CHAPTER V – PROTECTING STRUCTURES

Chapter Summary
The NFIP requires that new structures in floodplains be constructed in a way that will mitigate future flood damages. Three primary methods provide this protection:

1) elevation on fill;
2) elevation on stilts, pilings, crawl space, or other appropriate foundation; and
3) floodproofing (allowed only for nonresidential structures).

Small additions, repairs or improvements now have minimum standards that apply. However, any "substantial improvement" must meet the elevation or floodproofing standards of the ordinance just like new construction. *Substantial Improvement* is defined as any repair, reconstruction, or improvement of a structure, the value of which equals or exceeds 50% of the market value of the structure.

A. Structures

The term "structure" is defined in the Model Ordinance and NFIP Regulations as a building with walls and a roof. In addition for floodplain management purposes, above ground storage tanks are considered structures. The definition of a structure is primarily limited to buildings -- for these three reasons:

1. They are the most important, most valuable, and most common man-made structures subject to flood damage. Floodplain regulations are intended to prevent flood damage.

They are usually occupied by or used by people. Protecting them protects human life and health and reduces human suffering.

2. Buildings and their contents are the only things covered by an NFIP flood insurance policy. Protecting them reduces flood insurance claims.

These reasons should be kept in mind when deciding whether a development project qualifies as a *structure*. For example, a mobile home fixed to a foundation is considered a *structure* for regulatory purposes, but a travel trailer is not, unless it is left on the site for more than 180 consecutive days per calendar year.

Gas and liquid storage tanks are included in the definition of structures for flood damage prevention purposes.

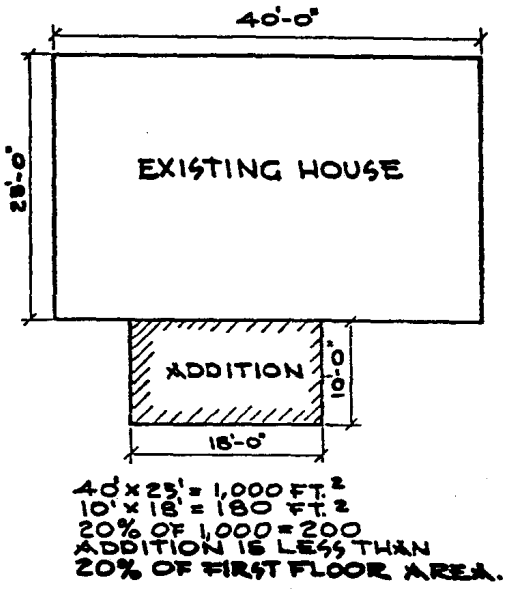
Elevated home In Georgetown, Maine. Photo by Bonnie Cowle, Maine Floodplain Management Program

Structures that are not enclosed are not insurable. These would include carports, open pavilions and tents. Buildings with at least two solid walls and a roof that are fully secured, however, are insurable (and do qualify as a *structure* for regulatory purposes). Contents coverage in these types of buildings is provided only if the contents are secured to prevent flotation out of the building during flooding.

Remember that *development* is defined as any change to real estate including mining, dredging, filling, grading, paving, excavation, storage or deposition of materials. There are many activities which will count as *development*, yet are not *structures*. All *development* must meet the requirements of Article VI, Section A of the Model ordinance. However, only developments which qualify as *structures* have to meet the protection requirements of Article VI, Sections F, G, H, L or P.

The Model Ordinance does not require that small additions to structures be elevated providing that the market value of the building is not increased by more than 50%. It should be noted that a larger addition or a *substantial improvement* to a house could be permitted, if that addition meets the regulatory standards of the ordinance. For example, if a building is being completely remodeled or reconstructed, and if that work would increase the market value of the building by 50%, then the building must meet the elevation or floodproofing standards outlined in Article VI of the Model Ordinance. The ordinance still requires that small additions and other minor development be reviewed through the Flood Hazard Development Permit process.

B. The Flood Protection Elevation



The NFIP requires that any new building or *substantial improvement* be constructed in such a manner as to protect it from flood damage in the event of a base flood. This also applies to a *substantially damaged* building that is being reconstructed. This is accomplished by elevating or floodproofing a building to the Flood Protection Elevation (FPE). The FPE is defined as the base flood elevation plus some margin of safety. This margin of safety is called "freeboard".

Freeboard compensates for additional hazards or unpredictable factors that accompany the base flood. These include wave action, downstream obstructions, ice jams, damage to floor joists, and statistical variability in base flood elevation calculations. Although the NFIP does not require any freeboard, in Maine there is a one foot freeboard requirement.

Many communities across the state have chosen to require a two foot freeboard. Since 1986, the State Subdivision Law has required a freeboard of one foot in all buildings in a subdivision.

