TECHNICAL APPENDIX

SELF ASSESSMENT

How to Estimate Potential Flood Damages. As part of the process for assessing one's need for flood protection, a homeowner must have an understanding of the potential magnitude of damage that may result from a given flood. In this regard, the use of depth-percent damage functions is a relatively simple method for the homeowner to estimate such losses. The depth-percent damage relationship is a mathematical relationship between the depth of flood waters above or below the first floor of a structure and the amount of damage that can be attributed to that water. In the following curves, referenced as figures A-1 through A-7, the first floor elevation is equivalent to zero and negative numbers indicate heights in feet below the first floor and positive numbers indicate heights in feet above the first floor. Curves are shown separately for structure and contents.

The curves represent damage incurred from flooding conditions that do not have high-velocity waters associated with the flood. These curves would therefore underestimate the damage of a flash flood or coastal storm with high-energy, storm-driven waves. The curves show structure damage as a percentage of structure value and content damage as a percent of content value for each foot of inundation. These curves can be an important tool in estimating the potential flood damages to your home and contents. It should be noted, however, that the curves shown were developed by the Federal Emergency Management Agency (FEMA) and represent averages computed from a number of actual flooding situations and, therefore, represent approximations of the range of potential flood damages that may occur to any specific home.

To illustrate how the curves are used, assume a one-story house without a basement with a current value (replacement cost of structure) of $100,000 and contents valued at $30,000 is flooded to a depth of 3 feet over the first floor. From the curves for a one-story house without a basement, the damage to the structure is estimated at about 28% or $28,000 and damage to contents is estimated at about 35% or $10,500. Therefore, for a flood of this height you could expect total flood damages in the neighborhood of $38,500 if you took no flood proofing measures to reduce your losses. To further facilitate use of the curves and estimating damages, a fill-in-the-blank worksheet has been included as figure A-8.

Decision to Flood Proof. There are a number of factors residential property owners should consider prior to making a decision to flood proof. Some factors will be more important than others depending on the financial situation and lifestyle of the homeowner and severity of the flooding problem. Following is a brief description of some of the more pertinent factors which should be considered.

• Flood proofing assistance. This is perhaps the most important of all the factors to be considered. Due to its importance, a separate section has been devoted to its treatment. The section entitled "Sources of Assistance" begins on page A-8 of this technical appendix.

• Building codes. Before property owners commit a significant investment of time and money in flood proofing, they should contact the local building inspector or city engineer for requirements and for information on obtaining necessary permits.

• Cost estimates. Before making a commitment to do any flood proofing work, the property owner should get a rough estimate of the cost of the flood proofing measure to assist in deciding whether further consideration is worthwhile.

Figure A - 1
Percent Damage to Structure and Contents Value
ONE STORY, NO BASEMENT

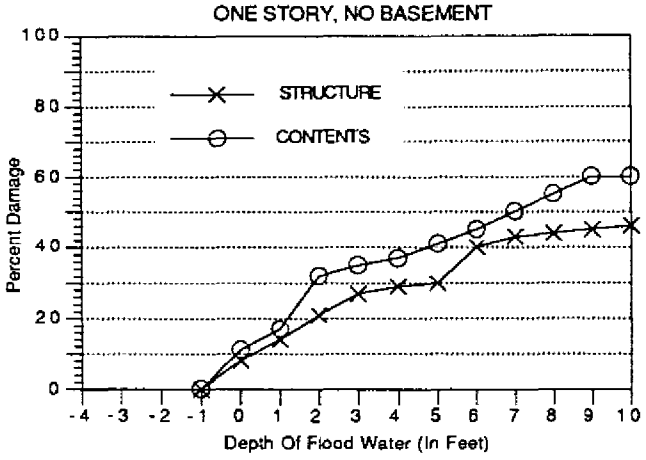

Figure A - 2
Percent Damage to Structure and Contents Value
ONE STORY, WITH BASEMENT

