HOMEOWNER'S HANDBOOK TO PREPARE FOR COASTAL NATURAL HAZARDS

Sea Grant Texas
AT TEXAS A&M UNIVERSITY

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T E X A S

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The *Texas Homeowner's Handbook* was developed as a project of the Gulf of Mexico Alliance (GOMA) Coastal Community Resilience Team. GOMA, a partnership of federal, state, and local organizations, shares a vision for healthy and resilient communities. A key priority of GOMA is to increase the resiliency of coastal communities from natural hazards. One major component of healthy communities is enhancing individual resilience and recognizing that adjustments to day-to-day living are necessary. This handbook is designed to promote individual resilience, thereby creating a fortified community.

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This handbook, as well as other documents, is available at the GLO website (www.glo.texas.gov/coast/coastal-management/forms/files/homeowners-handbook-hurricanes.pdf) and at Texas Sea Grant (https://texasseagrant.org/programs/hurricane-preparedness).

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Part 1
Introduction

Purchasing a home is one of the major milestones in your life and a major investment. It provides protection from the elements for you and your family as well as your worldly possessions. If you live on the coast, as many people do, you need to be aware of the threat to your investment from coastal natural hazards such as hurricanes, tornadoes, and flooding.

This handbook was created to help you prepare for coastal natural hazards and help you reduce the risks to your family and property. Although it is never possible to eliminate all risk from a hazard, you as a homeowner can take action and implement many small and cost-effective steps that could significantly lower your risk and exposure to those hazards.

This handbook is divided into five parts. This introduction presents the purpose and layout of the handbook, includes a discussion of common myths that may have prevented you from taking action in the past, and provides a summary of five things you can do to prepare. Part 2 provides basic information on hurricanes, tornadoes, and flooding, which will allow you to make an educated decision about the steps to take to protect your family and property. Part 3 provides a detailed discussion on how to protect yourself and your family. This section also includes information about essential emergency supplies, evacuation kits, evacuation planning and procedures, emergency contacts, and electrical and other power issues. Part 4 describes structural updates you can make to your property to protect it from wind and water damage. Part 5 addresses recovery and mitigation following a hazardous event and presents resources on insurance programs and state and federal assistance programs to aid in recovery if storm damage occurs.

This handbook is available free as a downloadable PDF file at the Texas Sea Grant College Program website at http://texasseagrant.org/programs/hurricane-preparedness/tsg-publications/ or the Texas General Land Office website at http://www.glo.texas.gov/coast/coastal-management/tools/index.html. It will be updated on an as-needed basis as new information becomes available and feedback from the public is obtained. You can also request a copy by contacting the Texas General Land Office Coastal Resources Division at (512) 475-0773 or Texas Sea Grant at seagrant@tamu.edu.

1.1 COMMON MYTHS AND REASONS TO PREPARE

There are many common myths that may cause complacency in homeowners and lead them to not fully prepare for a natural hazard. The most common ones are provided below in quotes and are discussed to encourage people to take action.

1. **"I survived the last hurricane and there was very little damage to my house. I shouldn't have to do anything more to prepare myself or upgrade my house."**

   Storms can vary to a large degree. Hurricane Ike in 2008 was a Category 2 hurricane, but rather large in diameter. Although it made landfall at Galveston Island, damage was widespread along the coast, mostly due to wind and surge. On the other hand, Hurricane Harvey became a Category 4 hurricane shortly before it made landfall near Rockport, and that area suffered major wind damage. Then Harvey moved back out into the Gulf of Mexico, downgraded to a tropical storm, and stalled near Houston, bringing record-breaking rainfall and flooding to that area. We should not look to the last storm we experienced as a guide for preparation. We must prepare ourselves and our homes for the full range of possibilities.

2. **"Disasters only happen once every 100 years. I've already been through one disaster, so there won't be another one in my lifetime."**

   The 100-year storm is a misconception. In fact, FEMA uses the phrase "1.0 % annual chance" to define its Special Flood Hazard Area. A National Weather Service report from 2010 shows that 44 hurricanes and 44 tropical storms have struck Texas since 1900.[1] It also states that along any 50-mile segment of coast, the probability of an event is once every six years. While some storms obviously have costlier impacts and more widespread effects, it not safe to assume what could happen in any given year or in your lifetime.

