

Lesson 2. Protecting Against Water Damage

Introduction

Floods can happen in cities, in mountains, and in deserts. Every year, more homes and businesses are damaged by floods than by any other natural disaster. Floods move, and can spread for miles. Strong currents can sweep away the belongings of a lifetime and leave behind a thick layer of mud and debris.

Your home or business can be flooded even if you don't live near water. Storms, melting snow, dam and levee failure, or drainage system failure can occur far from a river, lake, or ocean. Hurricanes often generate torrential rains for hundreds of miles inland. If your community is located near a river, lake, or coastline, the chances increase that your home or place of business will suffer damage from flooded rivers, waves, and storm surges.

How Great Is Your Risk of Flooding?

Self-Assessment Questions:

- Has your current home and/or place of business been affected by flooding since you lived or did business in this location?
 Yes No

 - To your knowledge, was your community affected by flooding during the last 10 years?
 Yes No
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Check with your local floodplain manager, building official, city engineer, or planning and zoning administrator. They can tell you whether you live or have a business located in a Special Flood Hazard Area.

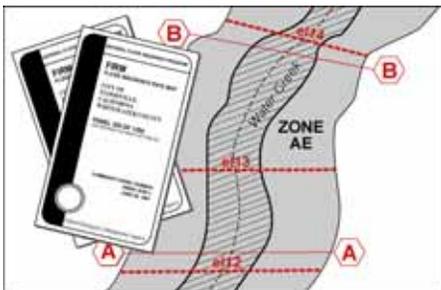


Figure 1. Graphic Showing a Portion of a Flood Map

Ask to see a flood map of your community, which may show a projected flood level for your neighborhood or place of business.

If you know how high floodwaters might reach, you have an idea how much water could come in.

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Protecting Personal Property

If your home or place of business has a basement or lower level, think about what would happen if water enters the space. Move possessions to a higher floor as appropriate for your situation. Take photos or videos of important possessions for insurance purposes.

Make sure that items such as important documents and irreplaceable personal objects such as photographs are stored in a safe location, if possible in watertight containers.

If major flooding is expected:

- Bring in outdoor furniture and other personal property kept outdoors.
 - Secure outbuildings.
 - Consider putting your valuables in a storage facility in a safe, nonflooding location.
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Retrofitting Your House or Place of Business

Retrofitting is making changes to an existing building to protect it from flooding or other hazards such as high winds and earthquakes.

If you decide to retrofit your house or place of business, you'll need to be aware of other potential hazards such as high winds and earthquakes.

Retrofitting may range from simple measures you can perform yourself to major construction. Retrofitting includes:

- Measures to protect utilities and service equipment.
- Dry floodproofing to protect against shallow flooding.
- Elevating the structure above the projected flood level.
- Relocating the structure away from the flood hazard area.

FEMA and other Federal agencies offer a wide array of assistance programs that help States, communities, and individual property owners protect against the negative effects of flood hazards.

You may be eligible to receive financial assistance through one or more flood protection programs that will help pay for your retrofitting project. Check with your local officials, your NFIP State Coordinator, or the FEMA Regional Office for your State.

A professional contractor licensed to work in your State, county, or city should make changes that:

- Are complicated or large-scale.
- Affect the structure of your house or place of business.
- Affect electrical wiring and plumbing.

Check with your local building department about building permit requirements. Make sure that changes meet local building code standards.

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Protecting Utilities and Service Equipment

During a flood, equipment such as furnaces, water heaters, and electrical meters may be inundated and ruined. Sewer backups present another costly and unpleasant possibility. Protecting utilities and equipment from flood damage can involve changes that vary in complexity and cost.

The measures you take depend on whether key utilities and equipment are exposed to flood damage in current locations. Possible actions are to:

- Raise or floodproof heating, ventilation, and cooling (HVAC) equipment.
- Raise the main electric switch box, electric outlets, switches, light sockets, baseboard heaters, and wiring.
- Elevate the washer and dryer.
- Anchor fuel tanks.

To protect against drainage system backups, you can install:

- A floating floor drain plug.
- A sewage system backflow valve.

Protecting HVAC Equipment

In flood-prone buildings, a good way to protect HVAC equipment is to move it from the basement or lower level to an upper floor, or even to the attic. A less desirable method is to build a concrete or masonry block floodwall around the equipment. Relocation can involve plumbing and electrical changes, and floodwalls must be adequately designed and constructed to be strong and high enough to provide the protection needed.