In addition to the need for a margin of safety, freeboard is economically justifiable for the owner: the extra protection will save the owner from flood damages and will lower insurance premiums. The NFIP Regular Program insurance premium rating tables that follow show the difference in rates for buildings with their lowest floors above or below the base flood elevation (BFE).

INSURANCE RATING EXAMPLE* May 1, 2007
Preferred Risk Policy-Building and Contents Combination

		Coverage			Annual Premium
No Basement/Enclosure		$75,000/$30,000			$207
With Basement/Enclosure		$75,000/$30,000			$232
No Basement/Enclosure		$150,000/60,000			$264
With Basement/Enclosure		$150,000/60,000			$295

Standard B,C, And X Coverage-Building and Contents Coverage

		Coverage	ICC	Fed Fee	Annual Premium
No Basement/Enclosure		75,000/30,000	6	30	$690
With Basement/Enclosure		75,000/30,000	6	30	$794
No Basement/Enclosure		150,000/60,000	6	30	$931
With Basement/Enclosure		150,000/60,000	6	30	$1113

Standard B,C and X Coverage – Building ONLY

		Coverage	ICC	Fed Fee	Annual Premium
No Basement/Enclosure		75,000	6	30	$439
With Basement/Enclosure		75,000	6	30	$509
No Basement/Enclosure		150,000	6	30	$581
With Basement/Enclosure		150,000	6	30	$711

Post FIRM Construction

Constructed after community entered regular program. $100,000. Single family - elevated floor–Zone AE

1st Floor Elevation	First $50,000	Over $50,000	ICC	Fed Fee	Annual Premium
3 ft above BFE	$ .24 per $100	$ .08 per $100	$6	$30	$ 196
2 ft above BFE	$ .37 per $100	$ .08 per $100	$6	$30	$ 261
1 ft above BFE	$ .67 per $100	$ .08 per $100	$6	$30	$ 411
0 ft at BFE	$1.31 per $100	$ .10 per $100	$6	$30	$ 741
1 ft below BFE	$3.31 per $100	$ 1.21 per $100	$6	$30	$2296
2 ft below BFE**	$3.50 per $100	$1.44 per$100	$35	$30	$2535
3 ft below BFE**	$3.70 per $100	$1.82 per$100	$35	$30	$2825
5ft below BFE**	$7.41 per $100	$3.95 per $100	$35	$30	$5745

AO, AH Zone Construction

Constructed after community entered regular program. $100,000.

	First $50,000	Over $50,000	ICC	Fed Fee	Annual Premium
With Elevation Cert.	$ .25 per $100	$ .08 per $100	$6	$30	$201
Without Elevation Cert.	$ .85 per $100	$ .19 per $100	$6	$30	$556

Manufactured (Mobile) Homes

Typical manufactured home in existing manufactured home park - $60,000 coverage. Zone AE

1st Floor Elevation	First $50,000	Over $50,000	ICC	Fed Fee	Annual Premium
2 ft above BFE	$ .37 per $100	$ .08 per $100	$ 6	$30	$ 229
1 ft above BFE	$ .85 per $100	$ .09 per $100	$ 6	$30	$ 470
0 ft at BFE	$2.03 per $100	$ .10 per $100	$ 6	$30	$1061
1 ft below BFE**	$2.87 per $100	$1.18 per $100	$ 6	$30	$1589
2 ft below BFE**	$3.01 per $100	$1.23 per $100	$35	$30	$1693
3 ft below BFE**	$3.97 per $100	$1.63 per $100	$35	$30	$2213

Commercial

Small Business; one floor - $150,000 coverage. Zone AE

1st Floor Elevation	First $150,000	Over $150,000	ICC	Fed Fee	Annual Premium
1 ft above BFE	$ .46 per 100	$ .10 per $100	$6	$30	$ 726
0 ft at BFE	$1.18 per 100	$ .20 per $100	$6	$30	$1806
1 ft below BFE	$4.67 per$100	$1.35 per $100	$6	$30	$7041

Structures Not in Special Flood Hazard Area (Pre & Post FIRM)

$100,000 policy Single Family; $60,000 policy Manufactured Home. – Zones B, C, X

*__These tables are examples only and are not to be used for actual rating purposes. For single family dwellings and manufactured homes, these examples do not include a basement or enclosure.__

** Can be higher depending on how risk exposure is reviewed by FEMA

	First $50,000	Over $50,000	ICC	Fed Fee	Annual Premium
Single Family	$ **.71** per $100	$ .19 per $100	$6	$30	$486
Manufactured Home	$ .71 per $100	$ .34 per $100	$6	$30	$425

C. How Floods Damage Buildings

It is important to understand how floods damage buildings, so that new construction can be built in order to avoid damage or minimize flood damage. A flood can directly damage a building in three ways:

1. Hydrostatic pressure: The lateral pressure of standing water can push over walls or windows. Hydrostatic pressure increases as water gets deeper (higher). Once the ground under a building is saturated, water tries to seek its own level. Hydrostatic pressure from underneath is known as uplift and can crack a concrete floor or even float a wood frame house.

