

SECTION 12: PROTECTING NEW BUILDINGS

Contents

12.1. Terminology.....	12-3
12.1.1. “Building” and “structure”	12-3
12.1.2. Freeboard	12-3
12.1.3. Flood protection elevation (FPE).....	12-3
12.2. Elevation	12-4
12.2.1. Fill.....	12-5
12.2.2. Piles, posts, piers, or columns	12-5
12.2.3. Walls or crawlspace	12-6
12.2.4. How high?.....	12-8
12.2.5. Elevation Certificate	12-9
12.3. Enclosures.....	12-9
12.3.1. Problems with enclosures	12-9
12.3.2. Materials and utilities.....	12-10
12.3.3. Openings	12-10
12.3.4. Use of the area	12-13
12.4. Floodproofing	12-14
12.4.1. NFIP requirements	12-14
12.4.2. Human intervention	12-15
12.4.3. How high?.....	12-15
12.5. Provisions for all Buildings	12-16
12.5.1. AO and AH Zones	12-16
12.5.2. Basements	12-16
12.5.3. Basements and LOMR-F areas	12-17
12.5.4. Anchoring	12-18
12.5.5. Flood-resistant material	12-19
12.6. Accessory Structures	12-20
12.6.1. Small structures.....	12-21
12.6.2. Wet floodproofing specifications.....	12-21
12.7. Manufactured Homes	12-23
12.7.1. Definition	12-23
12.7.2. Elevation	12-23
12.7.3. Anchoring manufactured homes	12-24

12.7.4. Evacuation..... 12-25
12.7.5. Recreational vehicles 12-26

Buildings must be protected from flood damage for three reasons:

1. They are the most important, most valuable, and most common man-made structures subject to flood damage.
2. They are usually occupied or used by people. Protecting them protects human life and health and reduces human suffering.
3. Buildings and their contents are the only things covered by an NFIP flood insurance policy. Protecting them reduces flood insurance claims that are subsidized by the taxpayer.

Therefore, protecting buildings from flood damage is the cornerstone of a local flood-plain management program.

12.1. TERMINOLOGY

Basic Rule #4:
New buildings must be protected from damage by the base flood.

12.1.1. “Building” and “structure”

One objective of a local floodplain ordinance is to protect new buildings. In this desk reference, the term “building” is the same as the term “structure” in the NFIP regulations. Other ordinances may use either term.

44 CFR 59.1 Definitions: “Structure” means, for flood plain 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.

The term “building” or “structure” does not include open pavilions, bleachers, carports, and similar structures that do not have at least two rigid walls and a roof.

How to determine if a building is substantially improved or substantially damaged is discussed in Section 16. In this Section, consider the term “building” as an all-encompassing term that includes substantial improvements and repairs of substantial damage to a building.

Residential and nonresidential buildings are treated differently. A residential building must have a higher level of protection — if it is to be built in the floodplain, it must be elevated above the flood protection elevation. Nonresidential buildings, on the other hand, may be elevated or floodproofed (made watertight below the BFE).

Exemptions: Small additions and inexpensive buildings (less than \$1000.00) may be exempted from the building protection standards. They will still have to meet other requirements of the local ordinance. Before an ordinance is changed, IDNR/OWR and/or the FEMA Regional Office must be contacted to clarify what is exempt.

12.1.2. Freeboard

Freeboard is an additional height requirement above the base flood elevation (BFE) that provides a margin of safety against extraordinary or unknown risks. This reduces the risk of flooding and makes the building eligible for a lower flood insurance rate. See Section 13.3.2. for more information on freeboard.

12.1.3. Flood protection elevation (FPE)

The FPE or flood protection elevation is the base flood elevation plus freeboard. The FPE must be defined in the local floodplain ordinance. It sets the minimum protection level for new buildings in the floodplain.

The NFIP does not require freeboard for regulatory purposes so, if a community chooses, the FPE could be the same as the BFE. However, IDNR/OWR strongly recommends that a community adopt a freeboard appropriate to the local flood hazard. In ponding areas, it could be 1 foot. On rivers it could be up to 2 feet because of waves. The model ordinances use a 1 foot freeboard which most communities have adopted.

Remember: the BFE identifies the area affected by the base flood. The FPE sets the protection level for new and substantially improved buildings.

12.2. ELEVATION

Elevating a building above the FPE is the most common and secure way to protect a building from flood damage. It is the only way allowed for residential buildings.

44 CFR 60.3(c)(2) [Communities must] 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...

In Zones A1-A30, AE, AO, and AH, all new construction and substantial improvements of residential structures must be elevated so that the lowest floor (including the basement) is elevated to or above the FPE. This can be done in one of three ways:

1. Elevation on fill (see Figure 12.1).
2. Elevation on piles, posts, or columns.
3. Elevation on walls or a crawlspace (see Figure 12.1).

How to Elevate Your Floodplain Building

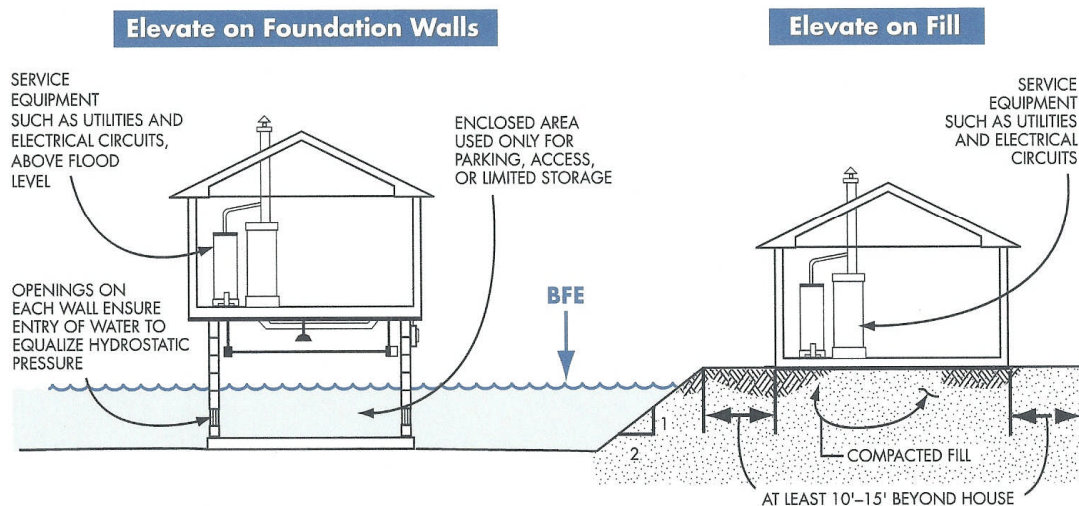


Figure 12-1: How to Elevate Your Floodplain Building
Source: IDNR's *The Floodplain Management Quick Guide*

12.2.1. Fill

IDNR/OWR and NFIP regulations allow fill to be used, but restrictions apply in floodways where fill would cause an increase in flood heights (see Figure 12-2).