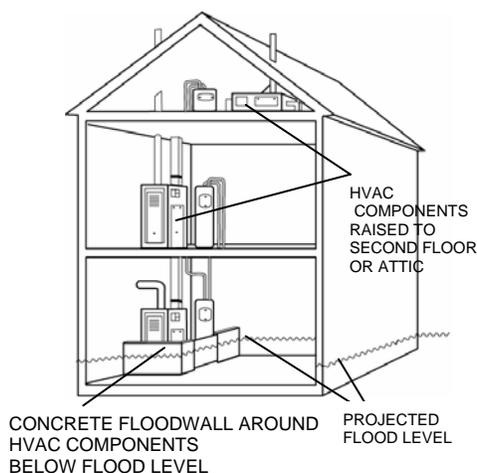


Figure 2. Graphic Showing HVAC Protection Methods

If you are having your existing furnace or hot water heater repaired or replaced, consider having it relocated at the same time. It probably will be cheaper to combine projects than to do them separately. If you decide to raise your HVAC equipment, consider upgrading to a more energy-efficient unit at the same time. Upgrading not only can save you money on your heating and cooling bills, but also may make you eligible for a rebate from your utility company. If you decide to protect your HVAC equipment with a floodwall, remember to leave enough space in the enclosed area for repairs and maintenance. If the wall has an opening to provide access to the enclosed area, the opening will need to have a gate that can be closed to prevent floodwaters from entering.

Protecting Utilities and Service Equipment (Continued)

Protecting Electrical Systems

Electrical system components, including service panels (fuse and circuit breaker boxes), meters, switches, and outlets, are easily damaged by floodwater. If inundated even for short periods, components probably will have to be replaced. Another concern is the potential for fire caused by short circuits in flooded systems. Raising electrical system components helps you avoid damage. After a flood, an undamaged, operating electrical system will help you clean up, make repairs, and move back into your home or business with fewer delays.

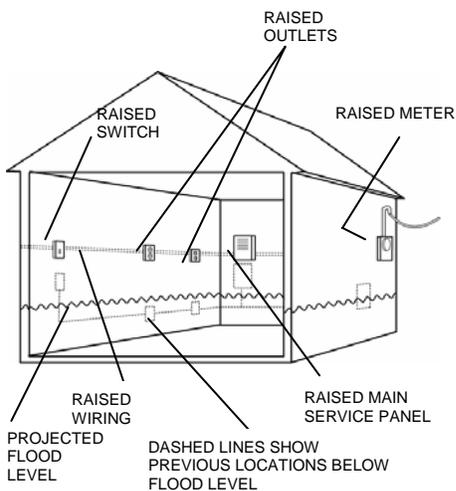


Figure 3. Graphic Illustrating Methods for Protecting Electrical Systems

All components of the electrical system, including the wiring, should be raised at least 1 foot above the base flood level for your location.

Your contractor should check with the local power company about the maximum height that the electric meter can be raised.

If your house or place of business is equipped with an old-style fuse box or low-amperage service, you may want to consider upgrading to a modern circuit breaker system and higher amperage service, especially if you have large appliances or other electrical equipment that draw a lot of power.

Protecting Your Washer and Dryer

Your washer and dryer may be elevated on masonry or pressure-treated lumber at least 1 foot above the projected flood level.

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Protecting Utilities and Service Equipment (Continued)

Anchoring Fuel Tanks

Unanchored fuel tanks can be easily moved by floodwaters, and cause serious threats to you, your family, and your home or business.

When floodwaters move an unanchored fuel tank in your basement, the supply line can tear free and your basement can be contaminated by oil.

An unanchored fuel tank outside your house or place of business can be driven into walls and swept downstream to damage other houses and buildings. Propane is stored in pressurized vessels as liquefied petroleum gas (LPG), which can be extremely volatile and potentially explosive if the tank is ruptured and a spark ignites the escaping LPG.

Even a buried tank can be pushed to the surface by the buoyant effect of soil saturated by water.