2. Hydrodynamic forces: The effects of current, waves, and floating debris can batter down a wall.

(Brunswick, ME) *The spring 2007 storms that pummeled Knox County significantly damaged this home. Photo by Lance Carpenter, FEMA.*

Hydrodynamic force increases with the water's velocity (Mean floodway velocity is listed in the Flood Insurance Study's Floodway Data Table. See table on page 2-9.) When the velocity of a riverine flood is greater than five feet per second, the floodway can be considered a "high hazard" area and should be avoided. Along the coast, in areas designated as V Zones, the force of storm waves can destroy buildings with little effort. The effects of ice floes and tree trunks can be so great that the State Planning Office recommends that no structures be allowed in high hazard areas subject to these dangers.

3. Wetting: Contact with water can warp, decompose, or otherwise ruin certain materials. Especially damage-prone are wood and wood products, drywall, insulation, carpeting and most furniture and contents.

D. Protecting Against Flood Damage

General

The Maine floodplain management standards are such that residential buildings must have their lowest floor elevated to at least one foot above the base flood elevation. Non-residential structures may be elevated or floodproofed. There are different ways of meeting the elevation standards for elevating a structure.

Elevation on Fill

Outside of the floodway, fill was once considered one of the best ways to protect a building against flood damage. While this is a very effective way to protect a structure, the value of the floodplain is reduced when large amounts of fill are introduced into the area that would normally be flooded. Fill removes flood storage. The overall effect of allowing fill at many sites in a community will ultimately result in raising the base flood elevations.

In some cases, however, fill is the best alternative. Fill for the purposes of construction should be what is commonly referred to as engineered fill. It would be foolish to construct a new building on a pile of fill only to have the soil settle under the weight of the building and cause structural failure. It is also imperative to stabilize or protect the fill from erosion. An engineering standard that must be followed is that the fill must be

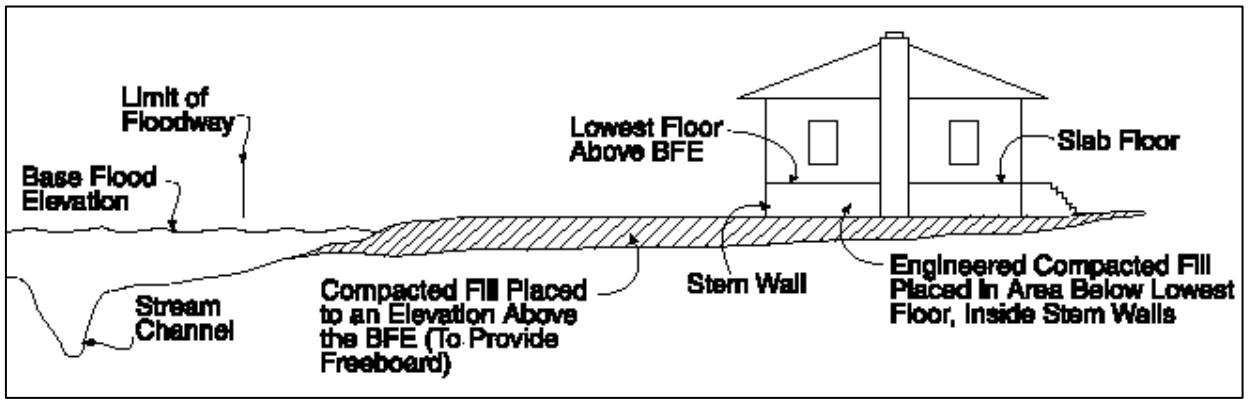


Diagram showing the utilization of stem walls when building on fill. From FEMA Technical Bulletin construction FIA TB-1 10-1

compacted to 95% of the maximum density obtainable with the Standard Proctor Test.

Fill slopes for granular material may not be steeper than one vertical on one and one-half horizontal. Slopes exposed to flows with velocities of up to five feet per second (fps) during the 100-year flood must, at a minimum, be protected by a permanent cover of grass, vines, weeds, or similar vegetation; slopes exposed to velocities greater than five fps during the 100-year flood must, at a minimum, be protected by appropriately designed stone, rock, or other durable products.

Note that when a building site is filled, it is still considered to be in the Special Flood Hazard Area, and **no basements are permitted**. As specified in Article VI of the Model Ordinance, the building's lowest floor must be at least one foot above the BFE. The elevation of the floor is measured from the top of the floor in A1-30, AE, AO, AH, and A Zones. Using fill as a means to elevate a building is only allowed outside of a floodway and in flood zones A1-30, AE, AO, AH, and A. Fill in AO and AH zones must include drainage paths around the structure.