Many communities also limit the use of fill in the flood fringe to protect flood storage capacity or require compensatory storage, which is discussed in Section 11.

Where fill is the method of choice, it should be properly designed, installed in layers, and compacted. Simply adding dirt to the building site may result in differential settling over time.

The fill should also be properly sloped and protected from erosion and scour during flooding. To provide a factor of safety for the building and its residents, it is recommended that the fill extend 10 – 15 feet beyond the walls before it drops below the FPE. Further, the fill should not adversely affect the flow of drainage from or onto neighboring properties. The fill must be protected from erosion and scour during flood. In areas with low velocity flooding, planting grass can do this. In higher velocity areas, rip rap or walls may be necessary.



Figure 12-2: This building was elevated on fill and was not damaged by this flood.

FEMA's Technical Bulletin 10-01, *Ensuring That Structures Built on Fill In or Near Special Flood Hazard Areas Are Reasonably Safe from Flooding in Accordance with the National Flood Insurance Program*, has some good guidance on constructing buildings on fill.

12.2.2. Piles, posts, piers, or columns

Piles, piers, posts, or columns are appropriate where there is deeper flooding and fill is not feasible. Elevation with no lower area enclosure is preferred where flooding is likely to have high velocities, ice, or to create waves. As illustrated in Figure 12-3, this permits unrestricted flow of floodwater under buildings. There will be less force applied to the building by floodwaters and less impact on flood heights than if solid walls were used.



**Figure 12-3: Elevation on piers
Mississippi River at Thebes**

12.2.3. Walls or crawlspace

The third elevation technique is to build on solid walls. In shallower flooding areas, this elevation technique is the same as creating a crawlspace — a foundation of solid walls that puts the lowest floor above the flood level.

When solid walls are used, care must be taken to ensure that hydrostatic or hydrodynamic pressure does not damage the walls. As discussed in Section 2, these water pressures can break a solid wall or concrete floor (Figures 2-9 and 2-10).

There are two ways to prevent this:

1. Stem walls can be used on two sides parallel to the flow of water. The other two sides are kept open (Figure 12-4). This minimizes the obstruction to floodwaters and lessens pressure on the foundation.
2. The walls can have openings large enough to allow floodwaters to flow in and out, preventing differential pressures on the walls (Figure 12-5). This is discussed in more detail in the later section on enclosures.



Figure 12-4: Building elevated on parallel stem walls.

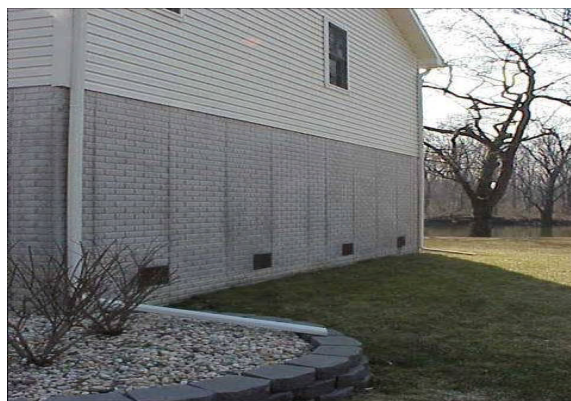
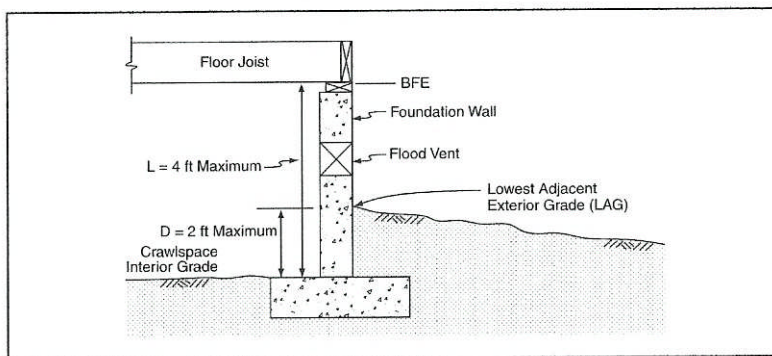


Figure 12-5: Building elevated with openings.

When a crawlspace is used to elevate the building above the base flood elevation, it creates an enclosed area below the BFE that must meet all requirements that apply to enclosures including the openings requirement. In addition, the floor of the crawlspace should be at or above the lowest adjacent grade to the building to minimize hydrostatic pressures against the crawlspace walls and the ponding of water within the crawl space after a flood.

Recently FEMA issued a policy allowing communities to permit below-grade crawlspaces in the Special Flood Hazard Area (SFHA) under certain conditions. These crawlspace rules have been incorporated into the State's model ordinance. Communities that wish to allow below-grade residential crawlspace construction must require that the interior grade of the crawlspace is no more than two feet below the lowest adjacent grade, the height of the crawlspace measured from the interior grade of the crawlspace to the top of the crawlspace wall does not exceed four feet at any point, and the building meets other limitations (See Figure 12-6). These communities must adopt these requirements as part of their floodplain management ordinance. Below-grade crawlspaces that meet these requirements will not be considered basements, but the buildings will still have higher flood insurance rates than if the same crawlspace had its floor at or above lowest adjacent grade.

- Below-grade crawlspace construction in accordance with the requirements listed above will not be considered basements.



Requirements regarding below-grade crawlspace construction.

Figure 12-6: Requirements regarding below grade crawlspace construction

Source: FEMA's Technical Bulletin 11-01 *Crawlspace Construction for Buildings Located in Special Flood Hazard Areas*

Technical Bulletin 11-01 *Crawlspace Construction for Buildings Located in Special Flood Hazard Areas* provides a best practices approach for crawlspace construction. While communities may allow below-grade crawlspace construction, the Technical Bulletin continues to recommend that the interior of the crawlspace be backfilled so that the interior grade is level to or higher than the lowest adjacent grade (LAG) to the building. The Technical Bulletin offers appropriate considerations and guidance for below-grade crawlspace construction. Communities that wish to allow below-grade crawlspaces should refer to the Technical Bulletin for the specific requirements that must be incorporated into their floodplain management ordinance.