3. **"I don't live near the coast, so I am safe."**

   Major hurricanes often carry powerful winds and devastating floods for many miles inland after landfall before weakening. The storm surge associated with Hurricane Katrina in 2005 was recorded 12 miles inland, and hurricane-force winds were felt near Hattiesburg, Mississippi. Hurricane Ike weakened to a tropical storm just east of Palestine, Texas, approximately 175 miles north of where it made landfall. Devastating

floods and hurricane-force wind gusts associated with the remnants of Ike were recorded as far north as the Ohio Valley.

4. "Sometimes they say it's going to be bad or they make us evacuate, but then it isn't that bad."

The same principle applies to wearing a seatbelt while driving a car. You can't predict how bad any car accident may be, or if you will be in an accident at all, but you wear your seatbelt all the same. Weather events can still be difficult to predict, even with new technology for forecasting. Emergency management and government officials use the most up-to-date information to make difficult decisions, and it is better to err on the side of caution. For your safety, it is important to listen to weather advisories and comply with evacuation procedures. Remember, it will be more difficult to evacuate or to receive assistance from emergency management when the storm has already struck your area.

5. "If a disaster occurs, the government will come to the rescue."

After Hurricane Ike, many residents found that the government would not repair their damaged houses or provide adequate compensation for property damage. In most cases, the compensation was received many months after the storm. Keep in mind that after any disaster, the number of people in need may overwhelm governments. Likewise, a particularly active hurricane season, like that of 2017, can result in multiple cities and states competing for funding. It is up to you to plan properly, strengthen your house, and have the appropriate financial protections in place, including insurance if it is available.

6. "There is no guarantee that anything I do will help in the event of a natural disaster."

Fortunately, there are many reasonable steps you can take to significantly reduce the risk of damage to life and property. While it is not possible to eliminate all risk, these steps for planning and preparing can make a major difference and determine whether you survive without injury and the damage to your house and property is mitigated. The information in this handbook covers two major topics for preparation: 1) protecting yourself and your family, and 2) protecting your property.

7. "Strengthening my house is too expensive and not worth the effort."

National Institute of Building Sciences issued a report in January 2018 showing that every $1 spent on pre-disaster mitigation on a community level resulted in $6 saved during post-disaster recovery.[2] Some of these community actions can actually be done individually by you on your own home, such as adding hurricane shutters and meeting or exceeding

building codes. Although you may not be able to avoid any damage, you may be able to return and live in your home sooner if there is only minor damage. Also, by reducing the amount of building debris scattered around the neighborhood, you can help governmental emergency management quicken their response and recovery efforts. Lastly, strengthening your house should be considered a home improvement that adds value, especially if you ever consider selling it. These types of improvements may also lower your insurance premiums.

1.2 HOW TO PREPARE FOR THE NEXT STORM

As covered below and in later parts of this handbook, there are simple steps you can take to provide greater protection from coastal hazards for your family and your property.

1. **Gather emergency supplies and personal documents.**

   You can do this in your house now. Many items you need are probably already in your home. Make a list of essential emergency supplies, such as gallons of water, non-perishable food items like canned food, etc. (see Part 3 and Appendix C), and check and restock each month so the supplies are complete and not outdated or used. This will help you avoid rushing to a store during an emergency to gather supplies. There will be long lines and empty shelves, and you will add to the crowd and confusion. You should also put together an evacuation kit with critical personal items, such as a driver's license, birth certificate, clean set of clothes, medications, cash for travel expenses, a list of emergency phone numbers, and copies of insurance policies and your pets' vaccination records and other documents (see Part 3).

2. **Create an evacuation plan for both a flood and a hurricane.**

   Different hazards require different responses. For a hurricane, your plan may include sheltering in your house if it is outside the evacuation zone and sufficiently strong. If you cannot use your house or stay with a friend or a relative, find a shelter that is officially open (listen to local radio and television). For a flood, evacuate to higher ground only if you know that your house is located within a Special Flood Hazard Area or if you are instructed by local officials to evacuate. Once you have evacuated, the wait may be several hours or days before you can return. Discuss and practice drills for your evacuation plan with your family each year.