Note that in AO zones the elevation requirements are controlled by the flooding depth and not by a base flood elevation as we find in the other Special Flood Hazard Areas. AO zones are areas of sheet flow where the

flood waters typically flow over a site in a consistent depth, usually one to three feet deep. The flood protection measure is from the **highest adjacent grade**. If the building site is on a sloping grade, the measurement is taken from the highest point where the building footprint meets the ground. The entire building footprint is regulated by this one elevation. A building cannot be "stairstepped". Not only does the lowest floor have to be elevated to at least one foot above the highest adjacent grade, but the utilities, such as the furnace and electrical service panel also need to be elevated above the lowest floor.

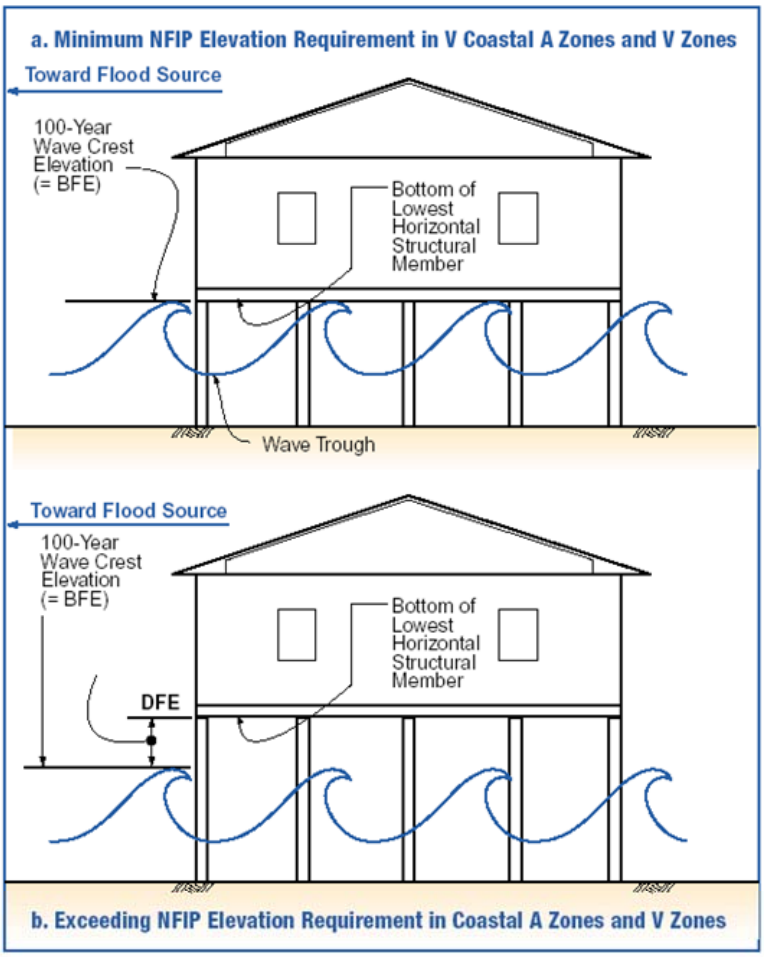
Fill is not allowed for structural support in V1-30 and VE Zones. In coastal velocity zones, V1-30 and VE, buildings must be elevated on open foundation systems such as piers, columns, or posts. So-called shear walls (two parallel walls open at both ends) are considered a truly open foundation system. See *FEMA's Technical Bulletin 5-93 Free-of-Obstruction Requirements*. In addition, the elevation of the lowest floor is measured from the lowest horizontal member in V Zones. The diagrams below show the construction requirements in select coastal V Zones (from FEMA Publication 55CD, ***Coastal Construction Manual***, third edition).

Elevated Foundation

Elevation of a building on stilts, piles, walls, crawl space or other support is a well-recognized technique to avoid flood damage by locating all damageable parts of a building one foot above the BFE. When using this method, there are two major concerns:

1. to ensure that the supporting members can resist the three effects of flooding; and
2. to ensure that the building is properly rated by the NFIP flood insurance rating system.

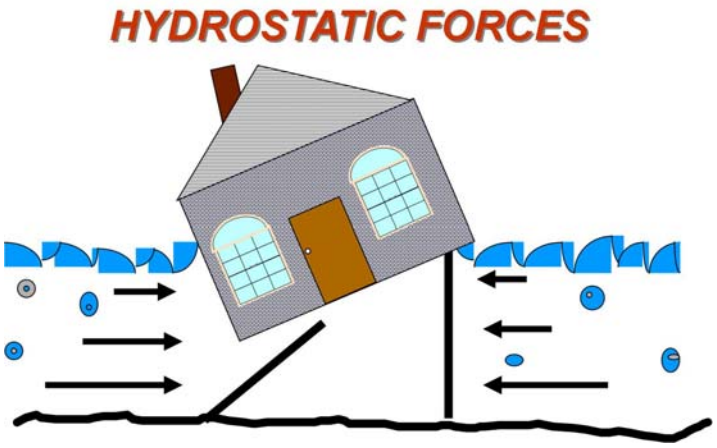
Many times an NFIP rating technically defines the lower area of an elevated building as the "lowest floor" and the owner is unpleasantly surprised with the high flood insurance premium for a building intended to be free from flood damage. Conversely, buildings that are seemingly damage-resistant may include lower area levels that were converted to finished rooms that are highly susceptible to damage. Therefore, it is important that the design of an elevated foundation consider the factors addressed below.