12.2.4. How high?

NFIP regulations require that the lowest floor of a building must be elevated above the BFE. Note three things about this minimum requirement:

1. The term “lowest floor” includes a basement because all usable portions of a building must be protected from flood damage.

44 CFR 59.1. Definitions: “Lowest Floor” means 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 section 60.3.

2. The minimum requirement is to elevate to the BFE. Earlier in this section, we discussed freeboard, an extra margin of protection that requires the lowest floors to be one or more feet above the BFE (i.e., to the FPE).
3. In A Zones, under the minimum NFIP requirement, the lowest floor is measured from the top of the floor (Figure 12-7). However, all portions of the building below the BFE must be constructed with flood resistant materials and building utility systems (including ductwork) must be elevated above the BFE or floodproofed (made watertight) to that elevation. To meet these requirements, it is recommended that buildings on elevated foundations, such as piles or a crawlspace, have supporting beams or floor joists and building utility systems elevated to or above the FPE to protect them from flood damage. This is generally easier than using flood resistant materials for floor support systems of floodproofing building utility systems.

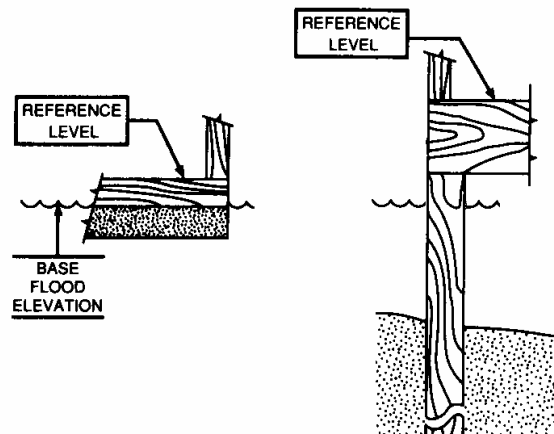


Figure 12-7: In A Zones: the top of the floor is the reference level

12.2.5. Elevation Certificate

Because most new buildings built in the floodplain are residences, elevating them is one of the most important requirements of the NFIP. To ensure that a building is elevated above the FPE, the lowest floor is surveyed and a licensed surveyor, engineer, or architect completes an elevation certificate. The local permit office keeps a copy of the certificate. This is discussed in more detail in Section 15.

Completing and maintaining the FEMA Elevation Certificate is an important element of a floodplain management program.

12.3. ENCLOSURES

12.3.1. Problems with enclosures

Enclosures are areas created by a crawlspace or solid walls below the FPE. They deserve special attention for two reasons:

1. The walls of enclosed areas are subject to flood damage from hydrostatic and hydrodynamic forces. Damage to these walls can lead to damage to the entire structure.
2. People are tempted to convert enclosures that are intended to be flooded into habitable or finished areas that can sustain damage in a flood.

An enclosure under an elevated floor need not just go to waste. NFIP regulations do allow certain uses in enclosures below the FPE because they are subject to minimal flood damage. Three uses are allowed:

1. building access,
2. vehicle parking, or
3. storage.

The storage permitted in an enclosed lower area should be limited to that which is incidental and accessory to the principal use of the structure. For example, if the structure is a residence, storage should be limited to items such as lawn and garden equipment, bicycles, and snow tires which either have a low damage potential or that can be easily moved to the elevated portion of the building if there is a flood.

The floodplain regulation requirements can be easier to accept if owners and builders are encouraged to think about the enclosed lower areas as usable space. If a building has to be elevated, say, five feet above grade, the owner should be encouraged to go up eight feet. This allows the lower area to be used for parking — and provides three extra feet of flood protection.

Enforcing restrictions against conversion of enclosed areas below the BFE to habitable space is a problem for many floodplain administrators. Often, homeowners convert these spaces into bedrooms, recreation rooms, or other living areas long after the original permit for construction has been issued, resulting in a noncompliant structure. If the property changes ownership, new

residents may claim ignorance of the restrictions. The conversions may be difficult to catch by even the most experienced building inspectors.

One way to help prevent conversions is to have the owner sign a nonconversion agreement. An example is provided in Figure 12-8. The owner signs the form indicating that the restrictions on the below BFE enclosure have been recorded on the deed to the property. Since the deed follows the property, future homebuyers are informed of the restrictions. Figure 12-8 can be copied and used locally. A nonconversion agreement is only necessary if the finished flood is 5 feet or more above grade.

12.3.2. Materials and utilities

Since floodwaters are intended to enter the enclosure — it must be built of flood-resistant materials (see the section on flood-resistant materials to determine which are acceptable). Not allowed are finishings such as carpeting, paneling, insulation (both cellulose and fiberglass), and gypsum wallboard (also known as drywall and sheet rock).

Utilities that serve the upper level also must be protected from flood damage. Consequently, a furnace cannot be put in an enclosure unless it is located above the FPE. Air conditioning units should be suspended from the first floor's floor joists or on a pedestal, above the FPE. It is especially important to make sure that any ductwork in a crawlspace be above the FPE, too.

When the lower area enclosure is used to provide access to the upper level, a stairway can be designed that provides this access yet is resistant to flood damage. Installing an elevator is more difficult, but there are ways to design and install an elevator that will face minimal flood damage, as explained in *Elevator Installation for Buildings Located in Special Flood Hazard Areas* (FEMA's Technical Bulletin 4-93).

12.3.3. Openings

As noted in Section 2, solid walls can collapse from hydrostatic pressure if floodwaters get too deep outside the building. To prevent this, an enclosure must have openings to allow floodwaters to enter and leave, thus automatically equalizing hydrostatic flood forces on both sides of the walls (See Figure 12-9).

44 CFR 60.3(c)(5) *[Communities must] 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.*

NON-CONVERSION AGREEMENT FOR ENCLOSURES BELOW THE BASE FLOOD ELEVATION

This DECLARATION made this ____ day of _____, 20__, by _____ (“Owner”) having an address at _____.

WITNESSETH:

WHEREAS, the Owner is the record owner of all that real property located at _____ in the City of _____ in the County of _____, designated in the Tax Records as _____.

