Provisions of the 2009 I-Codes and ASCE 24
that are "Higher Standards" or that are More Specific than the NFIP Requirements

2009 I-Codes/ASCE 24-05* "Higher Standards/More Specific"	**NFIP**
Inspections. IBC and IRC call for inspections "upon placement of the lowest floor, including basement, and prior to further vertical construction," at which time elevation documentation shall be submitted.	**60.3(b)(5):** Requires communities to obtain the elevation to which the lowest floor (or bottom of the lowest horizontal structural member of the lowest floor) is elevated, without specifying when such information is to be obtained.
ASCE 24 as referenced standard. IBC refers to ASCE 24 for details [IBC 1612.4]. IRC requires homes in floodways to be designed per IBC/ASCE 24 [IRC 301.2.4, IRC 322.1]. IRC allows use of ASCE 24 as alternative in coastal high hazard areas (V Zones) [IRC 301.2.4.1, IRC 322.1.1]. **Foundation Requirements.** ASCE 24 requires design to prevent flotation, collapse, or permanent movement under load combinations, which are specified in ASCE 7 [Sec. 1.5.3]. **Geotechnical characteristics.** ASCE 24 requires foundation designs to be based on geotechnical characteristics of the soils and strata below the structure [Sec. 1.5.3.1]. **Flood loads.** ASCE 24 refers to ASCE 7 for flood loads (including hydrostatic loads, hydrodynamic loads, debris impact loads, wave loads) and load combinations [Sec. 1.6]. **Stability of fill.** Requires fill to be designed to be stable under conditions of flooding [Sec. 1.5.4]. Requires side slopes of structural fill to be no steeper than 1:1.5 and protected from scour and erosion; specifies lift thickness and compaction requirements for structural fill [Sec. 2.4]. **Anchorage and Connections**. ASCE 24 provides some specific requirements for anchorage and connections [Sec. 1.5.5].	**60.3(a)(3)(i):** Requires review to determine that all new construction and substantial improvements are "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."
Design Flood Elevation. IBC, IRC and ASCE 24 define Design Flood/Design Flood Elevation. Definitions allows community that has more current or more extensive flood hazard mapping to adopt it, provided it shows areas that include at least the SFHAs shown on FIRMs	**60.3:** If special flood hazard areas and water surface elevations have been furnished by the Administrator, they shall be used, unless otherwise approved.

* Section number references in brackets are ASCE 24, unless otherwise noted.

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High Risk Flood Hazard Areas. ASCE 24 defines High Risk Flood Hazard Area to include flood hazard areas where one or more of the following occur: alluvial fan flooding, flash flooding, mudslides, ice jams, high velocity flows (greater than 10 ft/sec), high velocity wave action (V zones), Coastal A Zones, or erosion. Specific requirements for high risk flood hazard areas are in Chapter 3 and Chapter 4.	**60.3(b):** Communities are required to regulate only flood hazard areas delineated by FEMA, unless other maps are approved for use. The NFIP currently delineates and maps flood hazard areas along riverine and coastal areas. The only "high risk" areas mapped are the floodway, coastal high hazard areas (V zones), and alluvial fan flood hazard areas.
Elevation requirements. For elevation of buildings and structures, ASCE 24 requires the elevation of appropriate lowest element, as a function of flood hazard area and structure category, to be elevated is specified in tables. Minimum elevation is DFE; freeboard of +1 ft, +2 ft, or +3 ft in selected instances (see table below for summary of ASCE 24 elevation requirements). **Elevation requirement (V Zone).** IRC requires homes in coastal high hazard areas to be elevated as a function of the orientation of the lowest horizontal structural member relative to the direction of wave approach: at or above the DFE if parallel or at or above the BFE plus 1 ft or DFE whichever is higher, if perpendicular [IRC 322.3.2]. **Elevation requirement (CAZ).** IRC requires homes in CAZ to be at or above the BFE + 1' or the DFE, whichever is higher [IRC 322.2.1].	**60.3:** Requires buildings to be elevated to or above the BFE, as function of flood zone; reference level is lowest floor [A Zones, 60.3(c)(2)], height of floodproofing [A Zones, 60.3(c)(3)], or bottom of lowest horizontal structural member of the lowest floor [V Zones, 60,3(e)2)].
Residential foundation wall height limitations. Unless designed according to IRC Chapter 4, foundation wall heights are limited as a function of type (plain or reinforced masonry) and wall thickness (6" and 8").	**60.3(a)(3)(i):** Requires review to determine that all new construction and substantial improvements are "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."
High Risk Flood Hazard Areas. ASCE 24 prohibits construction of structures in certain high risk areas unless "protective works" have been determined to provide protection during the design flood; high risk areas include (alluvial fans, flash flood areas, mudslide areas, erosion-prone areas, high velocity flow areas, ice jam and debris areas [Chapter 3].	**65.10:** If engineering documentation is approved, areas protected levee systems may have the flood hazard area designation removed, thus such protected areas are no longer subject to regulation as flood hazard area.
Engineered openings. ASCE 24 provides specific design guidance for engineered openings in enclosures, to allow inflow/outflow of floodwaters [Sec. 2.6.2.2]. ASCE 24 allows openings in breakaway walls [Sec. 2.6.1.1].	**60.3(c)(5):** Requires flood openings that do not meet certain minimum criteria be certified by a registered professional.