CHAPTER 5 – PROTECTING STRUCTURES

Protection from Hydrostatic Pressure

Ensuring Free Flow of Water



The best way to prevent buildup of hydrostatic pressure is to maintain the area below the lowest floor open for the free flow of flood water by not converting it to habitable space, either at the time the structure is built or at some future point. However, the owner may want to enclose the lower area to protect against animals or vandalism. This can be done with screening or open lattice work.

Extra precautions must be taken if a home owner wants to protect the lower area from heat loss and rain. When this area is enclosed with block walls, they should be reinforced with steel bars to tie the footing to the sill. Specific guidance is available from the Army Corps of Engineers or FEMA.

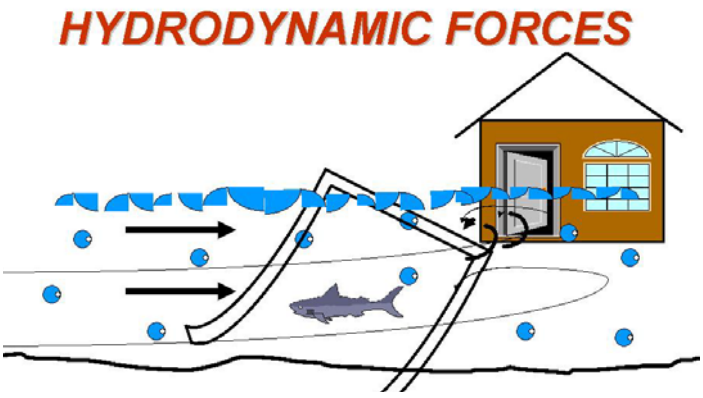
To ensure that the enclosure will not result in hydrostatic pressures on the walls, the lower area must have a minimum of two permanent openings (such as grates or cinder blocks turned sideways) on different walls of each enclosed area. The bottom of the openings must be no more than one foot above grade and have a net area of at least 1 square inch for each square foot of lower floor area. If flood heights could rise to within two feet of the lowest floor, air vents must be installed. Further guidance can be found in the FEMA Technical Bulletin, TB 1-93, *Openings in Foundation Walls*.

As an option to having permanent openings, a cover such as plastic sheeting may be taped on the inside of the openings to prevent passage of air. Any cover must operate automatically; it cannot depend on a person being around to open it or require electrical or mechanical assistance (i.e. there can be no "human intervention" or "electrical dependency"). If it depends on water pressure to push it open, a cover cannot be nailed or otherwise securely fastened down nor can it be placed on the outside of the building. The floor of the lower area must be at grade on at least one side. Any floor that is below grade on all sides will be defined as a basement by the flood insurance rating system.