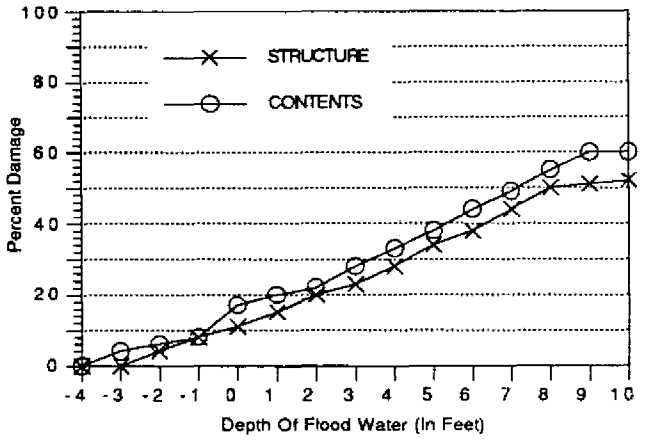

Figure A - 3
Percent Damage to Structure and Contents Value
SPLIT LEVEL, NO BASEMENT

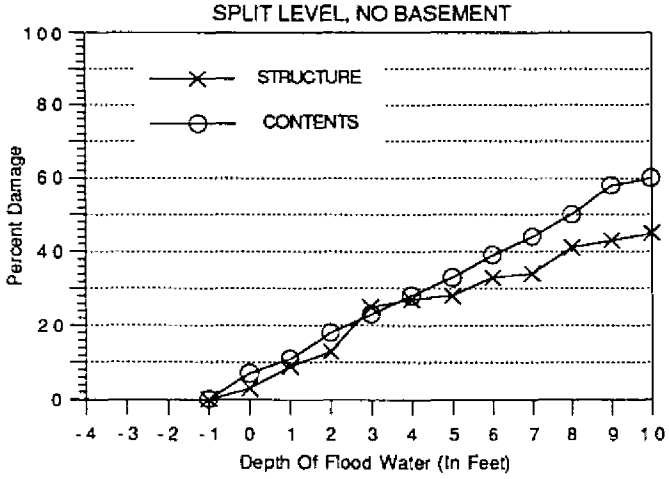

Figure A - 4
Percent Damage to Structure and Contents Value
SPLIT LEVEL, WITH BASEMENT

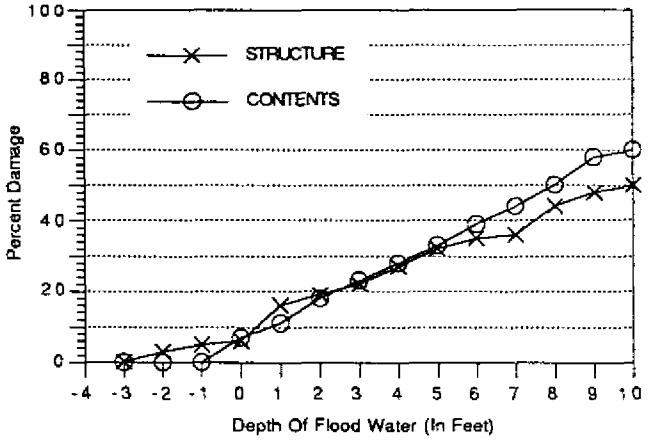

Figure A - 5
Percent Damage to Structure and Contents Value
TWO OR MORE STORIES, NO BASEMENT

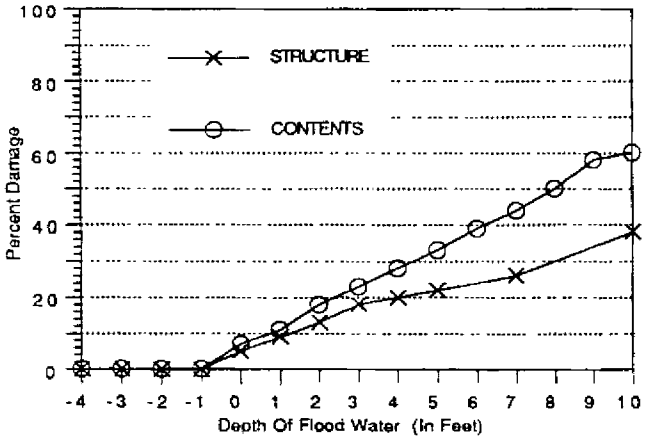

Figure A - 6
Percent Damage to Structure and Contents Value
TWO OR MORE STORIES, WITH BASEMENT