3. **Know your house and your property; take actions that fit your**

circumstances.

A) When was your house built? Blueprints or other information may be available from your homebuilder, your architect, or your local building department. A house built after the early to mid-1990s should have hurricane clips to tie the roof to the wall and strong connectors from the wall to the foundation (see Part 4). If your house was built before then, you can still retrofit at a reasonable cost. The actions a homeowner can take will vary with each house. For the majority of homeowners, there are steps that can make a significant difference, such as protecting your windows, doors, and garage, and upgrading your roof.

B) Where is your home located? If your property is near a ridge or at a higher elevation, it may be especially susceptible to wind damage. If your property sometimes floods, you may or may not be in a floodplain. In any case, you should consider setting up an insurance policy and fortifying your house. If trees hang over or stand too close to your house, consider trimming or cutting the branches that might damage your house.

4. Seek the assistance of a qualified, licensed architect, structural engineer, or contractor.

New technology continually allows researchers to conduct better studies and engineers to improve building methods and products. This handbook covers work that you may be able to do yourself. However, it is always a good idea to consult with a professional for the most up-to-date information. If you cannot do the work yourself, make sure the person you hire has references and insurance, and sets up a formal contract with you. Many communities have a local registry for contractors, if you need assistance in finding someone.

5. Buy insurance, take advantage of potential discounts for premiums, and finance creatively.

Do not gamble with the investments you have made in your house and your belongings. Obtain adequate insurance for wind and flood risks (see Part 5). Coverage may vary among companies, so talk with your insurance agent about discounts that may be available. Significant discounts may be provided for reducing your risk by installing window protection, roof-to-wall connectors (hurricane clips), and wall-to-foundation connectors (see Part 4). Many projects are not that expensive, especially if completed in phases. For more costly projects, a small home improvement loan combined with potential insurance discounts can make these projects more affordable.

Part 2
Coastal Natural Hazards: An Overview for Homeowners

With 367 miles of Gulf shoreline and more than 3,300 miles of bay shoreline, Texas has one of the longest coastlines along with one of the highest erosion rates in the nation. The Texas Gulf shoreline is a diverse coast consisting of a system of six barrier islands (Galveston, Follett's, Matagorda, San Jose, Mustang, and Padre) and two peninsulas (Bolivar and Matagorda).

In Texas, many different types of coastal natural hazards can occur, such as high winds, flooding, tornadoes, subsidence, coastal erosion, and relative sea-level rise. Preparing for the larger events (hurricanes and flooding) will also better prepare you for the smaller, more frequent events such as tropical storms, high tides, and coastal erosion. This handbook is not intended to go into detail on all events, but to provide only basic information that may play a role in how you as a homeowner may prepare for these hazards.

2.1 HURRICANE HAZARDS

2.1.1 HURRICANE FORMATION

The official hurricane season in the Atlantic Basin is from June 1 to November 30, but hurricanes and tropical storms can occur before and after this period. Most of the activity occurs from August to October.

A hurricane is an intense tropical storm with strong and very pronounced counter clockwise circulation in the Northern Hemisphere. An area of clear weather called an "eye" is present in the center of the circulation. A hurricane begins as an organized disturbed weather system of persistent clouds, thunderstorms, and closed low-level circulation with maximum sustained winds of up to 38 miles per hour. This stage is referred to as a tropical depression. As the depression further develops and its maximum sustained winds exceed 39 miles per hour, the system becomes a tropical storm. The tropical storm reaches hurricane status when the maximum sustained winds reach 74 miles per hour or more. Tropical storms usually occur more frequently than hurricanes in the Gulf of Mexico and usually

are more common early in the season. While not full-fledged hurricanes, tropical storms and even tropical depressions can still cause substantial damage. For example, Tropical Storm Allison brought tremendous amounts of rain and flooding to Texas in 2001.