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Coastal A Zones. ASCE 24 defines the Coastal A Zone and specifies that such areas are treated as coastal high hazard areas (V Zones) [Sec. 4].	NFIP regulations do not have provisions for Coastal A Zones. Starting in 2008, revised FIRMs show the Limit of Moderate Wave Action (LiMWA), which delineates the landward limit of the CAZ.
Erosion and scour in V Zones and CAZs. ASCE 24 requires consideration of erosion and scour in coastal high hazard areas and Coastal A Zones [Sec. 4.5].	**60.3(e):** No specific requirement to evaluate or include the potential for erosion in foundation design, although certification is required that "the foundation is anchored to resist flotation, collapse and lateral movement due to the effects of wind and water loads acting simultaneously on all building components."
Foundations in V Zones and CAZs. ASCE 24 allows buildings in coastal high hazard areas and Coastal A Zones to be supported on piles, columns, or walls serving as shear walls [Sec. 4.5.1]. ASCE 24 foundation requirements include: . Geotechnical considerations – account for instability and decreased structural capacity associated with erosion, scour, shoreline movement [Sec. 4.5.2]; . Foundation depth – sufficient to account for erosion, scour, and predicated shoreline movement [Sec. 4.5.3]; . Use of fill – minor amounts for minimal site grading, landscaping, and drainage; dune construction/reconstruction [Sec. 4.5.4]; . Pile foundations – penetration depth, attachments, pile caps, wood piles, steel piles, concrete piles [Sec. 4.5.5]; . Pile design – lateral resistance, capacity of supporting soils, minimum penetration, spacing, caps, connections, splicing [Sec. 4.5.6]; . Posts, piers and columns – minimum spacing, minimum penetration [Sec. 4.5.7]; . Footings, mats, rafts, and slabs-on-grade – at or below grade, reinforced [Sec. 4.5.8]; . Grade beams – at or below grade; independent of decks, patios, concrete pads [Sec. 4.5.9]; . Bracing – limitations based on orientation to primary direction of waves [Sec. 4.5.10]; and . Shear walls – orientation to direction of wave approach [Sec. 4.5.11].	**60.3(e)(4) and (5):** In coastal high hazard areas, the regulations specify that new construction and substantial improvements be elevated on pilings and columns, and there is a requirement that the space below elevated buildings be "free of obstruction" or be enclosed by breakaway walls.

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Decks, concrete pads, and patios (V Zone). ASCE 24 includes specifications for decks, concrete pads, and patios that are beneath or adjacent to structures in coastal high hazard areas and Coastal A Zones, including specific requirements for concrete pads that reinforcing shall not be used and limiting pad thickness [Sec. 4.8]. IRC requires slabs, pools, pool decks and walkways to be structurally independent of buildings, unless building foundation are designed to resist the additional flood load [IRC 322.3.3].	
Flood damage-resistant materials. ASCE 24 clearly specifies the elevations below which flood damage resistant materials shall be used [ASCE 24-05 Table 5-1, see below]. IRC specifies pressure-preservative treated wood, lists specific allowable wood species, and cites a third-party standard for wood preservatives [IRC 322.1.8]. **Materials and third-party standards.** ASCE 24 references third-party standards for certain materials, including metal connectors and fasteners, structural steel, concrete, masonry, wood and timber, and finishes [Sec. 5].	**60.3(a)(3)(iii):** Broad statement that all new construction and substantial improvements shall be constructed with materials resistant to flood damage.
Dry floodproofing. ASCE 24 lists several elements that are to be accounted for in the design of dry floodproofing measures. Some of these elements bear on the practicality of certain types of floodproofing measures, notably those that require action by the occupants [Sec. 6.2]. ASCE 24 specifies the minimum height of dry floodproofing, which is at least BFE + 1 ft or the DFE, whichever is higher [Sec. 6.2.2].	**60.3(c)(3)(ii) and 60.3(c)(4):** Has a single statement regarding acceptable performance of floodproofing measures, without listing factors to be considered in the design of such measures. Requires designed to be developed or reviewed by a registered professional, and the design, specifications and plans are to be certified as being in accordance with accepted standards of practice. Requires floodproofing to or above the BFE.
Wet floodproofing. ASCE 24 includes specifications for wet floodproofing and limits its use to certain structures [Sec. 6.3].	Does not use the term "wet floodproofing;" such measures are allowed for enclosures below elevated buildings (and, by policy, certain accessory structures that meet the use limitations).