Protection from Hydrodynamic Pressure

Anchoring Supporting Structure

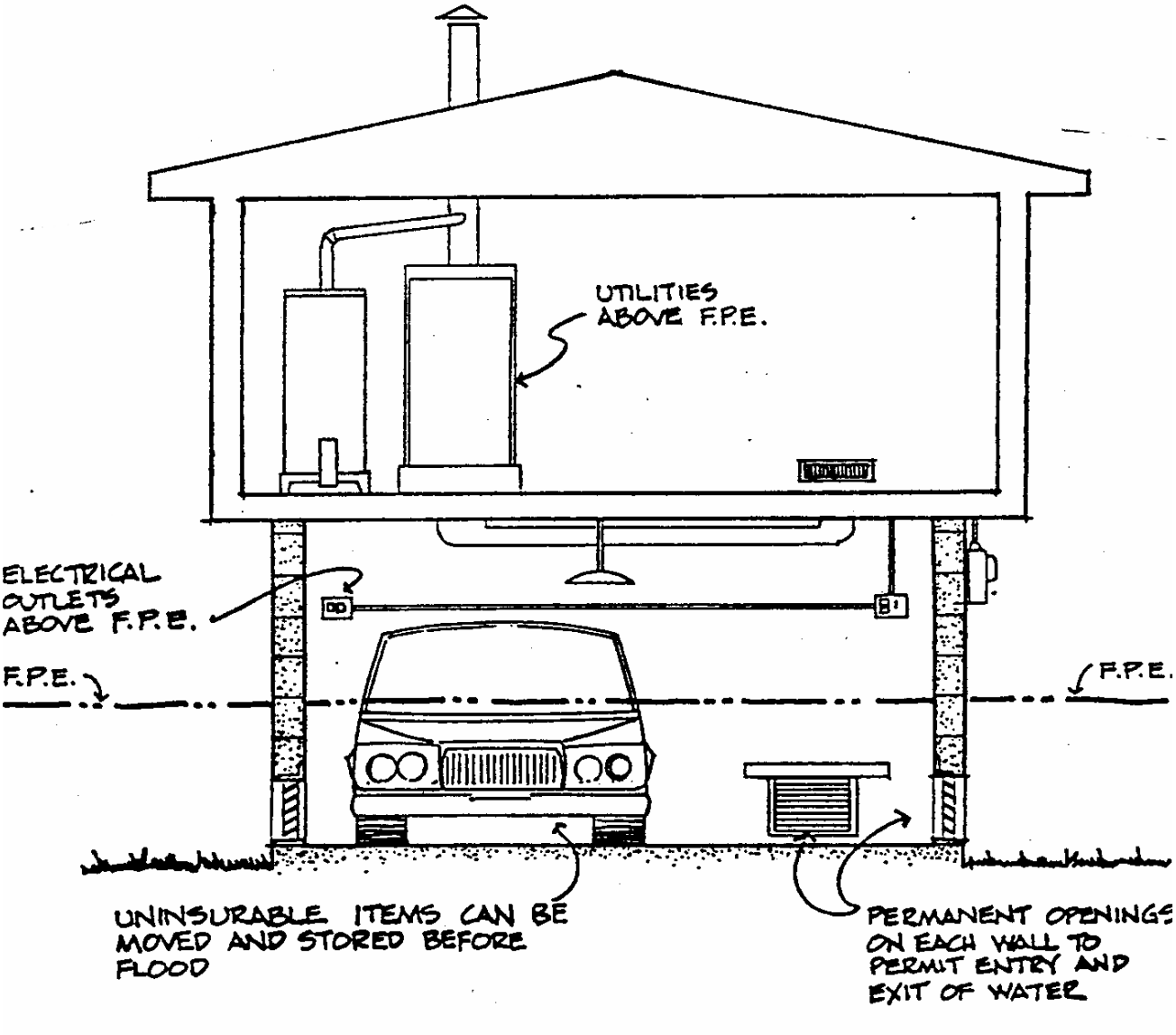
The foundation and supporting members must be anchored and aligned parallel with the direction of flow to present the least obstacle to flood waters. In areas of low velocity and shallow flooding, normal building practices can handle hydrodynamic pressure. Most building codes include a requirement to anchor window sills to the foundation. This standard is generally sufficient to protect a building that is subject to flood depths of less than three feet, and buildings exposed to lower flood velocities. Given the serious nature of potential flood damage, the code enforcement officer should ensure that both the studs and the sill are properly anchored according to code.



Open Support

Where riverine floods have high velocities, or where flood flows should not be obstructed, a building should be elevated on open supports such as pilings or open lattice walls. This allows flood waters to flow freely under the building causing no pressure or danger of collapse of the supports. This technique should be used when the flood insurance study's Floodway Data Table lists the average floodway velocity as greater than five feet per second, and in all coastal high hazard areas (V zones).

If debris is present, the supports need to set apart to minimize the chance of creating dams. If there are coastal high hazard areas, the FPE should have enough freeboard to ensure that the lowest floor will be above them and the supports should be adequately braced to withstand battering. In areas subject to ice jams, the average builder would not be likely to be able to reinforce supports enough to resist ice pack pressure. If a code enforcement officer is unsure whether a structure will resist potential forces, an engineer's certificate similar to the one required in Article VI.G.1.c. must be required.



Flood Damage Resistant Materials

The area below the FPE must be unfinished and remain free of water damage. This requires the use of materials resistant to flood damage. FEMA Technical Bulletin, TB 2-93, *Flood Resistant Materials Requirements*, is very helpful in understanding what materials are acceptable in an area that may get inundated. Following is only a partial list of materials that can be considered flood damage resistant.

Brick, face or glazed
Cast stone in waterproof mortar
Cement/bituminous
Cement/latex
Clay tile, ceramic veneer
Concrete
Concrete block
Concrete tile
Epoxy, formed-in-place
Glass
Glass blocks
Insulation, foam or closed cell types
Metal
Paint: polyester-epoxy and other waterproof types
Polyurethane
Silicone
Steel with waterproof applications
Stone: non-absorbent natural or artificial with waterproof grout
Terrazzo
Vinyl asbestos tiles with asphaltic adhesives

Wood, if properly treated for water damage by pressure preservative treatment, can also be used as a flood resistant construction material. The professional organizations which have tested wood products make the following recommendations:

American Wood Preservers Bureau (AWPB) mark "LP-22": acceptable for ground or fresh water contact.