In addition to the distinct eye of the storm, hurricanes are divided into quadrants (Figure 2.1). Due to the circular formation and forward-moving track, the right side of the storm has winds blowing on-shore, and the left side has winds blowing off-shore (Figure 2.2). The off-shore winds are weaker because they encounter more friction from blowing over land. The forward velocity of the storm also adds to the wind speed of the right front quadrant, giving that quadrant the strongest winds. The greatest destruction, the highest surge, and more tornadoes are found in the right front quadrant,[3] which is sometimes referred to as the "dirty side" of the storm. Two cities that are equally distant from where a storm makes landfall can experience significantly different impacts depending on which quadrant strikes each community.

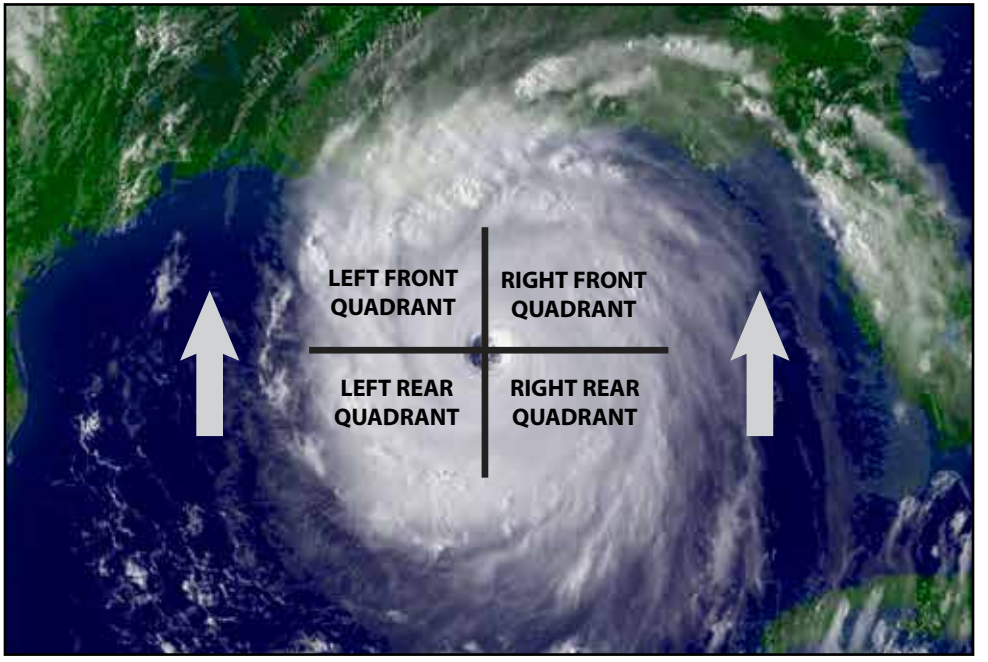


Figure 2-1. Hurricane Quadrants

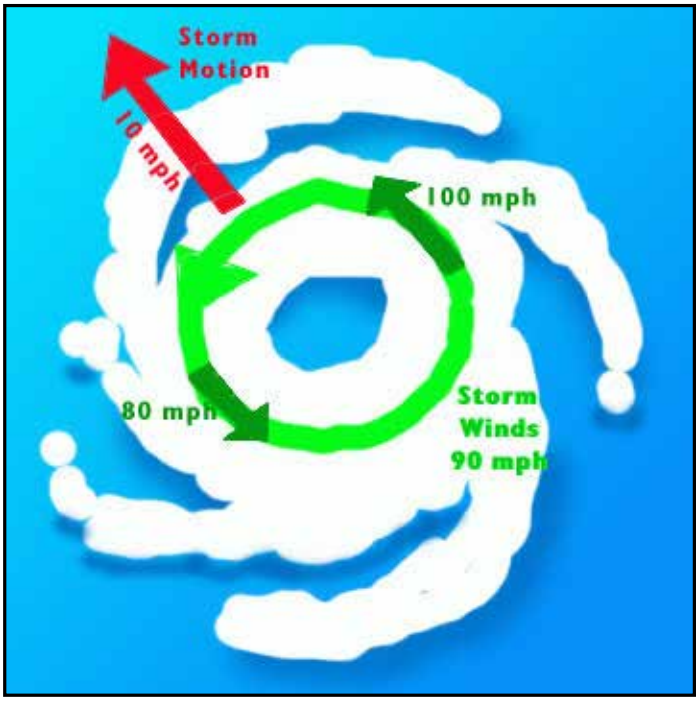


Figure 2-2. Comparison of Wind Speeds within a Hurricane

Source: NOAA

2.1.2 WIND AND THE SAFFIR-SIMPSON SCALE

Hurricane strength is categorized using the Saffir-Simpson Scale (see Table 2-1), which rates hurricanes from 1 to 5 based on the intensity of the sustained winds. It is important to note that the Saffir-Simpson Scale illustrates the peak of "sustained winds" in a hurricane. "Wind gusts," which come and go, can reach up to 135 miles per hour for a Category 2 storm and up to 160 miles per hour for a Category 3 storm. In addition, hurricane winds rapidly increase in strength going from the outer edge of the storm in toward the eye wall. The eye wall contains the most intense wind and is generally 20-40 miles wide.

Earlier versions of this scale incorporated central pressure and storm surge as components of the categories. However, after it was realized that surge had too many complexities (see section 2.1.3), the Saffir-Simpson Scale was reduced to measuring only wind speed.

Table 2-1. Saffir-Simpson Hurricane Wind Scale
Source: NOAA-NWS

Category	Sustained Wind Speed	Impacts due to Wind