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Manufactured homes. IRC requires all manufactured homes to meet the elevation requirements, regardless of location or loss history [IRC 322.1.9]. IBC Appendix G requires all manufactured homes to meet the elevation requirements, regardless of location or loss history [IBC G501.1]. IBC Appendix G requires all manufactured homes to be placed on a permanent, reinforced foundation that is designed in accordance with Section 1612 [IBC G501.2].	**60.3(b)(8) and (c)(6):** Specify elevation and anchoring to adequately anchored foundation systems to resist flood loads. **60.3(c)(12):** Allows replacement units or substantially improved units in existing manufactured home parks and subdivisions to be no less than 35 inches above grade and anchored to adequately anchored foundation systems.
Platforms for utility equipment. ASCE 24 requires that exterior elevated platforms be supported on piles or columns, or cantilevered from or knee braced to the structure; if piles or columns are used, they shall be adequately embedded to account for erosion and local scour [Sec. 7.1]. **Utilities and breakaway walls.** ASCE 24, IMC, IPC, and IRC specify that utilities and attendant equipment shall not be mounted on or pass through breakaway walls [Sec. 7.1; M301.13.1, P309.3; IRC 322.3.4]. **Electric components required to meet life safety requirements.** ASCE 24 has specifications for exposed conduits and cables, electric meters, disconnect switches and circuit breakers, and other electric elements below the minimum elevations, including a statement that electric elements required to meet life safety provisions may be permitted within certain limitations [Sec. 7.2]. **Duct systems.** ASCE 24, IMC, and IRC specifically require ductwork/duct systems to be above the required elevations [Sec. 7.4; M602.4, M603.13; IRC 322.1.6; IRC1601.4.9].	**60.3(a)(3)(iv):** The only provision specific to utilities requires new construction and substantial improvements to "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."
Fuel supply lines. ASCE 24, IMC, and IRC specify that fuel supply lines below the required elevation shall be equipped with a float-operated automatic control valve [Sec. 7.4; M1305.2.1; G2404.7].	**60.3(a)(3)(iv):** The provision specific to utilities requires new construction and substantial improvements to "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."

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Underground plumbing system elements. ASCE 24 specifies that if installed under-ground, piping and plumbing systems shall be buried to a depth sufficient to prevent movement, separation or loss due to flooding and erosion [Sec. 7.3.1].	**60.3(a)(3)(iii) and (4):** Require construction with methods and practices that minimize flood damages and determination that proposed development will be reasonably safe from flooding. **60.3(a)(6):** Requires new and replacement sanitary sewage systems to be designed to minimize or eliminate infiltration of flood waters int the systems and discharges from the systems, and onsite waste disposal systems are required to be located to avoid impairment.
Tanks. ASCE 24 requires tanks to be elevated or installed to resist flood loads, and have fill openings and vents elevated. Designs shall assume 1.5 times the potential buoyant and other flood forces acting on an empty tank [Sec. 7.4.1]. IBC Appendix G requires tanks to be anchored to prevent flotation, collapse or lateral movement (underground and above-ground) or elevated; requires tank inlets and vents to be at or above DFE or fitted with covers to prevent inflow of floodwaters and outflow of contents [IBC G701].	**60.3(a)(3)(i):** The general performance requirement addresses stability of all development under flood loads. .
Elevators. ASCE 24 has specifications for elevators that require use of flood damage resistant materials. For hydraulic elevators, electric control panels and hydraulic pumps and tanks shall be elevated. For traction elevators, machine rooms shall be elevated. In certain circumstances, controls shall prevent elevator cabs from descending into floodwaters [Sec. 7.5].	**60.3(a)(3)(iv):** The provision specific to utilities requires new construction and substantial improvements to "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."
Pools. ASCE 24 requires pools in coastal high hazard areas and Coastal A Zones to be elevated, designed to breakaway, or to remain in the ground without obstructing flow [Sec. 9.5].	**60.3(a)(3)(i):** The general performance requirement addresses stability of all development under flood loads.
Subdivisions. IBC Appendix G requires residential building lots to be provided with buildable area outside of the floodway [IBC G301.2(3)].	**60.3(b)(3);** Requires all new subdivision proposals and other proposed developments (including proposals for manufactured home parks and subdivisions) greater than 50 lots or 5 acres, whichever is the lesser, to include within such proposals base flood elevation data.

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Recreational vehicles. IBC Appendix G prohibits placement of recreational vehicles in flood hazard areas subject to high velocity wave action (V zones) and in floodways [G601.1].	**60.3(c)(14):** Has no limitations on location.
Fences. IBC Appendix G requires fences in floodways that may block the passage of floodwaters, such as stockade fences and wire mesh fences, to meet the requirements for floodway encroachments in G103.5 [IBC G801.2].	No specific provisions for fences; however, fences are development and subject to the general performance requirements.
Prefabricated swimming pools. IBC Appendix G requires that prefabricated swimming pools in floodways meet the requirements for floodway encroachments in G103.5 [IBC G801.5].	No specific provisions for prefabricated swimming pools; however, swimming pools are development and subject to the general performance requirements.
Temporary structures and temporary storage. IBC Appendix G requires temporary structures to be anchored to prevent flotation, collapse, or lateral movement; stored materials shall not include hazardous materials; and temporary structures and temporary storage in floodways meet the requirements for floodway encroachments in G103.5 [IBC G901].	No specific provisions for temporary structures and temporary storage; however, such activities are development and subject to the general performance requirements. NFIP guidance includes recommendations for temporary structures and temporary storage.