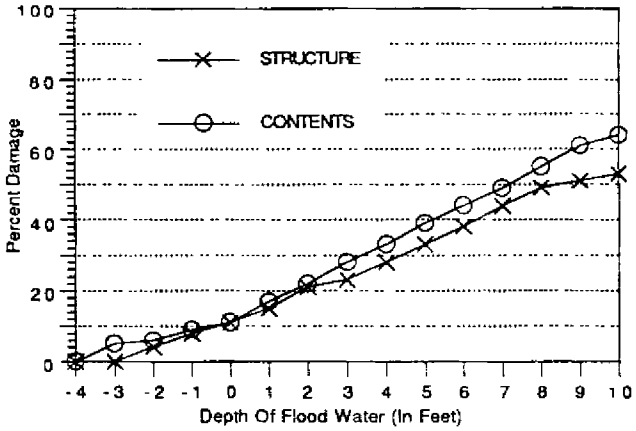

Figure A - 7
Percent Damage to Structure and Contents Value
MANUFACTURED HOME

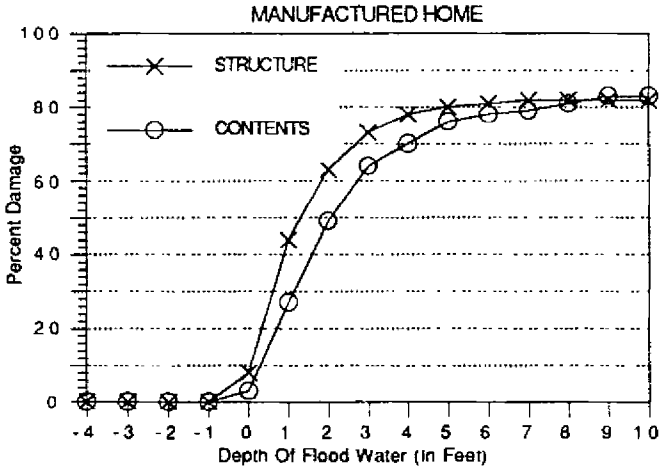

FIGURE A-8. ESTIMATING RESIDENTIAL FLOOD DAMAGES

WORKSHEET

1. Current estimated replacment cost of residential structure (exclude value of land) $_____

2. Current estimated replacement cost of contents in residence $_____

3. Type of residential structure (check one):

   a. One story, no basement (figure A-1) _____
   b. One story, with basement (figure A-2) _____
   c. Split level, no basement (figure A-3) _____
   d. Split level, with basement (figure A-4) _____
   e. Two or more stories, no basement (figure A-5) _____
   f. Two or more stories, with basement (figure A-6) _____
   g. Manufactured home (figure A-7) _____

4. Estimated flood damage to residential structure:

   a. Assume depth of flood on first floor (in feet) _____ft.

   b. Go to figure for corresponing structure type referenced in item 3. and record the percent structural damage for the appropriate depth of flooding (figs. are located on p. A-2 & 3) _____%

   c. Multiply value in 1. by 4b. and divide by 100 $_____

5. Estimated flood damage to residential contents:

   a. Record depth of flood from item 4a. _____ft.

   b. Go to same figure as in 4b. and record the percent content damage for the appropriate depth of flooding _____%

   c. Multiply value in 1. by 5b. and divide by 100 $_____

6. Total estimated residential flood damages, add 4c. and 5c. $_____

• Benefits. The most obvious benefit to consider is the potential reduction in flood damages. However, other less obvious benefits may include the avoidance of the expense and inconvenience of staying in a motel, loss of time from work while cleaning and repairing the flooded structure, and the preservation or extension of the life of the structure by reducing repeated floodings.

• Inconvenience. Associated with most flooding is a significant amount of personal inconvenience. In many cases, the house cannot be occupied until cleanup and repairs have been completed. The owner may also have to file insurance claims and disaster assistance applications. Damaged household and personal items such as clothes, furniture, and appliances will have to be cleaned or replaced. Utilities must be restored. Also, irreplaceable items, such as photographs or family heirlooms, may be destroyed by a flood.