5	157 mph or higher 137 kt or higher 252 km/h or higher	Catastrophic Impacts: High percentage of homes will suffer severe damage or destruction, due to breached openings, roof failure, and wind-driven rain. Fallen trees and power lines will isolate neighborhoods. Disruption to utilities may last weeks or months.
4	130-156 mph 113-136 kt 209-251 km/h	Catastrophic Impacts: Homes will suffer severe damage to roof structure, exterior walls, and windows. Wind-driven rain may cause interior damage. Numerous trees will be snapped and uprooted. Disruption to utilities may last weeks.
3	111-129 mph 96-112 kt 178-208 km/h	Devastating Impacts: Homes will incur major damage to exterior walls, roof shingles and decking. Snapped trees and downed power lines will block numerous roads. Disruption to utilities may last days to weeks.
2	96-110 mph 83-95 kt 154-177 km/h	Extensive Impacts: Many homes will incur damage to siding, roof shingles and decking. Many trees will be snapped, uprooted, and block some roads. Power outages expected for several days.
1	74-95 mph 64-82 kt 119-153 km/h	Homes could have damage to shingles, vinyl siding, and gutters. Trees may lose major branches; smaller trees may uproot. Power loss could last days.
Tropical Storm	39-73 mph 35-63 kt 63-118 km/h	Damage to some trees and power lines. Power loss in some areas. Outdoor items may become airborne and dangerous.

2.1.3 STORM SURGE

Storm surge develops as the low pressure inside a hurricane's eye sucks up a dome of ocean water and strong winds push that dome ashore. Storm surge is affected by the depth of near-shore waters, topography, hurricane size, speed, and angle to the coast. It can reach 25 feet high and may be 50 to 100 miles wide. It typically accounts for 90% of storm-related deaths. A surge of 10 feet or more can cause severe flooding far inland and severe damage along the coast. Storm tide is the combination of storm surge and normal tide (i.e., a 15-foot storm surge combined with a 2-foot normal high tide creates a 17-foot storm tide). Wave action adds more destructive power and more height to the basic surge elevation (Figure 2.3).