WHEREAS, the Owner has applied for a permit to place a structure on that property that has an enclosed area below the base flood elevation constructed in accordance with the requirements of Article _____ Section _____ of the Floodplain Management Ordinance of _____ (“Ordinance”) and under Permit Number _____ (“Permit”).

WHEREAS, the Owner agrees to record this DECLARATION and certifies and declares that the following covenants, conditions and restrictions are placed on the affected property as a condition of granting the Permit, and affects rights and obligations of the Owner and shall be binding on the Owner, his heirs, personal representatives, successors, future owners, and assigns.

UPON THE TERMS AND SUBJECT TO THE CONDITIONS, as follows:

The structure or part thereof to which these conditions apply is:

1. At this site, the Base Flood Elevation is _____ feet above mean sea level, National Geodetic Vertical Datum.
2. Enclosed areas below the Base Flood Elevation shall be used solely for parking of vehicles, limited storage, or access to the building.
3. All interior walls, ceilings and floors below the Base Flood Elevation shall be constructed of flood resistant materials.
4. Mechanical, electrical or plumbing devices shall not be installed below the Base Flood Elevation.
5. The walls of the enclosed areas below the Base Flood Elevation shall be equipped and remain equipped with permanent flow-thru openings as shown on the Permit.
6. The jurisdiction issuing the Permit and enforcing the Ordinance may take any appropriate legal action to correct any violation. Any alterations or changes from these conditions also may render the structure uninsurable or increase the cost for flood insurance.
7. A duly appointed representative of the City is authorized to enter the property for the purpose of inspecting the exterior and interior of the enclosed area to verify compliance with this Declaration. Such inspections will be conducted upon due notice to the Owner and no more frequently than once each year. More frequent inspections may be conducted if an annual inspection discovers a violation of the Permit.
8. Other conditions:

In witness whereof the undersigned set their hands and seals this _____ day of _____, 20__.
_____(Seal) _____(Seal)
Owner Witness

Figure 12-8: Sample Nonconversion Agreement

The openings can be adequately designed by using one of two methods.

The first method of meeting the requirement is to have the design certified by a registered professional engineer or architect as meeting the requirement to automatically equalize hydrostatic forces on exterior walls by allowing for the entry and exit of floodwaters. Under some circumstances it may be possible to vary the size or location of the openings based on this certification.

The second method is to have the design meet or exceed the following four criteria:

1. The bottom of the openings must be no higher than one foot above grade (see Figure 12-9).
2. The openings shall be installed on at least two walls of the enclosure to ensure that at least one will work if others get blocked or plugged.
3. Provide a minimum of two openings having a net area of not less than one square inch for every square foot of enclosed area that is subject to flooding. If the area of the enclosure is 1,000 square feet, the area of the openings combined must total at least 1,000 square inches.
4. The openings must allow for automatic entry and exit of floodwater.

Openings may be equipped with screens, louvers, valves, or other coverings or devices to keep animals out of the enclosure. However, any covering must permit the automatic flow of floodwater in both directions. If the opening is covered by a standard crawlspace vent cover or grate, the net area of the opening must be used and the number of openings increased accordingly. Net areas can be found on manufacturer's specifications or estimated if specifications are not available.

For example, removing a concrete block from a block wall results in an 8" x 16" or 128 square inch opening (see Figure 12-9). To determine how many openings would be needed, divide the square footage of the floor area by 128.

Example 1: $\frac{1,280 \text{ square foot house}}{128 \text{ square inches/opening}} = 10$ 10 openings will be needed

Example 2: $\frac{2,000 \text{ square foot house}}{128 \text{ square inches/opening}} = 15.62$ 16 openings will be needed

The opening sizes in the previous examples and in Figure 12-9 are based on standard crawlspace vents, which most building codes require to be installed in a crawlspace for ventilation purposes. Often these are located close to the floor in order to circulate air around the floor joists.

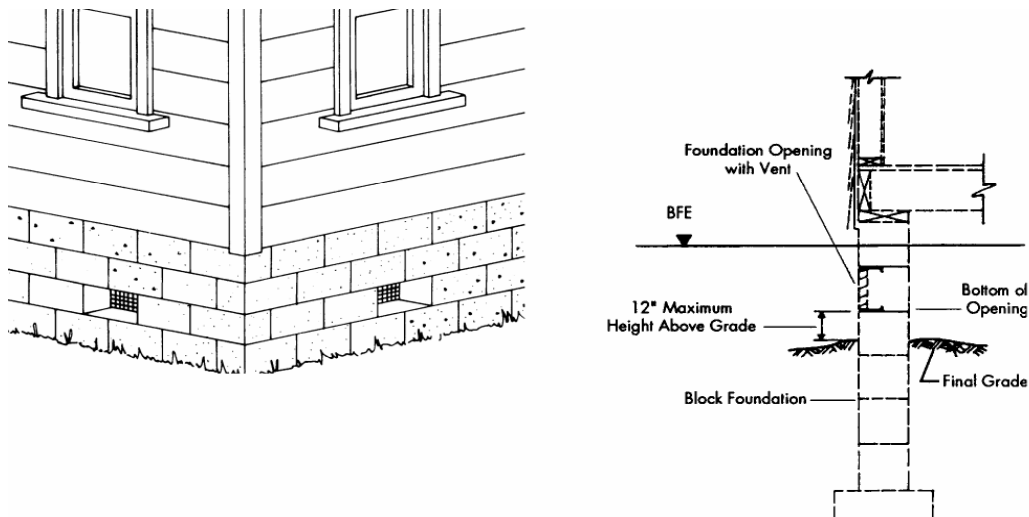


Figure 12-9: Opening location in solid foundation wall

Air vents are located well above the ground in an elevated house and would not meet the NFIP requirement that the bottom of the opening be within one foot of grade. However, NFIP requirements and building codes can be satisfied by the same vents if they meet the four criteria listed above.

Garage doors cannot be used to satisfy this requirement because they do not permit the automatic flow of floodwaters. However, garage doors may have vents in them that meet the above criteria.

Openings are not required for stem wall foundations that have been backfilled with a concrete floor slab poured that is supported by the fill. For further guidance, refer to *Openings in Foundation Walls* (FEMA's Technical Bulletin 1-93).

12.3.4. Use of the area

Enclosed areas are designed to be flooded and must be used only for parking vehicles, storage, or access to the elevated living area — uses that are subject to little or no flood damage.