• Health and Safety. When a home is flooded, occupants are exposed to a variety of health hazards. Sewer lines to the building may back up and flood the building. Rats and snakes may also temporarily inhabit the flood-damaged building. The water supply could become contaminated. Food, medicine, and cosmetics that have been touched by flood waters will be spoiled. Also, when attempting to reenter a building after a flood, occupants may be exposed to electrical shock from outlets or appliances. Flood waters may cause cracks in gas lines in the building, resulting in gas leaks and possibly fires. In addition, the aftermath of coping with a flood can cause considerable stress. Property owners and their families may suffer loss of sleep or fatigue. Many of the hazards associated with entering and occupying a flood-damaged building can be avoided by flood proofing the building.

• Architectural Aesthetics. The homeowner may wonder, "How will my house look if I flood proof? Will it look strange?" This is an important consideration. With the help of an architect, flood proofing can be integrated with the design of the home to create a pleasing appearance. In some cases, the beauty of a home can even be enhanced.

Another consideration regarding appearance occurs after the flood has subsided. If the home is not flood proofed, the property owner must repair and restore it, as described previously. During this period, which can be quite lengthy, the home will be a mess. On the other hand, if the home is flood proofed, the cleanup work after a flood will likely involve only landscaping repairs to the damaged yard. A flood proofed home can usually be restored to its pre-flood condition fairly quickly at a relatively low cost.

• Emergency Measures. If standard flood proofing measures turn out to be impractical, there are other actions that the property owner may take to reduce flood damage. In general, greater reductions in flood damage may be achieved by working with someone experienced or trained in emergency flood protection measures. If there is sufficient warning, prior to a flood, the property owner can relocate items such as electronic equipment, furniture, and personal items from the basement or first floor to a higher level above the expected flood elevations, or they may be transported from the property to a safe location. Also, if there is ample warning the property owner can participate in emergency flood protection measures such as sandbagging around windows and doors or boarding up entrances to the home.

• Flood Insurance. Property owners who do not presently have flood insurance should consider purchasing a flood insurance policy if they are located in a floodplain. This insurance will not reduce damages but it will lower the financial burden to the property owner when damage occurs. To find out if

flood insurance is available in your community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

SELECTING ARCHITECTS/ENGINEERS AND CONTRACTORS

Local building officials may require that plans and specifications for a flood proofing project be prepared by or under the direction of a licensed professional engineer or architect. The homeowner should check with local building officials to determine if this is a requirement before procuring a firm to carry out the project.

The coordination of construction work on a residence can be a difficult, time-consuming, and even frustrating process for the homeowner. It requires considerable knowledge of local building codes and permits, and may also involve hiring a variety of professionals, such as masons, concrete specialists, plumbers, engineers, architects, or landscape architects. Most projects will also involve the legal processes of dealing with contracts. Without proper planning, the inexperienced person attempting this coordination for the first time could face a difficult, financially risky undertaking. There are two general processes a homeowner may follow to simplify this process: obtaining architectural/engineering assistance or hiring a general contractor.

Architectural/Engineering Services. The more complex flood proofing techniques will often require a professional architect or engineer, or some other type of specialized professional service. For example, the construction of a floodwall could require input from a soils engineer to assist in determining soil-bearing capacity, a structural engineer to provide assistance in the structural design of the wall, a civil engineer to provide assistance in sizing drainage structures and sump pumps, and an architect to provide guidance in the placement of the wall to reduce the effect of the flood forces and improve the aesthetics of the finished project.

Some design firms employ professionals having expertise in only one particular area and this could require subcontracting of certain parts of the work. For a more complex project requiring a variety of services, the homeowner may wish to consider using a "full-service" architecture/engineering firm, which would be able to either provide all services in-house or coordinate the various expertise involved. Such a firm would be able to provide one point of contact between the homeowner and the design professionals involved in the project, which would not only provide better coordination of the project and a simpler line of communication, but would also serve to place liability for any problems which may occur with one firm or individual.

In evaluating architect/engineer firms, the homeowner should consider the following:

- Request that the firm provide a listing of projects similar to the one contemplated by the homeowner including former clients and telephone numbers, the dates of performance, and a brief scope of the work performed.