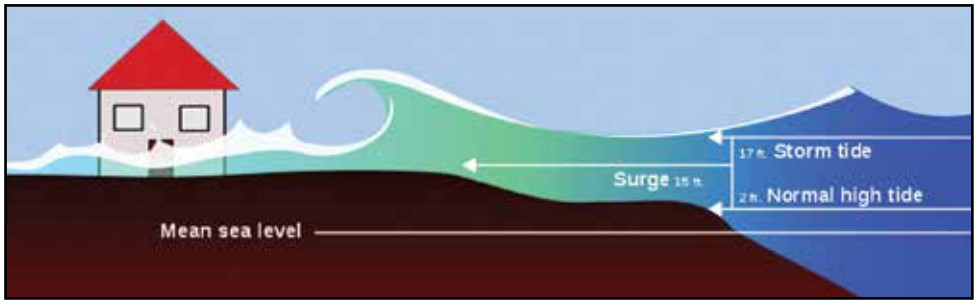


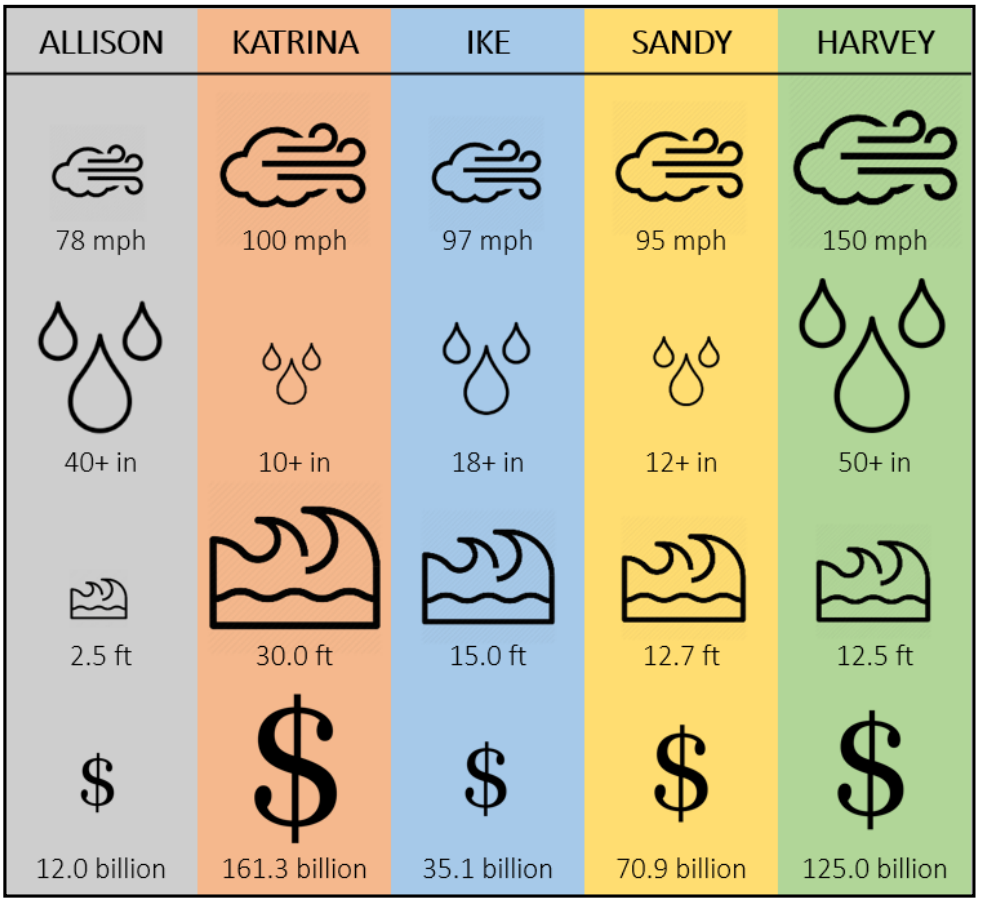
Figure 2-3. Storm Surge Depiction

2.1.4 RAINFALL

Rainfall totals of 10 inches or more are common when a tropical storm or a hurricane moves across a coastal location. Torrential rains continue inland long after the high winds of a hurricane have diminished. How much rainfall accumulates depends upon the speed of the storm's movement. The pattern of rainfall also changes throughout the course of a 24-hour day. Typically a "core rainfall" event occurs at night and concentrates in a smaller area, whereas the outer "rain bands" expand during the day and take action over a wider area.[4] As an example, with its slow-moving track, Hurricane Harvey kept up a constant cycle of core rainfall and active rain bands for five days. Although it had been downgraded to a tropical storm by the time it reached the Houston metroplex, Harvey created record-breaking amounts of rain in that area. Table 2-2 compares the characteristics of Hurricane Harvey and other recent, well-known storms.

