disruption in day-to-day life or significant economic losses in a community; and (11) buildings and other structures not included in Flood Design Class 4 (including but not limited to facilities that manufacture, process, handle, store, use, or dispose of such substances as hazardous fuels, hazardous chemicals, hazardous waste, or explosives) containing toxic or explosive substances where the quantity of the material exceeds a threshold quantity established by the authority having jurisdiction and is sufficient to pose a threat to the public if released. [Note (b)]	3
Buildings and structures that contain essential facilities and services necessary for emergency response and recovery, or that pose a substantial risk to the community at large in the event of failure, disruption of function, or damage by flooding. Flood Design Class 4 includes (1) hospitals and health care facilities having surgery or emergency treatment facilities; (2) fire, rescue, ambulance, and police stations and emergency vehicle garages; (3) designated emergency shelters; (4) designated emergency preparedness, communication, and operation centers and other facilities required for emergency response; (5) power generating stations and other public utility facilities required in emergencies; (6) critical aviation facilities such as control towers, air traffic control centers, and hangars for aircraft used in emergency response; (7) ancillary structures such as communication towers, electrical substations, fuel or water storage tanks, or other structures necessary to allow continued functioning of a Flood Design Class 4 facility during and after an emergency; and (8) buildings and other structures (including, but not limited to, facilities that manufacture, process, handle, store, use, or dispose of such substances as hazardous fuels, hazardous chemicals, or hazardous waste) containing sufficient quantities of highly toxic substances where the quantity of the material exceeds a threshold quantity established by the authority having jurisdiction and is sufficient to pose a threat to the public if released. [Note (b)]	4
<p>[Note (a)] Certain agricultural structures may be exempt from some of the provisions of this standard; see ASCE 24-14 Section C1.4.3.</p> <p>[Note (b)] Buildings and other structures containing toxic, highly toxic, or explosive substances shall be eligible for assignment to a lower Flood Design Class if it can be demonstrated to the satisfaction of the authority having jurisdiction by a hazard assessment as described in ASCE 7-10 Section 1.5.3 of <i>Minimum Design Loads for Buildings and Other Structures</i> that a release of the substances is commensurate with the risk associated with that Flood Design Class.</p>	

Significant Technical Revisions

ASCE 24-14 lists a number of significant technical revisions from the 2005 edition:

1. Defines *Flood Design Class* rather than use Risk/Occupancy Classification assigned under ASCE 7 and requires each building or structure governed by the standard to be assigned to Flood Design Class 1, 2, 3, or 4. Uses the assigned Flood Design Class to apply elevation requirements specified in Chapters 2, 4, 5, 6 and 7. Flood Design Class 4 buildings and facilities are equivalent to Occupancy Category/Risk Category IV buildings, which ASCE 7-10 identifies as essential facilities.
2. Adds definitions for *Mixed Use* and *Residential Portions of Mixed Use* in commentary to clarify limitations on use of dry floodproofing measures.
3. Changes the Coastal A Zone determination requirement from the designer's responsibility to one depending on either: 1) delineation of a Limit of Moderate Wave Action (LiMWA) on a Flood Insurance Rate Map, or 2) designation by the Authority Having Jurisdiction.
4. Separates specifications for flood openings from the installation requirements. Requires the presence of louvers, blades, screens, faceplates, or other covers and devices to be accounted for in determining net open area for non-engineered openings and in determining the performance of engineered openings. Revises coefficient of discharge table for engineered flood openings. Adds commentary regarding selection of coefficient of discharge and for grouping or stacking of flood openings.
5. For Flood Design Class 4 buildings, requires the minimum lowest floor elevation (or floodproofing level of protection) to be the higher of: the Base Flood Elevation plus freeboard specified in Chapters 2, 4 and 6, the Design Flood Elevation, or the 500-year flood elevation. The 500-year flood elevation requirement is new.
6. Clarifies text pertaining to alluvial fan high risk flood hazard areas.
7. In coastal high hazard areas (V Zone) and Coastal A Zones (if delineated):
 - a. Makes explicit that designs must account for local scour and erosion
 - b. Provides for shallow foundations in Coastal A Zones under certain circumstances
 - c. Requires flood openings in breakaway walls
 - d. Eliminates orientation of the lowest horizontal structural member as a factor to determine elevation for lowest floors, equipment, and flood damage-resistant materials
 - e. Requires exterior doors at the top of stairways that are located inside enclosed areas with breakaway walls
 - f. Consolidates requirements for all nonstructural concrete slabs
 - g. Allows substantial improvement of existing buildings seaward of the reach of mean high tide in V zones (makes ASCE 24 consistent with NFIP) and Coastal A Zones.
8. Updates flood damage-resistant material requirements.
9. Clarifies emergency escape and rescue opening requirements for dry floodproofed buildings.
10. Clarifies requirements for garages, carports, and accessory storage structures. Adds new section for multistory parking structures.
11. Consolidates requirements for tanks and more clearly distinguishes between requirements based on flood hazard area.