- Insure that the firm has familiarity with the project area including knowledge of contractors available to do the work, and knowledge of costs of various parts of the work.

- Landscape architects can help ensure that flood proofing techniques are provided in a practical and pleasing manner. In addition, they can provide expertise in appropriate plant material, as well as site layout and grading.

- Proximity of the firm to the project site and its ability to respond for consultations on the project.

• Qualifications and background of the firm and specific individuals that would be handling the work including a description of which phases of the work could be provided in-house and any proposed subcontracts which might be included.

• A proposed time schedule for the completion date, realistic deadlines for each phase of the project, and the acquisition of necessary building permits, etc.

Once a firm has been selected, the question of a contract must be addressed. Both the American Institute of Architects and the National Society of Professional Engineers have standard contracts which may be used, or a simple letter of agreement may be sufficient. Homeowners should ensure that the contract includes a detailed scope of work in accordance with their wishes. Professionals suggest that a firm be selected on the basis of capabilities, and then a fee for the work be negotiated with the selected firm. A proposed labor hour breakdown on large projects will assist the homeowner in determining if the fee is in line with the work to be performed.

General Contractors. Contractors are normally also licensed in the state where they do business, and there may be local codes that have additional requirements for certain specialized contractors, such as electricians. Along with price, the criteria for selecting a contractor should be the same as those used for A/E firms. A general contractor will often use subcontractors in the project. This should be specified in advance. Normally, the general contractor's fee will include all payments to subcontractors as well as management of the entire project.

When shopping for a contractor, the homeowner should obtain estimates from two or more contractors on the same project and ask for explanations from each about the differences in price. Since each contractor may operate with different kinds of equipment, different standards of workmanship, and different degrees of experience, the final choice should not be based solely on the lowest bid, but also on the quality of work and the ability to deliver the product within budget and on time.

Homeowners should obtain photos of the contractors' previous projects or details of sites that can be visited to examine their work. They should ask previous customers in particular about the contractor's quality of work, timeliness, and whether the proposed budget was met. A call to the local Better Business Bureau can determine if any complaints have been registered against a particular contractor with the local agency.

Among the questions that should be answered about the contractor are:

• Has the contractor previously done any similar work?

• Does the contractor regularly work on residential structures? Does the contractor thoroughly understand the work and will it be completed as specified?

• Does the contractor intend to employ subcontractors, and are they qualified to do the work?

• Do the contractor and any subcontractors carry liability insurance?

There are various forms of construction contracts used today, but the important items to check for are:

• Detailed Scope of Work

- Basis of Payment
- Period of Performance
- Warranties and Bonding
- Adequate Insurance Coverage

The homeowner should accept work as final only when all provisions of the contract are satisfied. Never sign "completion papers" before the work is completed or make final payment if work is not completed. Before making final payment to the general contractor, the homeowner should insist that the contractor submit a statement that all subcontractors and material suppliers have been paid. If large sums of money are involved, the homeowner should insist that this statement be signed by the major subcontractors involved. If a subcontractor goes unpaid, in most states, that subcontractor has the legal right to place a lien on the home for the amount of payment. This generally means that the subcontractor would have to be paid and the lien removed before the homeowner would be able to sell the house.

Following these general selection and contracting guidelines, the homeowner should be able to enter into a clear client/contractor relationship on a flood proofing project.

SOURCES OF ASSISTANCE

Financial and technical assistance may be available from state, federal, or local governments and community agencies to help property owners flood proof buildings. Property owners should investigate the availability of assistance and utilize free technical and/or financial assistance in their initial flood proofing efforts. The property owner may also need to obtain paid technical assistance from a local architect/engineer firm that has experience in flood proofing individual homes.

Technical assistance may be obtained from the State of Virginia, specifically the Floodplain Programs Section, Department of Conservation and Recreation, Division of Soil and Water Conservation. Assistance is also available from federal agencies, such as the U.S. Army Corps of Engineers (COE), Federal Emergency Management Agency (FEMA), Department of Housing and Urban Development (HUD), Soil Conservation Service (SCS), Tennessee Valley Authority (TVA), and Small Business Administration (SBA), as well as some local agencies. More information on flood proofing assistance programs administered by various agencies and organizations, as well as points of contact for various agencies, are included in the COE National Flood Proofing Committee's document entitled "Flood Proofing Techniques, Programs, and References," as well as many other flood proofing reference documents.