The type of storage permitted in an enclosed lower area should be limited to that which is incidental and accessory to the principal use of the structure. For instance, if the structure is a residence, the enclosure should be limited to storage of lawn and garden equipment, snow tires, and other low damage items which can be conveniently moved to the elevated part of the building. It would be good to advise the builder and owner that a flood insurance policy will not cover items stored below an elevated floor (see box).

A Standard Flood Insurance Policy does **not** cover:

"In a special hazard area, at an elevation lower than the lowest elevated floor of an elevated Post-FIRM building, including a manufactured (i.e., mobile) home:

"a. Personal property.

"b. Building enclosures, equipment, machinery, fixtures and components, except for the required utility connections and the footings, foundation, posts, pilings, piers or other foundation walls and anchorage system as required for the support of the building."

The interior portion of an enclosed area should not be partitioned or finished into separate rooms, except to separate the garage from the access and storage areas.

If a building is elevated eight feet or more, regulating the use of the enclosure presents special problems. Over time, the owner may forget the flood hazard and want to convert the floodable area into a finished room. Such an action would increase the flood damage potential for the building, violate the conditions of the building permit, and violate the NFIP regulations.

However, because the room is hidden behind walls, it can be very hard for the permit office to catch such a conversion. New building plans should be carefully checked for signs, such as roughed in plumbing and sliding glass doors that indicate that the owner may expect to finish the area in the future. The permit should clearly state what the limitations are on construction and use of the enclosed area.

12.4. FLOODPROOFING

12.4.1. NFIP requirements

Nonresidential buildings must be elevated or floodproofed. If they are elevated, they must meet the same standards as for residential buildings that were just reviewed. Elevation is the preferred method of flood protection because it is more dependable. Elevated commercial and industrial buildings can often be designed so that they can continue to operate during a flood reducing or eliminating business disruptions. Also, it will generally prove to be less expensive to elevate a non-residential building than to floodproof it.

44 CFR 59.1. *Definitions: "Flood proofing" means 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 60.3(c)(3) *[Communities must] 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;*

44 CFR 60.3(c)(4) *[Communities must] 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 accepted standards of practice for meeting the applicable provisions of paragraph (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 under §59.22(a)(9)(iii);*

For the purposes of regulating new construction, floodproofing is defined as measures incorporated in the design of the building so that below the FPE:

- ◆ Walls are watertight (substantially impermeable to the passage of water),
- ◆ Structural components can resist hydrostatic and hydrodynamic loads and effects of buoyancy, and
- ◆ Utilities are protected from flood damage.

Most floodproofing is effective only where floodwaters are less than three feet deep, since walls and floors may collapse under higher water levels.

A licensed professional engineer or architect must prepare the building plans and certify the floodproofing measures, preferably using the FEMA Floodproofing Certificate form. This is discussed in more detail in Section 15.

12.4.2. Human intervention

Human intervention means that for a floodproofing measure to work, a person has to take some action before the floodwater arrives, such as turn a valve, close an opening or switch on a pump.

There are many potential causes of failure for these techniques, including inadequate warning time, no person on duty when the warning is issued, the responsible person can't find the right parts or tools, the person is too excited or too weak to install things correctly, and/or the electricity fails.

Floodproofing techniques that require human intervention or an outside source of power are allowed by the NFIP but should be discouraged. Both Illinois model ordinances prohibit floodproofing techniques for new structures that rely on human intervention or an outside source of electricity. Therefore, it is likely that most local ordinance do, too.

Before plans are approved for a building that relies on human intervention to be floodproofed, it should be verified that the ordinance allows it and there are plans and precautions to keep problems from occurring. Techniques that rely on human intervention should only be allowed in areas with adequate warning time and in situations where there will be someone present who is capable of implementing or installing the required measures.

More information on floodproofing can be found in FEMA's Technical Bulletin 3-93, *Non-Residential Floodproofing Requirements and Certification for Buildings Located in Special Flood Hazard Areas*.

12.4.3. How high?

The minimum NFIP requirement is to floodproof a building *to at least 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 at least one foot above the BFE* to receive the same favorable insurance rates as a building elevated to the BFE.

12.5. PROVISIONS FOR ALL BUILDINGS

12.5.1. AO and AH Zones

AO Zones are shallow flooding areas where FEMA provides a base flood depth. Since there is only a flood depth, the rules read a little differently.

All new construction and substantial improvements of residential structures shall 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, or
- ◆ At least two feet if no depth number is specified.

All new construction or substantial improvements of nonresidential structures shall meet the above requirements or, together with attendant utility and sanitary facilities, be floodproofed to the same elevation.

In AO and AH Zones, adequate drainage paths are required around structures on slopes to guide floodwater around and away from proposed structures. (Requiring this throughout the community is a good idea, as it will prevent local drainage problems from causing surface flooding.)

12.5.2. Basements

For the purposes of the NFIP, a basement is defined as any area that is subgrade on all sides. The "lowest floor" of a building is the top of the floor of the basement if there is a basement. Since the "lowest floor" of a residential building must be at or above the BFE, it will be highly unusual to construct a basement in a floodplain that met these requirements.

44 CFR 59.1 Definitions: "Basement" means any area of the building having its floor subgrade (below ground level) on all sides.

Note that "walkout basements," "daylight basements," or "terrace levels" are usually subgrade on only three sides, with the downhill side at or above grade. Thus, they are not considered basements for either floodplain management or flood insurance rating purposes (but they are still the lowest floor of a building for floodplain management and insurance rating purposes). Communities should be careful to ensure walkout basements are always above the FFE and that the area adjacent to the downhill side of a walkout basement is not dug out bringing the floodplain to the house.

If these areas are used only for parking, access, or storage and they meet other ordinance requirements, they can be regulated as enclosures below an elevated building and not be considered the lowest floor of the building.

On the other hand, cellars, the lower level of a split-level or bi-level house, garden apartments and other finished floors below grade are considered basements under NFIP regulations. *This interpretation also applies to crawlspace floors that are below grade on all sides, too.*

Since the lowest floor of a residential building must be above the FPE, the only way to build a residential basement in the floodplain is if it is elevated above the FPE and surrounded by fill. Floodproofed non-residential basements are allowed provided they meet the requirements discussed in the previous section on floodproofing.

12.5.3. Basements and LOMR-F areas

It has become a common practice in some areas of the country to fill an area to above the BFE and then obtain a Letter of Map Revision based on fill (LOMR-F) to remove the land from the floodplain. Once the land is no longer in the floodplain, the builder obtains permits to build residences with basements below the BFE. This practice has raised a number of issues and concerns:

Because of enforcement difficulties, IDNR discourages LOMR-Fs.