FLOODPROOFING CERTIFICATE FOR NON-RESIDENTIAL STRUCTURES

Paperwork Burden Disclosure Notice

Public reporting burden for this data collection is estimated to average 3.25 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and submitting this form. You are not required to respond to this collection of information unless a valid OMB control number is displayed on this form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing the burden to: Information Collections Management, Department of Homeland Security, Federal Emergency Management Agency, 500 C Street SW, Washington, DC 20742, Paperwork Reduction Project (1660-0008). **NOTE: Do not send your completed form to this address.**

General: This information is provided pursuant to Public Law 96-511 (the Paperwork Reduction Act of 1980, as amended), dated December 11, 1980, to allow the public to participate more fully and meaningfully in the Federal paperwork review process.

Authority: Public Law 96-511, amended; 44 U.S.C. 3507; and 5 CFR 1320.

Privacy Act Statement

Authority: Title 44 CFR § 61.7 and 61.8.

Principal Purpose(s): This information is being collected for the primary purpose of estimating the risk premium rates necessary to provide flood insurance for new or substantially improved structures in designated Special Flood Hazard Areas.

Routine Use(s): The information on this form may be disclosed as generally permitted under 5 U.S.C. § 552a(b) of the Privacy Act of 1974, as amended. This includes using this information as necessary and authorized by the routine uses published in DHS/FEMA-003 – National Flood Insurance Program Files System or Records Notice 73 Fed. Reg. 77747 (December 19, 2008); DHS/FEMA/NFIP/LOMA-1 – National Flood Insurance Program (NFIP) Letter of Map Amendment (LOMA) System of Records Notice 71 Fed. Reg. 7990 (February 15, 2006); and upon written request, written consent, by agreement, or as required by law.

Disclosure: The disclosure of information on this form is voluntary; however, failure to provide the information requested may result in the inability to obtain flood insurance through the National Flood Insurance Program or being subject to higher premium rates for flood insurance. Information will only be released as permitted by law.

Purpose of the Floodproofing Certificate for Non-Residential Structures

Under the National Flood Insurance Program (NFIP), the floodproofing of non-residential buildings may be permitted as an alternative to elevating to or above the Base Flood Elevation (BFE). A floodproofing design certification is required for non-residential structures that are floodproofed. This form is to be used for that certification.

A floodproofed building is a building that has been designed and constructed to be watertight (substantially impermeable to floodwaters) below the BFE and with structural components having the capability of resisting hydrostatic and hydrodynamic loads and effects of buoyancy. Before a floodproofed building is designed, numerous planning considerations, including flood warning time, uses of the building, mode of entry to and exit from the building and the site in general, floodwater velocities, flood depths, debris impact potential, and flood frequency, must be addressed to ensure that dry floodproofing will be a viable floodplain management measure.

The minimum NFIP requirement is to floodproof a building to the BFE. However, when it is rated for flood insurance one-foot is subtracted from the floodproofed elevation. Therefore, a building has to be floodproofed to one foot above the BFE to receive the same favorable flood insurance rates as a building elevated to the BFE.

Additional guidance can be found in FEMA Publication 936, Floodproofing Non-Residential Buildings (2013), available on FEMA's website at <https://www.fema.gov/media-library/assets/documents/34270>.

FLOODPROOFING CERTIFICATE FOR NON-RESIDENTIAL STRUCTURES

The floodproofing of non-residential buildings may be permitted as an alternative to elevating to or above the Base Flood Elevation; however, a floodproofing design certification is required. This form is to be used for that certification. Floodproofing of a residential building does not alter a community's floodplain management elevation requirements or affect the insurance rating unless the community has been issued an exception by FEMA to allow floodproofed residential basements. The permitting of a floodproofed residential basement requires a separate certification specifying that the design complies with the local floodplain management ordinance.

BUILDING OWNER'S NAME	FOR INSURANCE COMPANY USE	
STREET ADDRESS (Including Apt., Unit, Suite, and/or Bldg. Number) OR P.O. ROUTE AND BOX NUMBER		
OTHER DESCRIPTION (Lot and Block Numbers, etc.)		
CITY	STATE	Zip Code

SECTION I – FLOOD INSURANCE RATE MAP (FIRM) INFORMATION

Provide the following from the proper FIRM:

COMMUNITY NUMBER	PANEL NUMBER	SUFFIX	DATE OF FIRM INDEX	FIRM ZONE	BASE FLOOD ELEVATION (in AO Zones, Use Depth)

Indicate elevation datum used for Base Flood Elevation shown above: NGVD 1929 NAVD 1988 Other/Source: _____

SECTION II – FLOODPROOFED ELEVATION CERTIFICATION (By a Registered Professional Land Surveyor, Engineer, or Architect)

All elevations must be based on finished construction.