Table 2-2. Varying Characteristics of Recent Storms (2001-2017)

Source of data: NOAA National Centers for Environmental Information



2.2 FLOOD HAZARDS

Flooding in Texas is probably the most common natural hazard in the state, if not the most intense. Flooding can be caused not only by a hurricane, but also by a tropical storm, tropical depression, or other weather systems that produce heavy rain. Flooding can build up gradually over a period of days, or occur suddenly in a few minutes (this is commonly known as a flash flood). In addition, coastal flooding and wave inundation can be produced by a hurricane or high-surf event with waves generated by local storms or by those that are hundreds of miles from the Texas coast. Flooding most often occurs near a body of water such as the Gulf of Mexico or a stream, river, or reservoir. Of Texas' 171 million acres, an estimated 20 million are flood-prone, more than any other state.[5]

You can determine if you are in a high-risk flood area by looking at FEMA's flood insurance rate maps. These maps show what areas are susceptible to flooding and high velocity wave action (for those near coastal areas). Copies of the maps can be obtained digitally from the FEMA Map Service Center at https://msc.fema.gov/portal/search. Copies may also be available for viewing at your city or county building departments.

2.2.1 COASTAL FLOODING

Coastal flooding results from storm surge and wave action and is usually associated with hurricanes or tropical storms. As described earlier, the low pressure inside a storm's eye sucks up a dome of ocean water near the center of the storm. As the storm approaches land, the storm's strong winds push the dome of water ashore as storm surge. An intense hurricane can have a dome of water that is many miles wide and more than 25 feet high as it hits the coast. In addition, with this temporary increase in sea level rise, breaking waves and floating debris have access to areas and structures that were not designed to withstand the pounding of ocean waves. These battering waves are responsible for most beach erosion and extensive damage to coastal structures, including buildings, roads, bridges, marinas, piers, boardwalks, and sea walls.[6]

2.2.2 FLASH FLOODS

Flash floods typically develop within less than six hours after a heavy rainfall event. Other characteristics that define flash floods are a rapid rise in water, high-velocity water flow, and large amounts of associated debris. These characteristics can make a flash flood more dangerous, and even fatal, compared to other types of flooding and require a rapid response to safeguard life and property. Major factors that contribute to the severity of flash floods are the intensity and duration of rainfall and the steepness of the area's terrain.[7]

Impervious surfaces, which do not absorb water well, can cause excessive runoff during heavy rainfall and bring about flash flooding. Rocky terrain, certain types of soil, and land hardened by long periods of drought are examples of impervious surfaces in the natural environment and in rural communities. However, with vast road systems, parking lots, and concrete buildings, cities also contain large areas of impervious surface.[8] Stormwater systems are built to control runoff during severe rain events but may not keep pace with the rate of urban development. If these systems become overwhelmed, they can release stormwater back into the community in the form of flash flooding.

Low water crossings exist in areas where it is inefficient to build typical bridges or culverts, such as creek beds that remain dry for extended periods of time and roads that do not get a lot of traffic.[9] Yet during extreme rainfall, water can quickly rise above the crossing and flash floods can even wash away the crossing structure. Permanent warning signs may be placed at low water crossings and roads may be blocked off during flash flood events to protect the public.

Examples of Low Water Crossing Signs

Source: retrieved April 24, 2018, from www.roadtrafficsigns.com

Dams, levees, and floodwalls are structures built to contain water and to protect communities. They can pose a danger if they become overwhelmed during heavy rain events, especially tropical storms and hurricanes. If they are overtopped or undergo structural failure, flash flooding could occur with little to no warning.

2.2.3 FLOOD ZONE DEFINITIONS

In addition to knowing about the different types of flooding, it is also important to understand your personal risk from flooding. FEMA has defined zones that are outlined on Flood Insurance Rate Maps (FIRMs). The maps show in which zone your property lies and what type of risk you face. FEMA answers homeowners' frequently asked questions about flood hazard maps and risks on their website at https://www.fema.gov/homeowners-frequently-asked-questions. The definitions and descriptions of the flood zones are:

Zone A: This zone is also known as a Special Flood Hazard Area (SFHA). It was previously known as the 100-year floodplain, but that terminology led people to believe that flooding in their area would only occur once every 100 years. This SFHA is currently referred to as an area susceptible to 1.0% annual chance of flooding, meaning that **every year** there is a 1.0% chance that it will flood. There are sometimes other letters or numbers that follow the "A." The letters and numbers determine a base flood height and an elevation height for your house.