- The procedure was being used to get around community floodplain management ordinances.
- Buildings with basements below BFE were being built too close to the edges of these fills that could be subject to severe flood damage if the basement walls are subjected to hydrostatic pressure from surface water or groundwater during flooding.
- LOMR-Fs for nearly identical buildings were being granted or not granted based on the date the LOMR was applied for and not on the risk to the building.

FEMA issued a final rule on May 4, 2001, revising LOMR-F procedures to address these issues. The new procedure places responsibility back in the hands of the community by requiring that, before a LOMR-F is granted, the community sign a community acknowledgement form and make findings that:

- The project, including any buildings, meets all the requirements of the community's floodplain management ordinance, and
- Any existing or future development on the filled area is "reasonably safe from flooding."

FEMA will not act on a LOMR-F request without this acknowledgement.

44 CFR 65.2(c) "Reasonably safe from flooding" means that base flood waters will not inundate the land or damage structures to be removed from the SFHA and that any subsurface waters related to the base flood will not damage existing or proposed buildings."

FEMA has issued Technical Bulletin 10-01 *Ensuring That Structures Built on Fill In or Near Special Flood Hazard Areas Are Reasonably Safe From Flooding* to provide guidance on how to make the determination that an area is "reasonably safe from flooding." The risk to buildings built in these areas will vary depending on soil conditions, the location of the building relative to the edge of the fill, and whether the building will have a basement below the BFE.

The safest method of constructing a building on filled land removed from the SFHA is to elevate the entire building above BFE. If basements are to be built in these areas, Technical Bulletin 10-

01 provides a simplified method for determining whether those basements will be “reasonably safe from flooding.”

Communities have asked for guidance on how they can ensure that future buildings placed on the property will be “reasonably safe from flooding” since, once the LOMR-F is issued, the land is no longer in the SFHA and generally is not subject to their floodplain management ordinance. Communities have several options they can use:

- They can withhold signing the acknowledgement until the LOMR-F applicant provides sufficient information on the location and type of proposed buildings to evaluate those building sites against the criteria in Technical Bulletin 10-01. For example, the community could require submission of a subdivision plat or grading plan showing future building locations.
- They could adopt or use other requirements that allow them to ensure any future buildings on the filled property remain reasonably safe from flooding. For example, a community may have building code requirements to ensure that any future basements are properly constructed to resist damage from groundwater.

Technical Bulletin 10-01 provides a number of other alternatives for ensuring that unimproved land is “reasonably safe from flooding” and stays that way. Communities have the option of requiring that the applicant submit any engineering information necessary to make the determination.

The criteria in Technical Bulletin 10-01 can also be used to ensure that buildings built with basements that are adjacent to the floodplain are constructed in a way that minimizes potential damages from groundwater during a flood.

12.5.4. Anchoring

44 CFR 60.3(a)(3) ...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...

Both elevated and floodproofed buildings must be properly anchored to stabilize them against flood forces. This means anchoring the building to its foundation and ensuring that the foundation won't move. Therefore, the floodplain administrator must make sure there is adequate protection against hydrostatic and hydrodynamic forces and erosion and scour that can undercut the foundation.

In areas of shallow flooding and low flood velocities, normal construction practices suffice. Additional anchoring measures, such as reinforcing crawlspace walls, using deeper footings, using extra bolts to connect the sill to the foundation, or installing rods to connect the cap to the sill should be required in three situations:

1. Where the flood flows faster than five feet per second.
2. In coastal areas subject to waves and high winds.
3. In manufactured or mobile homes (see the section on Manufactured Homes for details).

In some areas it may be necessary to use foundations such as piles or piers which provide less resistance to floodwaters.

In areas where these conditions are present, it is recommended that the builder's architect or engineer sign a statement saying the design of the building includes "anchoring adequate to prevent flotation, collapse and lateral movement" during the base flood.

12.5.5. Flood-resistant material

Whether a building is elevated or floodproofed, it is important that all parts exposed to floodwaters be made of flood-resistant materials (Figure 12-10).

44 CFR 60.3(a) (3) *...If a proposed building site is in a flood-prone area, all new construction and substantial improvements shall (ii) be constructed with materials resistant to flood damage...*

"Flood-resistant materials" include any building product capable of withstanding direct and prolonged contact with floodwaters without sustaining significant damage. "Prolonged contact" means at least 72 hours, and "significant damage" is any damage requiring more than low-cost cosmetic repair (such as painting).

- ◆ *Concrete, concrete block or glazed brick*
- ◆ *Clay, concrete or ceramic tile*
- ◆ *Galvanized or stainless steel nails, hurricane clips and connectors (in areas subject to saltwater flooding)*
- ◆ *Indoor-outdoor carpeting with synthetic backing (do not fasten down)*
- ◆ *Vinyl, terrazzo, rubber or vinyl floor covering with waterproof adhesives*
- ◆ *Metal doors and window frames*
- ◆ *Polyester-epoxy paint*
- ◆ *Stone, slate or cast stone (with waterproof mortar)*
- ◆ *Mastic, silicone or polyurethane formed-in-place flooring*
- ◆ *Styrofoam insulation*
- ◆ *Water-resistant glue*
- ◆ *Pressure treated (.40 CCA minimum) or naturally decay resistant lumber, marine grade plywood*

Figure 12-10: Flood-resistant materials

For further details on flood-resistant material requirements, refer to FEMA Technical Bulletin 2-93, *Flood-Resistant Materials Requirements for Buildings Located in Special Flood Hazard Areas*.

12.6. ACCESSORY STRUCTURES

Certain accessory structures may not qualify as “buildings.” For example, open structures, such as gazebos and picnic pavilions that do not have at least two rigid walls, are not “buildings” and do not have to be elevated or floodproofed. However, such projects must still meet all other ordinance requirements such as not causing an obstruction in the floodway.

12.6.1. Small structures

In some cases, low-cost accessory buildings may be wet-floodproofed and do not have to be elevated or dry floodproofed. These structures could include detached garages and small boat-houses, pole barns, and storage sheds. Such structures must meet all of these requirements:

- ◆ The owner must obtain a variance (see Section 14),
- ◆ The building must not be located in a floodway,
- ◆ The building must be no larger than 500 sq. ft. or a locally adopted cost threshold (such as \$1000),
- ◆ The building must be an accessory to an existing building, used only for storage or parking, and may not be later modified,
- ◆ The building must be adequately anchored to prevent flotation, collapse, and lateral movement,
- ◆ The building must be constructed using flood resistant material below the FPE,
- ◆ The building must be non-habitable,
- ◆ All flammable or toxic materials must be stored above the FPE, and
- ◆ All building utility equipment including electrical and heating must be elevated or flood-proofed so that it is contained within a watertight floodproofed enclosure capable of resisting damage during a flood.