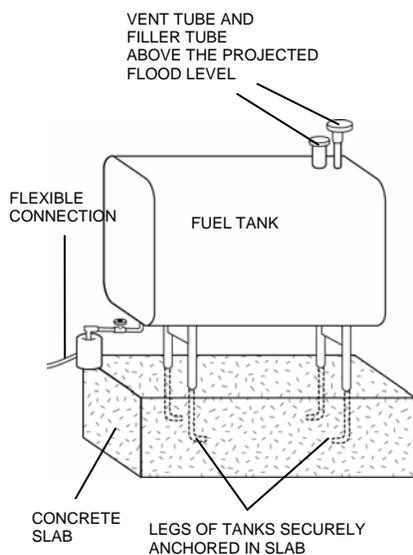


Figure 4. Graphic Showing an Anchored Fuel Tank

One way to anchor a tank is to attach it to a large concrete slab heavy enough to resist the force of floodwaters.

This method can be used for all tanks, both inside and outside your house or place of business.

You can also anchor an outside tank by running straps over it and attaching the straps to ground anchors.

Ground anchors and straps are the same products required by building codes to tie down mobile homes. Anchors and straps are available from suppliers and installers that service the manufactured home industry.

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Protecting Utilities and Service Equipment (Continued)

Protecting Against Drain and Sewer Backups

A sump pump with backup power is a key tool to prevent ground water from entering a building.

If you have a floor drain, you can install a floating floor drain plug at the current drain location. If the floor drainpipe backs up, the float will rise and plug the drain.

In some floodprone areas, flooding can cause sewage from sanitary sewer lines to back up into houses through drainpipes. These backups not only cause damage that is difficult to repair, but also create health hazards.

A good way to protect your house from sewage backups is to install backflow valves, which are designed to block drainpipes temporarily and prevent flow into the house. Backflow valves are available in a variety of designs that range from the simple to the complex.

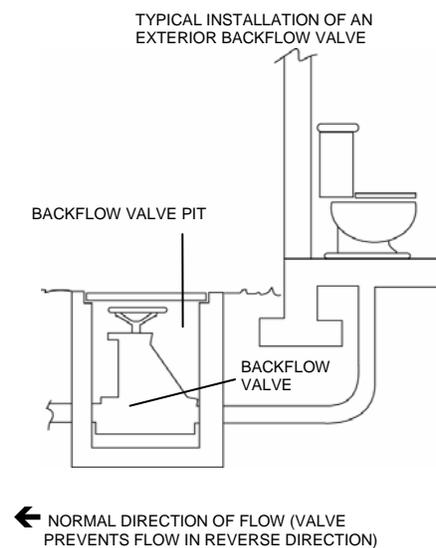


Figure 5. Graphic Showing a Gate Valve

The illustration shows a gate valve, one of the more complex designs. It provides a strong seal, but must be operated by hand. The effectiveness of a gate valve will depend on how much warning you have of impending flooding. Simpler valves include flap or check valves, which open to allow flow out of the house but close when the flow reverses. These valves operate automatically, but do not provide as strong a seal as a gate valve.

Some valves combine the advantages of flap and gate valves in a single design. Your plumber or contractor can advise you of the relative advantages and disadvantages of different types of backflow valves.

If you have a sump pump, it may be connected to underground drain lines that may be difficult to seal off.

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Making Major Structural Changes

Flood protection measures that involve major structural changes are:

- Dry floodproofing.
- Elevating your house or building(s) used for your business.
- Relocating structures above projected flood levels.

Dry Floodproofing

Even in areas where floodwaters are less than 2 feet deep, a building can be severely damaged if water reaches the interior. Damage to walls and floors can be expensive to repair, and the building may be unusable while repairs are underway.

One way to protect a house or place of business from shallow flooding is to add a waterproof veneer to the exterior walls and seal all openings, including doors, to prevent water from entering. This approach is called “dry floodproofing.”

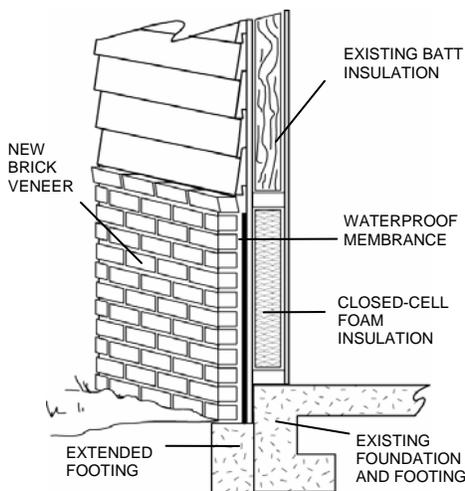


Figure 6. Graphic Showing Application of Waterproof Veneer

The veneer can be a layer of brick backed by a waterproof membrane. Before the veneer is applied, the siding is removed and replaced with exterior grade plywood sheathing. If necessary, the existing foundation footing is extended to support the brick. If the building has brick walls, the new brick veneer and waterproof membrane are added over the existing brick.