Floodproofing Elevation Information:

Building is floodproofed to an elevation of _____ . _____ feet (In Puerto Rico only: _____ . _____ meters).

NGVD 1929 NAVD 1988 Other/Source: _____

(Elevation datum used must be the same as that used for the Base Flood Elevation.)

Height of floodproofing on the building above the lowest adjacent grade is _____ feet (In Puerto Rico only: _____ meters).

For Unnumbered A Zones Only:

Highest adjacent (finished) grade next to the building (HAG) _____ . _____ feet (In Puerto Rico only: _____ . _____ meters).

NGVD 1929 NAVD 1988 Other/Source: _____

(NOTE: For insurance rating purposes, the building's floodproofed design elevation must be at least 1 foot above the Base Flood Elevation to receive rating credit. If the building is floodproofed only to the Base Flood Elevation, then the building's insurance rating will result in a higher premium. See the Instructions section for information on documentation that must accompany this certificate if being submitted for flood insurance rating purposes.)

FLOODPROOFING CERTIFICATE FOR NON-RESIDENTIAL STRUCTURES

Non-Residential Floodproofed Elevation Information Certification:

Section II certification is to be signed and sealed by a land surveyor, engineer, or architect authorized by law to certify elevation information

I certify that the information in Section II on this Certificate represents a true and accurate interpretation and determination by the undersigned using the available information and data. I understand that any false statement may be punishable by fine or imprisonment under 18 U.S. Code, Section 1001.

CERTIFIER'S NAME	LICENSE NUMBER (or Affix Seal)			PLACE SEAL HERE
TITLE	COMPANY NAME			
ADDRESS	CITY	STATE	ZIP CODE	
SIGNATURE	DATE	PHONE		

SECTION III – FLOODPROOFED CERTIFICATION (By a Registered Professional Engineer or Architect)

Non-Residential Floodproofed Construction Certification:

I certify the structure, based upon development and/or review of the design, specifications, as-built drawings for construction and physical inspection, has been designed and constructed in accordance with the accepted standards of practice (ASCE 24-05, ASCE 24-14 or their equivalent) and any alterations also meet those standards and the following provisions.

The structure, together with attendant utilities and sanitary facilities is watertight to the floodproofed design elevation indicated above, is substantially impermeable to the passage of water, and shall perform in accordance with the 44 Code of Federal Regulations (44 CFR 60.3(c)(3).

All structural components are capable of resisting hydrostatic and hydrodynamic flood forces, including the effects of buoyancy, and anticipated debris impact forces.

I certify that the information in Section III on this certificate represents a true and accurate determination by the undersigned using the available information and data. I understand that any false statement may be punishable by fine or imprisonment under 18 U.S. Code, Section 1001.

CERTIFIER'S NAME	LICENSE NUMBER (or Affix Seal)			PLACE SEAL HERE
TITLE	COMPANY NAME			
ADDRESS	CITY	STATE	ZIP CODE	
SIGNATURE	DATE	PHONE		

Copy all pages of this Floodproofing Certificate and all attachments for 1) community official, 2) insurance agent/company, and 3) building owner.

FLOODPROOFING CERTIFICATE FOR NON-RESIDENTIAL STRUCTURES

Instructions for Completing the Floodproofing Certificate for Non-Residential Structures

To receive credit for floodproofing, a completed Floodproofing Certificate for Non-Residential Structures is required for non-residential and business buildings in the Regular Program communities, located in zones A1–A30, AE, AR, AR Dual, AO, AH, and A with BFE.

In order to ensure compliance and provide reasonable assurance that due diligence had been applied in designing and constructing floodproofing measures, the following information must be provided with the completed Floodproofing Certificate:

- Photographs of shields, gates, barriers, or components designed to provide floodproofing protection to the structure.
- Written certification that all portions of the structure below the BFE that will render it watertight or substantially impermeable to the passage of water and must perform in accordance with Title 44 Code of Federal Regulations (44 CFR 60.3 (c)(3)).
- A comprehensive Maintenance Plan for the entire structure to include but not limited to:
 - Exterior envelope of the structure
 - All penetrations to the exterior of the structure
 - All shields, gates, barriers, or components designed to provide floodproofing protection to the structure
 - All seals or gaskets for shields, gates, barriers, or components
 - Location of all shields, gates, barriers, and components as well as all associated hardware, and any materials or specialized tools necessary to seal the structure.