American Wood Preservers' Association (AWPA) mark "C-2": acceptable for flood prone areas.

American Plywood Association (APA) stamp "Rated Sheathing Exposure 2": exterior type plywood acceptable for flood prone areas.

Projects constructed with pressure treated wood will last longer if hot-dipped galvanized or stainless steel fasteners are used. Conventional nails and fasteners may corrode, resulting in unsightly rust stains or separation of the wood or may in extreme cases result in structure failure because the fasteners have been weakened. See FEMA Technical Bulletin, TB 8-96, *Corrosion Protection for Metal Connectors in Coastal Areas*.

No machinery, electrical equipment, etc. may be located below the FPE. Electrical wiring and outlets, air conditioners, furnaces, gas fixtures, and similar equipment may be suspended from the ceiling or walls or elevated on pedestals in the lower area, provided that they are still above the FPE.

Protection of Contents and Prohibition of Alteration

It is important that the occupant be prohibited from exposing insurable items to flooding in an area below an elevated floor. This means keeping damageable contents out of harm's way and prohibiting the lower area from being altered to become habitable. When the permit is issued, the owner should be advised in writing that:

a. While the lower area may be used for parking of automobiles or storage of tools or other items, a flood insurance policy will not cover any contents below the elevated floor, and

b. Any changes such as installing paneling or carpeting may void flood insurance coverage.

One additional note of caution is to be extremely diligent in ensuring there are no “rough ins” for plumbing fixtures during the initial construction. This has been a problem in other southern states and has led to homes being finished off after the CEO has issued the certificate of occupancy.

Elevation of Manufactured Housing

Placement of manufactured housing in the SFHA must be regulated like any other structure.

A development permit must be issued and the manufactured housing must be elevated so the floor is at or above the FPE. The Model Ordinance applies this elevation standard to all manufactured housings placed in the SFHA (including those in a mobile home park or a single lot). The Maine Department of Human Services

has some regulations that apply to mobile home parks. However, these flood protection requirements must be enforced locally. The state licensing regulations do not preempt local floodplain regulations. NFIP has very specific tie down requirements (as listed in Article VI.H.1.b. of the Model Ordinance). The tie-down requirements apply to all manufactured housing in the SFHA.

Floodproofing

Dry floodproofing is allowed for use only for nonresidential structures (Model Ordinance Article VI.G.). Dry floodproofing means making the building watertight and structurally strong enough to resist the three direct hazards of flooding. It is very difficult and expensive. Because of the technical expertise required, the Model Ordinance and the NFIP require the applicant to demonstrate that the building is properly designed by a registered professional engineer or architect (Model Ordinance Article VI.G.1.c.). Further guidance can be found in the FEMA Technical Bulletin, TB 3-93, *Non-Residential Floodproofing - Requirements and Certification*. Local engineers and architects can use the Corps of Engineers' book *Flood Proofing Regulations* as a guide on how to meet the ordinance's performance standard.

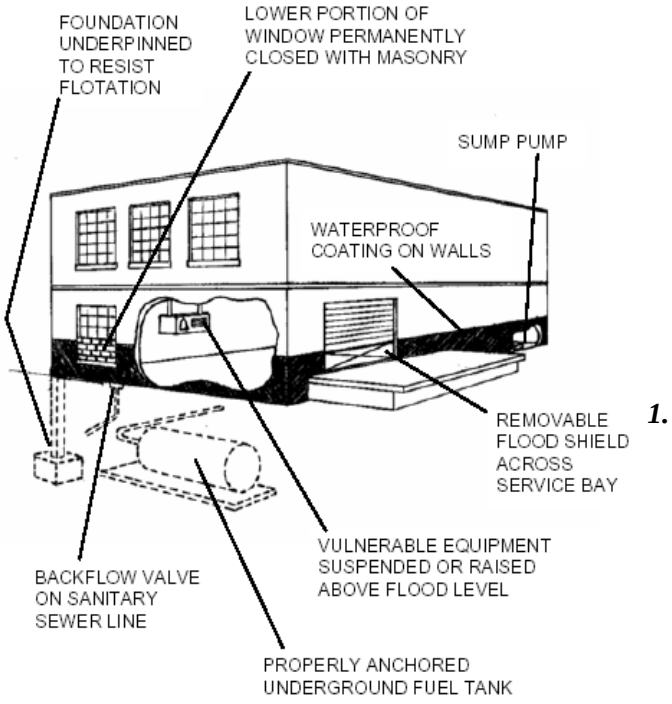
Because of the water pressures that accompany a flood, watertight floodproofing can be a tricky and dangerous endeavor. For example, designers relying on fill to support the walls against hydrostatic pressure must account for the possibility of a lengthy flood saturating the fill. Saturated fill is like no protection at all. Walls of cinder or concrete block or even poured concrete will collapse under more than 3 or 4 feet of flood depth.