The table on the following page is a listing of addresses and telephone numbers of some of the key agencies from which floodplain and flood proofing information is available.

In addition to these, there are a number of other agencies which may be of specific assistance. These agencies and a brief description of their work follow.

- Local Building Departments

Regulations that affect flood proofing are implemented by local building, zoning, or housing code departments. These offices sometimes provide general information and technical assistance to property owners. Several have developed handbooks on flood proofing for their residents.

Point of contact: Generally, county regulatory departments only operate in unincorporated areas. Municipal departments have jurisdiction in incorporated cities, towns, and villages (check the local

Agency	Address	Phone No.
Department of Conservation & Recreation, Div. of Soil and Water Conservation, Bureau of Rivers & Shores	203 Governor Street Suite 206 Richmond, Va. 23219-2094	804-371-6095
Floodplain Management Services Branch, Planning Division, Norfolk District, U.S. Army Corps of Engineers	803 Front Street Norfolk, Va. 23510-1096	804-441-7779
Federal Emergency Management Agency, Region III	Liberty Square Building 2nd Floor 105 South Seventh Street Philadelphia, Pa. 19106-3316	215-431-5500
Floodplain Management Services, Lower Mississippi Valley Division, U.S. Army Corps of Engineers	P.O. Box 80 Vicksburg, Ms. 39181-0080	601-634-5827

telephone directory). The state NFIP coordinator and FEMA Regional Offices may know of local departments particularly active in flood proofing.

- Local Housing, Community Development, and Planning Agencies

There are many different kinds of city, county, and regional agencies involved in housing, planning, urban renewal, and community development. Community development departments and housing authorities work to improve local housing conditions through both public housing and programs to help low- and moderate-income residents. This work can be in the form of building inspections, technical assistance, and financial assistance.

Other local and regional agencies include regional planning commissions, sanitary districts, and water management districts. Most provide general information to residents and technical assistance to local officials. Some sanitary districts have regulatory authority based on the need to keep flood waters out of sewer lines. Some of these agencies have active technical and financial assistance programs to help property owners flood proof.

Point of contact: These agencies may be listed in the local telephone directory. State NFIP coordinators and FEMA Regional Offices may know of

agencies particularly active in flood proofing.

• Soil Conservation Service (SCS)

As part of the U.S. Department of Agriculture, the SCS primarily serves rural areas. SCS staff provides information on land use planning; conservation planning; resource development; water management and flood prevention to farmers, community officials, and land developers. While mostly a general information and technical assistance operation, SCS also funds protection projects that can include flood proofing elements.

Point of contact: The SCS' work is conducted through local soil and water conservation districts. The point of contact is the district conservationist who usually has an office in the county seat (check the local telephone directory) or call the state office in Richmond at 804-771-2457).

• Small Business Administration (SBA)

The SBA administers the federal government's major disaster loan program. In spite of its name, SBA disaster loans are available for any privately owned property, including businesses and residences. The low interest loans are provided to rebuild a damaged building, including the cost of bringing a building up to the building code standards. The loans can pay for code-required flood proofing of substantially damaged buildings and some smaller projects that are not required by code. SBA loans are only available following either a SBA or Presidentially declared disaster.

Point of contact: Disaster Application Centers are established to process applications. The location and hours of these centers are well publicized.

• Department of Housing and Urban Development (HUD)

HUD programs are designed to improve housing conditions, local economies, and neighborhoods. As the nation's housing agency, HUD has been active in protecting both public and privately owned homes from flood damage. HUD's major flood proofing program is the Community Development Block Grant (CDBG), which provides funds directly to larger cities and counties. States handle CDBG funds for smaller communities.

The block grant concept allows states and communities to set their funding priorities as long as the local projects relate to program objectives, i.e., they must benefit low- and moderate-income people, prevent or eliminate slums and blight, or meet other urgent community development needs. Many communities have used CDBG funds to flood proof buildings as a way to provide low-income residents with safe and sanitary housing. Some states have reserved block grant funds for special post-disaster projects that have included flood proofing.