Because the wall will be exposed to floodwater, changes are made to the interior walls as well so that they will resist moisture damage.

In the area below the projected flood level, standard batt insulation is replaced with washable closed-cell foam insulation, and any wood blocking added inside the wall cavity is made of exterior grade lumber.

In a building that is dry floodproofed, all openings below the projected flood level must be sealed, including not only doors and windows but also the openings for water pipes, gas and electric lines, dryer vents, and sump pump discharge pipes.

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Making Major Structural Changes (Continued)

Dry Floodproofing (Continued)

If your house or place of business is being remodeled or repaired, consider having the veneer added as part of the remodeling or repair work.

When flood depths exceed 2 feet, the pressure on waterproofed walls increases greatly, usually beyond the strength of the walls. Dry floodproofing is not appropriate if greater depths are expected. Also, if flooding comes from ground water entering through the floor, dry floodproofing will not be effective.

Dry floodproofing:

- Does not reduce flood insurance premiums for homes.
- When flooding threatens, makes you responsible for installing flood shields on openings in time to keep water from entering.

Elevation

Elevating a house to prevent floodwaters from reaching living areas is an effective retrofitting method. The goal of the elevation process is to raise the lowest floor to or above the projected flood level.



Figure 7. Graphic Showing an Elevated House

You can elevate the entire house, including the floor, or leave the house in its existing position and construct a new, elevated floor within the house. The method used depends largely on construction type, foundation type, and flooding conditions.

During the elevation process, most houses (including manufactured homes) are separated from their foundations, raised on hydraulic jacks, and held by temporary supports while a new or extended foundation is constructed below.

Making Major Structural Changes (Continued)

Elevation (Continued)

Elevation works well for houses originally built on basement, crawlspace, and open foundations. As explained later in this section, the new or extended foundation can consist of continuous walls or separate piers, posts, columns, or pilings.

A variation of elevation is used for houses on slab-on-grade foundations. In these houses, the slab forms both the foundation and the floor of the house. Elevating these houses is easier if the house is left attached to the slab foundation and both are lifted together. After the house and slab are lifted, a new foundation is constructed below the slab.

Alternative techniques are available for masonry houses on slab-on-grade foundations. These techniques do not require the lifting of the house. Instead, they involve raising the floor within the house or moving the living space to an upper story.

Although elevating a building can help protect it from floodwaters, you need to consider other hazards such as wind and earthquakes before choosing this method.

Making Major Structural Changes (Continued)

Relocation

Relocation—moving your house or place of business out of the flood hazard area—offers the greatest protection from flooding. It also can free you from anxiety about future floods and lower or even eliminate your insurance premiums. However, relocation usually is the most expensive of the retrofitting methods.

The relocation process involves lifting a house or other building off its foundation, placing it on a heavy-duty flatbed trailer, hauling it to a new site outside the flood hazard area, and lowering it onto a new, conventional foundation. The process sounds straightforward, but a number of considerations require careful planning.

A building must be structurally sound to be picked up and moved successfully. All the structural members and their connections must be able to withstand the stresses imposed when the building is lifted and moved. Before the building is lifted, the moving contractor must inspect it to verify its structural soundness. A house or other building that is in poor condition, especially one that has been damaged by flooding, may need so much structural repair and bracing that relocation will not be practical.

Relocation is sometimes used as an alternative to demolition when a house has been damaged. Instead of demolishing the house, the owner may be able to sell it for salvage to a contractor, who will then move the house to another site, renovate it, and sell it. Relocation can also occur after a community acquires a floodprone property from the owner. Rather than leaving the house to be demolished, the owner may decide to keep the house and move it to property outside the flood hazard area.

For information about house relocation companies, contact the International Association of Structural Movers (ISM) at P.O. Box 1213, Elbridge, NY 13060, (315) 689-9498.

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Flood Insurance

If you own a structure in a flood hazard area and you obtained a mortgage or loan to build, buy, or remodel that structure, your lender had to make sure you were covered by flood insurance. It's a Federal law.