Dry floodproofing relies on the strength of the walls to keep water out of the building. There are occasions, however, where it may be appropriate to allow water to enter a building if no damage would occur (a garage, for example, or a storage building for mobile construction equipment). This method is called wet floodproofing and is permitted only by variance. A variance for wet floodproofing a building should ensure that the building meets all the requirements for an elevated foundation discussed above. Remember that insurance rates will be very high for structures that are wet floodproofed. Further guidance can be found in the FEMA Technical Bulletin, TB 7-93, *Wet Floodproofing Requirements*.

DRY FLOODPROOF YOUR BUILDING

One way to protect a building and its contents from flood damage is to seal the building so that flood waters cannot enter. This method, referred to as "dry floodproofing," encompasses a variety of measures (some of which are covered by separate fact sheets – see back of this sheet):

- applying a waterproof coating or membrane to the exterior walls of the building
- installing watertight shields over doors, windows, and other openings
- anchoring the building as necessary so that it can resist floatation
- installing backflow valves in sanitary and storm sewer lines
- raising utility system components, machinery, and other pieces of equipment so that they are above the flood level
- anchoring fuel tanks and other storage tanks to prevent flotation
- installing a sump pump and foundation drain system
- strengthening walls so that they can withstand the pressures of flood waters and the impacts of floodborne debris



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E. Substantial Improvements/Substantial Damages

Defining Substantial Improvement

The term *Substantial Improvement* (SI) means any reconstruction, rehabilitation, addition, or other improvement of a structure, the cost of which equals or exceeds 50 percent of the market value of the structure **before the start of construction of the improvement**. This term includes structures which have incurred substantial damage, regardless of the actual repair work performed. The term does ***not*** include:

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

(2) Any alteration of a historic structure, provided that the alteration will not preclude the structure's continued designation as a historic structure, and a variance is obtained from the Board of Appeals.

Notes:

- Where a structure is substantially damaged, the assessment of market value of the structure refers to the point in time before any substantial damage occurred.

- Value of work to repair sanitary or safety code violations, that is to be excluded from the 50% calculation, must directly address a citation of violation received from the code official prior to the start of construction of an improvement or prior to the occurrence of substantial damage.

- Substantial improvement most often occurs in non-disaster situations through the rehabilitation of or addition to structures.

- Fair market value is for the structure subject to the improvement only. When determining the market value of the structure, do not include the value of the lot, accessory structures, contents, landscaping or septic system.

  When reviewing the value of the improvements, do not include architectural fees, appraisal fees, or permit fees. Essentially the primary factors of the improvement cost are labor and materials. There must be a value included for all materials and labor even if donated. Material costs included must be comparable to what one would expect to pay at any retail facility. Labor costs must be based on prevailing labor rates in the community.

A substantially improved structure must be compliant with the standards of a municipality's local ordinance and/or NFIP regulations. Of primary concern is the requirement that the structure be elevated (or floodproofed if it is a non-residential structure) to or above the level of the 100-year or base flood, and meet other applicable requirements.

The substantial improvement requirements apply to two different types of structures:

1. all existing (pre-FIRM) at the time a community adopted a floodplain management ordinance. Many of these structures do not meet the standards of the ordinance adopted, but are grandfathered (only until such time of a substantial improvement).

2. new construction (post-FIRM) in communities that have undergone map revisions resulting in areas with more restrictive zone designations that include their location.

A structure is ***substantially damaged*** when damage of any origin is sustained by a structure whereby the cost of restoring the structure to its before-damaged condition would equal or exceed 50% of the market value of the structure before the damage occurred.

(Brunswick, ME) *This structure is in the process of being elevated. Photo- Maine Floodplain Management Program*

The repair of a structure that has been declared substantially damaged is automatically considered a substantial improvement. The structure must be elevated (or floodproofed if it is non-residential) to one foot above the level of the base flood, and meet other applicable ordinance requirements. Where the structure is located in a coastal high hazard area (Zones V1-30 and VE), the elevation must be on pilings or columns so that the bottom of the lowest horizontal structural member of the lowest floor is elevated to one foot above the base flood level. This foundation must be anchored to resist flotation, collapse and lateral movement due to the combined effects of wind and water loading. Before issuance of a permit to reconstruct a substantially damaged structure located in a V Zone, a registered professional engineer or architect must develop, review and certify that the structural design, specifications and plans for the construction meet the requirements of the ordinance and NFIP standards.

Where a building has been destroyed down to the foundation, and is to be reconstructed upon the original foundation, the reconstruction must be considered a substantial improvement. The old foundation may have a "residual" value, but if 50% of the building itself is damaged, it is a substantial improvement.

For more information about substantial damage, determining market value, estimating cost of repair, and post disaster permitting consult FEMA publication 213, *Answers to Questions About Substantially Damaged Buildings*.