Point of contact: Virginia's HUD Area Office (804-278-4575). State departments of community affairs are also points of contact on the Community Development Block Grant (check the local telephone directory).

• Association of State Floodplain Managers (ASFPM), P.O. Box 2051, Madison, WI 53701-2051

While not a government agency, the ASFPM supports many government flood proofing programs. Its Floodproofing/Retrofitting Committee works on coordinating and publicizing federal, state, and lo-

cal flood proofing activities. The Mitigation Committee focuses on post-disaster activities, especially programs that can provide funding help to property owners.

The Association sponsors a Floodplain Management Resource Center that is both a library and a referral service for floodplain management publications from around the nation. Publication summaries are entered into a computer data base and, by using key words, Center staff can easily and quickly search through the data base for publications that best meet a user's need. Write to:

Natural Hazards Research and Applications Information Center, IBS #6, Campus Box 482, Boulder, CO 80309, Attention: Floodplain Management Resources Center.

FLOOD PROTECTION FACT SHEET

PREPARING FOR A FLOOD

If you live in a floodplain area, there are many things you can do to prepare for the next flood that will save you time, money, or your life. Following is a partial list you can accomplish:

- Determine whether your property is in a floodplain or downstream of a dam. If it is, determine the elevation of the property in relation to nearby streams and other waterways. This information is available from building inspectors/zoning administrators. If below a dam, know the warning system for evacuation in the event of dam failure.
- Learn and practice the safest route from your home or business to high ground.
- Know where community evacuation shelters are located.
- Buy flood insurance and examine claim procedures.
- Itemize personal belongings to facilitate insurance claims.
- Install check or backup valves in building to prevent flood water from backing up sewer lines.
- Prepare an itemized list of personal items you will need if you must evacuate (medicines, prescriptions, clothing, special foods needed for infants, etc.).
- Keep important documents in a flood-free safety deposit box.
- Monitor local radio and television stations for flood warnings.
- Make provisions for pets or livestock.

WHEN FLOODING IS IMMINENT

- Evacuate ASAP if living in a flash flood warning area.
- Elevate or move furniture to a higher floor.
- Fill and anchor tanks to keep them from floating away.
- Grease immovable machinery.
- Turn off electricity, gas, and water at main switch and valves. Label where these are located and teach responsible members of the family where they are located.

- Bring outside possessions inside the house, or tie them down securely.
- Keep gas tank in vehicle(s) at least half full.
- Pack personal evacuation kit.
- If home will not be evacuated or not directly impacted by flood:
  - Draw water and store in air-tight containers.
  - Have a supply of non–perishable food on hand.
  - Have flashlights with spare batteries, portable radio, first aid kit, fire extinguisher, and emergency cooking equipment in working order.

DURING FLOOD CONDITIONS

It is essential to understand that floods are hazardous. The peril is no less if your neighborhood is covered with a foot, or under twelve feet of water.

Things to do include:

- The safety of your family is the most important consideration since flood waters can rise rapidly. Keep the family together so you can evacuate if necessary.
- If evacuation appears necessary, turn off all utilities at the main switch and close the main gas valve. Secure your home before leaving.
- If car stalls in a flooded area, abandon it as soon as possible. Flood waters can rise rapidly and sweep a car (and its occupants) away.
- Listen to radio for information of flood conditions.
- Follow instructions of emergency personnel.
- Keep children out of flood waters (no playing therein).
- Watch out for fallen electrical wires, open manholes, etc.
- Be sensitive to the emotional condition of family members.

- Make plans for recovery.

Things <u>not</u> to do:

- Use foods that have come in contact with flood water.
- Cross a flowing stream where water is above your knees.
- Drive where flood water is extensive over the roads. Parts of the road may be washed out.
- Play or wade in flooded streets.
- Operate electrical equipment in flood water.
- Panic

WHAT TO DO AFTER A FLOOD

When returning to a flooded home or business, one should focus on personal safety, building hazards, cleanup and salvage, and mitigation.

