

## CHAPTER 19:

# Floods, Droughts, and Landslides

### DEALING WITH FLOODS

Floods are the second most common natural disaster, after fire disasters. Any real estate manager who has endured catastrophic flooding on a property can attest that flooding is one of the worst natural disasters that can occur. Flooding causes more property damage in the U.S. than any other natural disaster, averaging losses of several billion dollars each year. Most natural floods are due to melting snow, the effects of tsunamis and hurricanes, and prolonged or heavy rainfall. Floods can also result from overflow of inland tidal waters, failure of a dam or levee, a mudflow, or an unusual and rapid accumulation or runoff of surface waters from any source. Flooding inside buildings can also be caused by broken water lines, frozen or bursting pipes, or an unexpected accident.

In the case of natural flooding, real estate managers should be aware of flood forecasts and warnings to determine the possibility of a flood, its expected severity, and when and where it could begin. Severe conditions may require evacuating buildings. Floods can be slow or fast rising, but they generally develop throughout a period of days. Flash floods, however, are like walls of water that develop in minutes—these can be caused by intense rainfall or failure of a dam.

While a flood can cause extensive property damage, it can also cause other potential disasters, including electrical outages, which could impede rescue operations, and result in electrocution of occupants. Drowning is a strong possibility in large regional floods. Depending on the type of property, food, fuel, and water contamination or shortages can also occur.

### **Areas and Properties at Risk for Floods**

Properties with the highest risk of flooding are those located on a flood plain and in areas with histories of flooding. It is wise to check with the local Federal Emergency Management Agency (FEMA) field office to review

potential flood risks. FEMA periodically updates public flood zone maps.<sup>1</sup> The Advanced Hydrologic Prediction Service of the National Weather Service (NWS) also provides improved flood forecasting and offers tools to assist in flood emergency planning.<sup>2</sup>

There are several types of floods—each having its own risk factors. River floods occur seasonally when winter or spring rains couples with melting snows, filling river basins with too much water too quickly. They also occur when floating ice accumulates at a natural or man-made obstruction and stops the flow of river water, eventually causing an overflow. Torrential rains from decaying hurricanes or tropical storms can also produce river flooding.

Coastal floods occur when winds generated from tropical storms and hurricanes or intense offshore low-pressure systems drive ocean water inland. Established escape and evacuation routes can be cut off and blocked by high water. Coastal flooding can also be produced by tsunamis, which are ocean waves produced by earthquakes or volcanic activity.

Flash floods are the leading cause of death related to thunderstorms, resulting in more than 140 fatalities each year. Most fatalities from flash floods either occur at night, when the dangers of fast-moving water may be obscured, or involve motorists trapped in their vehicles. Urban flash floods occur where land has been converted from fields or woodlands to paved roads and parking lots, caused by the ground surface losing its ability to absorb rainfall. Urbanization increases water runoff by two to six times more than runoff on natural terrain. During periods of urban flooding, streets can become swift-moving rivers capable of sweeping away vehicular traffic; basements can also become deathtraps as they accumulate water.

## Warning Signs and Weather Advisories

Except for flash floods, the average natural flood is preceded by a few potential warning signs. A roaring sound upstream may herald an impending flood. Other common signs include rapidly rising water in a river or stream or water turning muddy. Continuous heavy rains for several days can lead to flooding in low-lying areas—areas that have been flooded in the past often exhibit telltale signs of old waterlines on the sides of buildings. When skies darken and thunderstorms are forecast, look and listen for increasing

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1. Flood hazard maps can be found online at <http://www.fema.gov/mit/tsd>.

2. Information from the NWS regarding tools to assist in flood emergency planning can be found online at [www.nws.noaa.gov/om/water/Ahps.shtml](http://www.nws.noaa.gov/om/water/Ahps.shtml).

winds, flashes of lightning, or sounds of thunder. Severe thunderstorms often lead to flash flooding, but may contribute to river flooding as well.

Local radio, TV stations, and National Oceanic and Atmospheric Administration (NOAA) Weather Radio broadcast watches and warnings regarding flooding in specific areas. A flood watch means a flood is possible in the cited areas, while a flood warning means flooding is already occurring or will occur soon in the area and necessary precautions should be taken at once. Authorities may advise evacuation. The same applies for flash flood watches and warnings. Urban and small stream advisories are issued when flooding of small streams, streets, and low-lying areas such as railroad underpasses and urban storm drains occur. Real estate managers should refer to their emergency procedures guidelines to determine what actions should be taken in each circumstance.