Wet floodproofing involves using flood-resistant materials below the FPE and elevating things subject to flood damage above the FPE. Items that should be installed above the FPE include electrical boxes, switches, and outlets. Only the minimum amount of electrical equipment required by code may be located below the FPE, and that equipment must be flood damage resistant.

12.6.2. Wet floodproofing specifications

The following specifications can be used when granting a variance for a wet floodproofed accessory building. They are limited to detached garages, sheds, and other accessory buildings that are between 70 and 500 square feet and valued at less than \$7,500. [Note: a community can adopt these specifications in its ordinance. If it does, permit applicants would not have to go through the variance procedure.]

Buildings larger or more expensive, attached garages, room additions, and similar modifications to a larger building must meet the regular flood protection requirements (e.g., additions to a residential building must be elevated above the flood protection elevation (FPE)).

Location: These specifications are limited to areas in a floodplain where:

- ◆ The average floodway velocity is less than one foot per second. Average floodway velocity is found in the Floodway Data Table of the community's Flood Insurance Study.
- ◆ The flood protection elevation is less than three feet above the floor of the building.
- ◆ The rate of rise is less than one foot per hour.

Construction: The building must be on a poured slab foundation or footings that extend below the frost line. For frame construction, the sill must be fastened to the foundation with standard ½" anchor bolts no more than four feet apart. For masonry construction, standard anchoring of the masonry to the slab or foundation wall will suffice (but need to be verified during the site inspection).

Interior: The interior wall must be left open, at least below the flood protection elevation. There can be no wallboard or insulation below the FPE. Shelving, storage spots, and places where damageable or floatable contents may be stored must be located above the FPE.

Openings: If the FPE is less than one foot above the building floor, then no openings are required. If the FPE is one foot or more above the floor, then there shall be at least two vents or other permanent openings in at least two walls. Doors, including garage doors, do not qualify as permanent openings. Each opening must be at least 100 square inches (a standard 8" x 16" crawlspace vent will meet this requirement). The bottom of each opening can be no more than one foot above the floor.

Electrical:

- ◆ Wiring may be located below the FPE provided it is of a type designed for wet locations, such as RHW, TW, THW, or XHWN. T, THHN and THWN do not qualify.
- ◆ The circuit must have a ground fault circuit interrupter (GFCI) breaker.
- ◆ All electrical outlets, fixtures, and switches must be located above the FPE.

Other requirements: all other building code, floodway, and other regulatory requirements must be met.

Elevation record: The lowest floor elevation of the structure must be documented. A record needs to be kept that shows that the interior and utilities are protected up to the FPE.

Release: The owner should be advised that if a separate flood insurance policy is purchased on the building, the rates will be extremely high. The applicant must sign a release of liability before the community grants a variance for a wet floodproofed structure.

For additional guidance, see *Wet Floodproofing Requirements* (FEMA's Technical Bulletin 7-94).

12.7. MANUFACTURED HOMES

12.7.1. Definition

44 CFR 59.1 Definitions: “Manufactured home” means a structure, transportable in one or more sections, which is built on a permanent chassis and is designed for use with or without a permanent foundation when attached to the required utilities. The term “manufactured home” does not include a “recreational vehicle”.

Manufactured homes include not only manufactured homes that meet HUD manufactured home standards but also older mobile homes that pre-date these standards. The term does not include a “recreational vehicle.”

12.7.2. Elevation

Generally, manufactured homes must meet the same flood protection requirement as “stick built” or conventional housing. Because they are usually residential buildings, they must be elevated so the lowest floor is above the FPE.

44 CFR 59.1 Definitions: “Manufactured home park or subdivision” means a parcel (or contiguous parcels) of land divided into two or more manufactured home lots for rent or sale.

44 CFR 60.3(c)(6) Require that manufactured homes that are placed or substantially improved within Zones A1-30, AH, and AE on the communities FIRM on sites (i) Outside of a manufactured home park or subdivision, (ii) In a new manufactured home park or subdivision, (iii) In an expansion to an existing manufactured home park or subdivision, or (iv) In an existing manufactured home or subdivision on which a manufactured home has sustained “substantial damage” as the result of a flood, be elevated on a permanent foundation such the lowest floor of the manufactured home is elevated to or above the base flood elevation and be securely anchored to an adequately anchored foundation system to resist floatation collapse and lateral movement.

44 CFR 60.3(c)(12) Require that manufactured homes to be placed or substantially improved on sites in an existing manufactured home park or subdivision within Zones A-1-30, AH, and AE on the community’s FIRM that are not subject to the provisions of paragraph (c)(6) of this section be elevated so that either (i) the lowest floor of the manufactured home is at or above the base flood elevation, or (ii) the manufactured home chassis is supported by reinforced piers or other foundation elements of at least equivalent strength that are no less than 36 inches in height above grade and be securely anchored to an adequately anchored foundation system to resist floatation, collapse, and lateral movement.

44 CFR Section 60.3(c)(6) establishes the basic elevation and anchoring requirements that apply to most manufactured home placements including those outside of manufactured home parks and subdivision and in new manufactured home parks and subdivisions. These manufactured homes must have their lowest floors at or above the BFE. These requirements also apply to manufactured homes placed in expansions to existing manufactured home parks and on sites where manufactured homes are substantially damaged by a flood. As with stick-built housing, all parts of the manufactured home below the BFE must be constructed with flood resistant materials and building utility systems must either be elevated or made watertight to the BFE. The best way to meet this requirement is to elevate the bottom of the manufactured home chassis to this eleva-

tion. See FEMA's *Manufactured Home Installation in Flood Hazard Areas*, FEMA-85, for additional guidance

44 CFR Section 60.3(c)(12) allows for a limited exemption to elevating to the FPE for sites in existing manufactured housing (mobile home) parks. These older manufactured home parks were established before Flood Insurance Rate Maps (FIRMs) were issued for the community and before the community adopted a floodplain management ordinance that meets NFIP requirements. In such older parks, a newly placed manufactured home chassis must be "supported by reinforced piers or other foundation elements of at least equivalent strength that are no less than 36 inches in height above grade."