Personal Safety

- Get a tetanus shot. Wear protective gloves and boots. No wading.
- Find out water contamination level and take necessary precautions.
- Look out for "critters" like snakes. Use a stick to lift debris.
- Don't overexert. Many deaths due to flooding occur during cleanup.
- Don't use electrical appliances until cleaned and repaired.
- Don't underestimate emotional stress. Use counselling resources.
- Have children stay out of flooded area.
- Salvage only canned foods and even then exercise extreme care.

Building Hazards

- Contact local official for permission to reoccupy flooded building.
- Make sure gas is turned off and don't light matches until then.
- Make sure electricity is turned off.
- Do not pump basement water all at once. Groundwater pressure against walls may cause them to collapse. Pump over several days.
- Report loose power lines to power company.
- Schedule appointment with insurance agent ASAP.

Cleanup and Salvage - Prioritize cleanup tasks. Store damaged contents on premises for adjuster to inspect.

High Priorities

- Heating and cooling system components must be cleaned and rinsed. Do not operate until inspected by certified technician.
- Open up doors and windows for circulation of air.
- Store valuable papers, works of art, paintings, etc. in cold storage to prevent mildew until they can be restored by an expert.
- Dry books by opening them and standing on end.
- Wooden furniture may warp if dried in direct sunlight. Dry in shade.
- Clean metal ASAP. After dried, wipe with an oiled cloth.

Medium Priorities

- Let wooden floors dry naturally to curtail cracking and splitting.
- Drill hole in wall near floor between studs to drain water.

- Wash with detergent or sanitizing solution (1 or 2 tablespoons of laundry bleach to 1 gallon of water at room temperature.)

- If burners and other motors are to be salvaged, seek guidance from certified technician. Hose down sediment.

Low Priorities

- Shovel and hose down sediment while wet.

- Wash upholstered furniture.

- Clean rugs thoroughly then lay out to dry. Consider professional cleaning.

- Mattresses, pillows and stuffed furniture may be a lost cause.

Mitigation - Steps to be taken to avoid a repeat of flooding devastation.

- Elevate building above flood level on pilings or fill.

- Elevate furnace and utilities above flood level.

- Install flood proofing devices such as "flood shields" across doors.

- Store keepsakes in watertight container or above flood level.

- Install check valves in sewer line and buy sewer backup insurance.

- Relocate structure out of floodplain.

- Buy flood insurance.

ROOF REINFORCEMENT FOR STORM PROOFING

Although roof reinforcement is a subject involving the opposite end of a house from where flooding occurs, it is a pertinent and related topic to discuss under the broad issue of water protection. Hurricanes Hugo and Andrew proved that roofs are highly vulnerable to damage by wind and that typically local building codes may underestimate these forces. The loss of shingles allows water to enter a house causing significant water damage. Once the entire roof is gone, the house is vulnerable to more extensive damage. As a homeowner, there are steps you can take to reduce the vulnerability of your home to roof damage. Typically the weak link in the roof system is where it is connected to the upright walls of a house. As high winds press against a wall in a perpendicular direction, the wind is deflected upward with tremendous upward forces against any overhanging portion of the roof. If the roof is destroyed or damaged by wind forces, a progressive collapse of the structure follows, beginning with the upper portions of the walls down. Additionally the loss of shingles allows water to enter a house causing significant water damage.

The use of hurricane clips or similar metal plate fasteners should be affixed between the rafters and studs. Roof sheathing should be inspected to ensure it is securely nailed down and attached to the rafters. Heavy-weight, self-adhesive type shingles provide more protection than the standard minimally acceptable design. A strong connection from the ridge line of the roof down through the interior stud walls to the floor system and subsequently to the foundation would provide an extremely secure configuration. The ideal time to inspect your roofing system and make necessary upgrades is when it is time for reroofing. This is a perfect opportunity to hire a contractor or roofing specialist to investigate the adequacy of the roof.

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11. Repairing Your Flooded Home, American Red Cross/Federal Emergency Management Agency, 1992.

12. Retrofitting Floodprone Residential Structures (Brochure), Federal Emergency Management Agency, 1987.

13. Best Build III - Videotape, "Protecting a Floodprone Home," Federal Emergency Management Agency/ National Home Builders Association, 30 minutes, 1989.

14. The Floodplain Management Plan for the Commonwealth of Virginia, Department of Conservation and Recreation, 1991.

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