### **Preventive Measures for Floods and Flash Floods**

Certain measures can be implemented to prevent losses that can occur from flooding. The following lists some suggestions:

- Ask your local emergency management office whether your facility is located in a flood plain. Learn the elevation of your facility in relation to streams, rivers, and dams. Research the history of flooding in the area.
- Review the community's emergency plan. Learn the community's evacuation routes and locate the nearest high ground.
- Make sure you can receive updates on current conditions. Consider purchasing a NOAA Weather Radio with a warning alarm tone and battery backup in addition to mobile devices or radios you might use. Check for flood watches and warning updates often.
- Contact the National Flood Insurance Program (NFIP) to find out if the community in which the property is located participates in the program.
- Ask your insurance carrier about flood insurance for your property. This is a separate policy; regular property insurance does not cover flooding.
- Inspect areas in your facility subject to flooding. Identify equipment, records, and other assets that can be moved to a higher location and make plans to move them if a flood is expected.
- Consider the need for backup and recovery systems, such as

alternate power sources, portable pumps to remove flood water, and battery-powered emergency lighting.

- Consider the feasibility of relocating vital building equipment (e.g., fire pump motors) if these items cannot be easily moved out of the path of flood water entering the building.
- Consult with a local building contractor or building official as to the best structural materials advised in flood-prone areas. For example, wood has a high water-absorption capacity, and average drywall acts like a sponge, drawing water up above the flood level.
- Know where asbestos-containing materials have been used in the building. Flood-damaged materials that contain asbestos require special handling; services of an asbestos contractor may be needed.
- Use site-planning techniques—sloping lawns, raised patios, improved drainage, flood walls, and levees—to protect a property against floods.
- Keep a supply of sandbags, plastic sheeting, lumber, and plywood for waterproofing at strategic locations and entrances.
- Keep auxiliary pumps on hand.
- Move valuable items to higher ground and advise building occupants to do likewise.
- Disconnect electrical appliances before flooding begins. Do *not* do this while standing in water.
- Identify a safe and elevated location for evacuees to assemble.
- Address dangerous and acceptable conditions for driving from the building. If a car stalls during evacuation, it should be abandoned immediately, and occupants should move to higher ground.
- Participate in community flood-control projects.

The National Institute of Building Sciences (NIBS) with the direction of FEMA has developed a standardized methodology, called HAZUS, for assessing losses from flood damage.<sup>3</sup> HAZUS software is also available for free online ([www.fema.gov](http://www.fema.gov)).

### What to Do During a Flood

The emergency procedures manual should outline what management should do during a flood or immediately after a flood warning is issued.

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3. For more information about HAZUS, visit [nibs.org/index.php/hazus](http://nibs.org/index.php/hazus).

## FLOOD INSURANCE

U.S. government-backed flood insurance is available to any business owner, homeowner, or renter whose property is located in a community that participates in the National Flood Insurance Program (NFIP). Participating communities must adopt and enforce local flood plain management ordinances that are designed to reduce the risk of flood losses in the future. In such communities, flood insurance can be purchased from a licensed insurance agent or company—for example, the same person who writes the owner's property policies.

Flood insurance is the best means of recovering losses from flood damage. It should be purchased well beforehand because policies do not take effect immediately. The effective date is normally 30 days after purchase.

The following lists what a standard flood insurance policy should cover:

- Structural damage
- HVAC damage
- Cleanup of flood debris
- Damage to floor surfaces (e.g., tile, carpeting)

It is also possible to obtain flood insurance coverage for building contents—furnishings, collectibles, and other personal property.

Note: Information on the National Flood Insurance Program can be found online at [www.fema.gov/nfip](http://www.fema.gov/nfip) or [www.floodsmart.gov](http://www.floodsmart.gov).

The following lists some possible actions to take:

- Give priority to the protection of power plant and fire pumps, keeping them in service if at all possible. In the event flood waters overwhelm defenses and enter the building, vital fire pump motors or engines should be protected. If they can be moved, they should be relocated. The same should be done for important motors, controls, and emergency power generation equipment.
- If possible, shut down the electricity in the building and distribute emergency flashlights.
- Open basement or lower-level windows to equalize water pressure on the building's foundation and walls.
- Do not use open flames—there may be gas escaping from ruptured mains.
- Watch for and avoid live electrical wires.
- If water enters the building and evacuation becomes impossible, move to an upper floor or rooftop and wait for rescuers.
- While evacuating, avoid attempting to drive through floods or rising water; nearly half of all flash flood fatalities are auto related.

### FLOOD PROOFING METHODS

According to FEMA, there are three basic methods for flood proofing a property.

1. Permanent Flood proofing:

- Where possible, elevate the facility on walls, columns, or compacted fill.
- Reinforce walls to resist water pressure and seal them to prevent or reduce seepage.
- Install check valves to keep flood water from entering the building by backing up through sewer lines.
- Build watertight walls around equipment or work areas within the facility that are particularly susceptible to flood damage.
- Construct floodwalls or levees outside the building to help keep water away.