Self-Assessment Question:

Do you currently have a flood insurance policy for your home and/or place of business?

Yes No

Flood insurance is available to residents in more than 19,000 communities across the United States that participate in the National Flood Insurance Program (NFIP).

Most homeowners insurance doesn't cover damage to structures and contents from flooding, flood-related erosion, and flood-caused mudslides. Flood insurance does.

Federal law requires flood insurance in an amount equal to the outstanding principal balance on your mortgage or loan, the value of the building, or the maximum limit of coverage available, whichever is least.

While the law only requires coverage for the loan balance, consider protecting your equity as well. Up to \$250,000 in coverage is available for single-family residential buildings and \$100,000 is available for contents.

Up to \$1 million in coverage is available for your business, \$500,000 to cover the buildings and \$500,000 to cover the contents.

You can buy flood insurance even if you don't live or own a business in a flood hazard area. Approximately one in four flood insurance claims comes from areas where the flood risk is rated low or moderate.

Check into the low-cost Preferred Risk Policy, which offers coverage in low and moderate risk areas.

It takes 30 days for a flood policy to take effect, so you need to purchase flood insurance before flooding happens.

For more information about flood insurance, call:

1-888-CALL FLOOD or TDD# 1-800-427-5593 (toll-free telephone numbers)

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Flood Insurance Resources

Resources on the NFIP at the FEMA website (www.fema.gov/library/prepandprev.shtm#mit) include:

- Answers to Questions About the NFIP
- Avoiding Flood Damage: A Checklist for Homeowners
- Coping With a Flood - Before, During & After
- Flood: Are You Protected From the Next Disaster?
- How the NFIP Works
- How You Can Benefit From the New ICC Endorsement
- Myths & Facts
- Nothing Could Dampen the Joy of Home Ownership
- Preferred Risk Policy
- Things You Should Know About Flood Insurance
- Tips on Handling Your Flood Insurance Claim
- Top 10 Facts Every Consumer Needs To Know About the NFIP
- What You Need To Know About Federal Disaster Assistance & National Flood Insurance
- Who Is at Risk for Flooding?
- Why You Should Have a Preferred Risk Policy
- Your Homeowners Insurance Doesn't Cover Floods
- National Flood Insurance Program (NFIP) Program Description

Success Stories

Skagit County, Washington

When a property owner built a rental home, he elevated it a little higher than county regulations demanded.

Acting as a general contractor, the owner elevated the house as county regulations instructed. The 100-year flood level is gauged at 43 feet, and the county insists that new homes be elevated to 44 feet, one foot above flood stage.

The owner took no chances; he elevated the house to 45 feet, and it was a good investment. When flooding came to Skagit County in October 2002, the home was a safe 5 feet above the floodwaters. "My renter has a dry home, and my rental income is uninterrupted," he said. "Elevation worked as advertised."

The renter was displaced for a couple of days, but there were no property losses associated with the flood. "Just a little washing after the water receded," the owner said. "I'm delighted, and so is my renter." By elevating, the owner saved his investment and his renter's personal property.

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Success Stories (Continued)

Santa Barbara, California

On the morning of January 10, 1995, the staff of the United Way arrived at their facility in downtown Santa Barbara to find 3 feet of water in their offices. Flooding destroyed computers, carpet, furniture, workstation partitions, electrical wiring, and irreplaceable documents. Elevators, the alarm system, cabinets, and interior walls were also damaged.

Flooding in the city was the result of 7 hours of heavy rainfall the night before that generated runoff from the nearby hills, plus an unusually high tide that overwhelmed the city's pumping systems and fill culverts.

Everything that was destroyed or damaged had to be replaced before operations at United Way could return to normal. Included in the overall loss was the cost of business interruption, emotional impact on staff members, and the effects on United Way's customers during the several months it took to restore operations.

To protect its property from future disasters, United Way developed and implemented a plan to floodproof its building.

Measures taken included installation of three flood control panels (doors) that can be activated to prevent water from coming into the building and reaching the 3-foot level sustained in the 1995 flood. A 2-foot-deep trench was dug around the building foundation and filled with sealant to waterproof the structure. Water-resistant walls, doors, cabinets, and carpeting that can be removed one square at a time were installed. Critical infrastructure including electrical outlets, electrical panels, and the alarm system were elevated.