This exemption does not apply to repairing or replacing a manufactured home on a site in an existing manufactured home park where a manufactured home has been substantially damaged by a flood.

This exemption is a compromise that tries to balance the flood hazard against the severe economic impacts on some manufactured home park owners that would result if elevation to the FPE were required. There are often practical difficulties in elevating manufactured homes to the FPE in many of the older parks due to small lot sizes and the split ownership of the manufactured home and the lot itself.

The exemption may not be necessary or appropriate for all communities, especially if manufactured home parks are able to meet the requirement to elevate to the FPE. In other areas, the flood hazard may be so severe that the exemption may put lives and property at too great a risk.

A community must meet only the minimum requirements of the NFIP. If a community chooses to be more restrictive, it is perfectly acceptable (and encouraged). With this in mind, IDNR/OWR chose model ordinance language that requires that all manufactured homes located in a floodplain be protected to the same standard as any other residential building (lowest floor elevated to the FPE).

12.7.3. Anchoring manufactured homes

44 CFR 60.3(c)(6) ...*[Manufactured homes must] be elevated on a permanent foundation ... and be securely anchored to an adequately anchored foundation system to resist floatation collapse and lateral movement.*

A "permanent foundation" means more than a stack of concrete blocks. It should include a below-grade footing capable of resisting overturning, the depth needs to account for frost depth and expected scour, the footing must be sized appropriately for the site's soil bearing capacity, and the design needs to account for seismic and other hazards.

The following types of permanent foundations should be used:

- ◆ Reinforced piers,
- ◆ Post-tensioned piers,
- ◆ Posts,
- ◆ Piles,
- ◆ Poured concrete walls,
- ◆ Reinforced block walls, or
- ◆ Compacted fill.

“Adequately anchored” means a system of ties, anchors and anchoring equipment that will withstand flood and wind forces. The system must work in saturated soil conditions. Usually this means over-the-top or frame tie-downs in addition to standard connections to the foundation.

All manufactured homes in Illinois must be anchored to meet the Rules and Regulations for the Illinois Mobile Home Tie-Down Act issued pursuant to 21 0 ILCS 120. A copy of the Rules and Regulations of the State’s Tie-Down Act can be acquired from the Illinois Department of Public Health, Division of Environmental Health, 525 W. Jefferson St., Springfield, IL 62761 (See Figure 12-11).

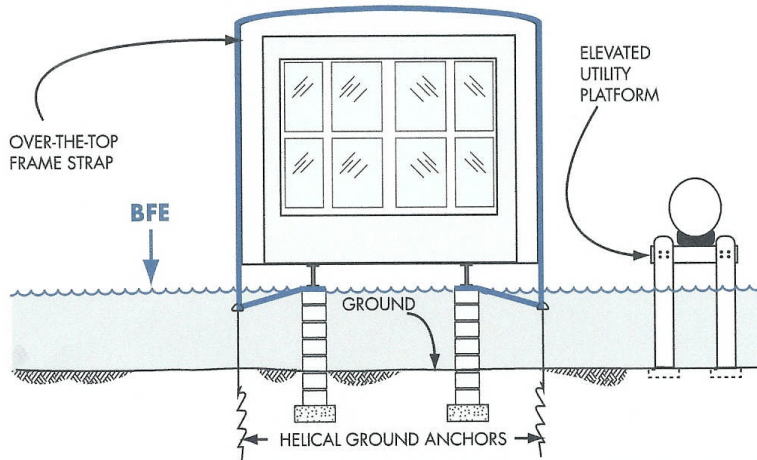
See also FEMA’s *Manufactured Home Installation in Flood Hazard Areas*, FEMA-85, for additional guidance on anchoring.

The anchoring requirement does apply in an existing (pre-FIRM) manufactured housing or mobile home park. Even if the manufactured home is not elevated above the FPE, the anchoring system must still withstand the forces of a flood over the first floor.

12.7.4. Evacuation

In some areas, there is adequate warning time to remove a manufactured home from harm’s way. Protecting such property should not be discouraged, so FEMA allows an evacuated manufactured home to be put back on the original site in an existing manufactured home park without having to meet the requirements for siting a new manufactured home (assuming it was on the site legally). Since much can go wrong in trying to evacuate a manufactured home, evacuation is not a substitute for permanently protecting the manufactured home by elevating it to or above the FPE.

Manufactured Homes Deserve Special Attention



Manufactured homes must be anchored to resist flotation, collapse, or lateral movement by being tied down in accordance with the Rules and Regulations for the Illinois Mobile Home Tie-Down Act (77 IL Administrative Code 870, IL Dept. of Public Health).

Experience shows that manufactured homes are easily damaged. As little as one foot of water can cause substantial damage.

Dry stacked blocks are not acceptable — they will **NOT** withstand a flood.

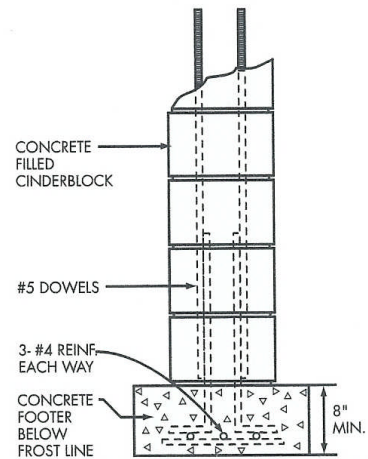


Figure 12-11: Manufactured Homes Deserve Special Attention

Source: IDNR's *Floodplain Management Quick Guide*

12.7.5. Recreational vehicles

44 CFR 59.1 Definitions: "Recreational vehicle" means a vehicle which is:

- (a) built on a single chassis;
- (b) 400 square feet or less when measured at the largest horizontal projection;
- (c) designed to be self-propelled or permanently towable by a light duty truck; and
- (d) designed primarily not for use as a permanent dwelling but as temporary living quarters for recreational, camping, travel, or seasonal use.

A recreational vehicle placed on a site in an SFHA must:

- ◆ Be on the site for fewer than 180 consecutive days,
- ◆ Be fully licensed and ready for highway use. "Ready for highway use" means that it is on its wheels or jacking system, is attached to the site only by quick disconnect type utilities and has no permanently attached additions, OR
- ◆ Meet the elevation and anchoring requirements for manufactured homes.

The purpose of this requirement is to prevent recreational vehicles from being permanently placed in the floodplain unless they are as well protected from flooding as a manufactured home.