2. Contingent Flood proofing:

- Install watertight barriers, called flood shields, to prevent flood water from entering through windows, doors, ventilation shafts, or other openings.
- Install permanent watertight doors.
- Construct movable flood walls.
- Install permanent pumps to remove flood waters.

3. Emergency Flood proofing:

- Build walls with sandbags.
- Construct a double row of walls with boards and posts to create a “crib” and fill the crib with soil.
- Construct a single wall by stacking small beams or planks.

Permanent flood proofing measures are undertaken before a flood occurs and require no human intervention when flood waters rise. Contingent flood proofing measures are also taken prior to a flood, but some additional action is required when flooding occurs. Emergency flood proofing measures, while generally less expensive than the other types, require substantial advance warning of a flood and do not satisfy minimum requirements for flood proofing as set forth by the NFIP.

Source: *Emergency Management Guide for Business and Industry* published by the Federal Emergency Management Agency (FEMA 141/ October 1993) and available online at <http://www.fema.gov/pdf/library/bizindst.pdf>.

- It is especially important to develop a specific flood evacuation plan for low-rise residential and commercial buildings because these types of structures are particularly vulnerable to collapse.

### What to Do After a Flood

It is important to verify the safety of a building before anyone re-enters it after a flood. If there is standing water next to the outside walls of a property, do not go in. The building may not be safe or structurally sound. Walk

around the building before entering it and check for downed or loosened power lines and gas leaks. The real estate manager should either call or appoint someone to call the appropriate utility company if either of these conditions are observed.

### Checking for Structural Damage

After a flood, the building should be inspected at the earliest opportunity to assess its condition. The exterior should be inspected before anyone is allowed to enter the building. The following lists what should be inspected before cleanup is started or power is restored.

- Check the foundation for cracks and examine overhangs for missing structural supports. If obvious damage is observed, the real estate manager could ask the city building inspector or fire chief if the building is safe to enter.
- Check ceilings for signs of sagging. If a ceiling is holding water, the wet plaster or drywall will be very heavy and could be dangerous if it falls. Carefully poke or drill a hole in the ceiling at the edge of the sagging area and away from electrical fixtures so that any water trapped there can begin to drain. Walls made of drywall or other water-absorbent materials should also be checked for signs of sagging and treated appropriately.
- Inspect building mechanical systems prior to restoring power to components.
- Determine whether flood damage requires full removal or if cleaning and/or other treatment will suffice. For example, once drywall has been saturated, it generally needs to be replaced.

### Restoring the Interior of a Property After a Flood

Provided the exterior of the building has passed inspection and is safe to enter, the following are considerations upon returning to a property after a flood:<sup>4</sup>

- Contact the property's insurance company or agent to file a claim under the flood insurance policy after the property's damage has been assessed.

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4. Additional information can be found in *Floods: The Awesome Power*, published jointly by NOAA, FEMA, and the American Red Cross and available for download at [nws.noaa.gov/om/brochures/Floodsbrochure\\_9\\_04\\_low.pdf](https://www.nws.noaa.gov/om/brochures/Floodsbrochure_9_04_low.pdf).

- Appoint and supervise cleanup crews.
- If the electricity is still on after a flood, it should be turned off immediately. If someone has to step into water to turn it off, call an electrician to do the job.
- Breaker boxes should be turned off using a dry stick while standing on a dry surface.
- Watch for and avoid live electrical wires; do not turn on any electrical appliances until an electrician says it is okay to do so.
- Pump out water gradually to minimize further structural damage (e.g., one-third of the water each day for three days). Draining too quickly could allow the pressure outside the basement to collapse the walls.
- Get fresh air moving throughout the building to reduce moisture and dissipate any leaking gas.
- Properly dehumidify the building and other areas to avoid unhealthy conditions. Use dehumidifiers in conjunction with fans to create laminar air movement and speed up evaporation.
- Affected areas will need to be treated with an antimicrobial solution to kill bacteria and prevent the growth of mold and mildew. Growth of bacteria, mold, and mildew in ductwork is especially dangerous. Water damage or mold/mildew growth may necessitate complete removal of some items. If a building is flooded for 24 hours or more, it may be appropriate to engage a qualified professional to identify and eliminate potential mold and mildew growth.
- Cover holes in the roof, walls, or windows with boards, tarps, or plastic sheets.
- Temporarily repair sagging floors or roof sections by using 4×4 boards as braces in weak areas.
- Check for broken or leaking water pipes. If any are found, turn off the water supply.
- Be prepared for looting; secure the property to guard against potential trespassers.

## DEALING WITH LANDSLIDES

Landslides are a global phenomenon. In the U.S. alone, landslides are estimated to cause \$2 billion in damage and 25 to 50 deaths each year. Typically