The cost of repairs of damage from the 1995 flood was \$450,000. This sum included the cost of repairing or replacing electrical systems, elevator and alarm systems, computers, carpet, cabinets, doors, furniture and interior walls. The cost of protective measures, including installation of flood doors, the trench and sealant, and elevation of critical lifelines, was \$100,000.

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What's Best for Your Home or Business?

The protective measures you consider depend on where your house or business is located.

Is your location within a flood hazard area? If so:

- Assess your vulnerability to water damage to the building and to your possessions.
- Decide which protective measures make the most sense in your situation.

Is your location at low or moderate risk of flooding? If so:

- Remember that approximately one in four flood insurance claims comes from areas outside of the flood hazard area.
 - Consider buying a low-cost Preferred Risk Policy, which offers coverage in low- and moderate-risk areas.
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Flood Protection Resources

A number of publications offer indepth information that can help you learn more about particular flood protection options.

The resources below can be located on the FEMA website (www.fema.gov/library/prepandprev.shtm#mit).

- Above the Flood: Elevating Your Floodprone House
- Addressing Your Community's Flood Problems
- After a Flood: The First Steps
- A Report - Mitigation of Flood and Erosion Damage to Residential Buildings in Coastal Areas
- Coastal Construction Manual: Principles and Practices of Planning, Siting, Designing, Constructing, and Maintaining Residential Buildings in Coastal Areas
- Crawlspace Construction for Buildings Located in Special Flood Hazard Areas
- Design and Construction Guidance for Breakaway Walls Below Elevated Coastal Buildings
- Design Guidelines for Flood Damage Reduction
- Engineering Principles and Practices of Retrofitting Floodprone Residential Structures
- Elevated Residential Structures
- Ensuring that Structures Built on Fill In or Near Special Flood Hazard Areas are Reasonably Safe From Flooding
- Federal Programs Offering Non-structural Flood Recovery and Floodplain Management Alternatives
- Floodproofing Non-Residential Structures
- Flood-Resistant Materials Requirements
- Free-of-Obstruction Requirements
- Hazard Mitigation Grant Program Desk Reference
- Homeowner's Guide to Retrofitting: Six Ways to Protect Your House from Flooding
- Manufactured Home Installation in Flood Hazard Areas
- Non-Residential Floodproofing -- Requirements and Certification
- Openings in Foundation Walls
- Protecting Building Utilities from Flood Damage
- Protecting Building Utilities from Flood Damage: Principles and Practices for Design and Construction of Flood Resistant Utility Systems.
- Repairing Your Flooded Home
- Wet Floodproofing Requirements

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Summary: Key Steps To Protect Against Water Damage

This lesson reviewed the following steps you can take to protect your home or place of business against water damage.

- Know your flood risk. Your local building or floodplain management department may be able to provide the projected flood level.
 - Move important possessions and valuables out of the basement or lower level and store them in safe locations.
 - Move or elevate any of the following utilities and equipment that are not located above the projected flood level:
 - Main electric switch box
 - Electric outlets and switches
 - Washer and dryer
 - Furnace and water heater
 - Take further protective steps as needed:
 - Anchor fuel tanks.
 - Install a sump pump with backup power.
 - Put float plugs in floor drains.
 - Install backflow valves in sewer systems.
 - As you assess your degree of risk, consider major structural changes, including:
 - Dry floodproofing for shallow flooding, especially for nonresidential buildings.
 - Elevation.
 - Relocation.
 - Get enough flood insurance to cover potential losses.
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Lesson 2. Protecting Against Water Damage

Test Yourself

The questions below review key points in protecting against water damage. After completing the questions, you can check your answers on the answer sheet located after the course glossary.

1. A _____ of your community may show a projected flood level for your neighborhood or place of business.

2. Retrofitting measures to protect a structure against water damage include:
(Mark all that apply)
 - Elevating utilities and service equipment.
 - Dry floodproofing.
 - Obtaining adequate flood insurance.
 - Elevating the structure above the projected flood level.

3. Write below two utilities that could be moved or elevated above the projected flood level.

4. Select the protective measure on the right that would be used to protect the item on the left, and write the appropriate letter on each blank space.
 - ___ Floor drains a. Install backflow valves
 - ___ Sewer system b. Anchor
 - ___ Fuel tanks c. Elevate
 - ___ Washer and dryer d. Install float plugs

5. You can buy flood insurance even if you don't live or own a business in a flood hazard area.

___ True ___ False