Zone B: This flood hazard area has moderate risk, or a 0.2% annual chance for flooding. It was previously called the 500-year floodplain. The base flood heights for this zone can be less than 1 foot.

Zone C: This hazard area has minimal risk to floods.

Zone D: This area has an undetermined risk, but it is still possible that flooding will occur.

Zone V: This zone is also referred to as a Coastal-V, or Coastal Velocity Flood Zone. It is susceptible to not only a 1.0% annual chance of flooding, but also wave action and storm surge from hurricanes. A number or letter after the "V" will determine the base flood height and the elevation height for homes.

Zone X: Newer FIRMs may show Zones B and C as Zone X.

Please be aware that some FIRMs are quite old, and FEMA has not updated all maps. Due to increased development, impervious surfaces, and sea level rise, the risk of flooding in your community is likely to be greater than appears on the FIRM. Inland properties may also be susceptible to flooding if there is poor localized drainage. Therefore, you do not need to be in an official flood zone to be at risk for flooding and to be eligible for flood insurance. Another way to determine your risk is to observe and study your property. If your property floods during small rain events, then the problem will be greater during an intense storm or hurricane. You can protect yourself by improving the local drainage, making your house resistant to floods, and purchasing flood insurance.

2.3 TORNADO HAZARDS

Hurricanes can also produce tornadoes that add to the storm's destructive power. Tornadoes are nature's most violent storms. Spawned from powerful thunderstorms, tornadoes can cause fatalities and devastate a neighborhood in seconds. A tornado appears as a rotating, funnel-shaped cloud that extends from a thunderstorm to the ground with rotating winds that can reach 300 miles per hour. Damage paths can be in excess of one mile wide and 50 miles long.[10]

The size of a tornado is not necessarily an indication of its intensity; large tornadoes can be weak, and small tornadoes can be violent. The Fujita (F) Scale was originally developed by Dr. Tetsuya Theodore Fujita in 1971 to estimate tornado wind speeds based on damage left behind by a tornado. An Enhanced Fujita (EF) Scale (Table 2-3), developed by a forum of nationally renowned meteorologists and wind engineers, makes improvements to and replaces the original F scale.[11]

Tornadoes are most frequently reported east of the Rocky Mountains during spring and summer months, and the entire state of Texas is at nearly equal risk for tornadoes. Peak tornado season in the southern states is March through May, and they are most likely to occur between 3 p.m. and 9 p.m., but can occur at any time.[12]

Table 2-3. Enhanced Fujita Scale

EF - Scale Number	Class	Wind Speed	Possible Damage
EF-0	Weak	65-85 mph	**Light**: Some damage to chimneys; breaks branches off trees; pushes over shallow-rooted trees; damages signboards.
EF-1	Weak	86-110 mph	**Moderate**: Peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off the roads; attached garages may be destroyed.
EF-2	Strong	111-135 mph	**Significant**: Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light object missiles generated.
EF-3	Strong	136-165 mph	**Severe**: Roof and some walls torn off well-constructed houses; trains overturned; most trees uprooted.
EF-4	Violent	166-200 mph	**Devastating**: Well-constructed houses leveled; structures with weak foundations blown off some distance; cars thrown and large missiles generated.
EF-5	Violent	>200 mph	**Incredible**: Strong frame houses lifted off foundations and carried considerable distances and destroyed; automobile sized missiles fly through the air in excess of 300 feet; trees debarked; steel reinforced concrete structures badly damaged; asphalt stripped from road surfaces.

Before a tornado hits, the wind may die down and the air may become very still. A cloud of debris can mark the location of a tornado even if a funnel is not visible. It is not uncommon to see clear, sunlit skies behind a tornado.

Tornadoes generally occur near the trailing edge of a storm. The average tornado moves from the southwest to the northeast, but has been known to move in any direction. The average forward speed of a tornado is 30 miles per hour, but may vary from stationary to 70 miles per hour. Waterspouts are tornadoes that form over water.

Part 3
Protecting Yourself and Your Family

This part of the handbook covers the topic of protecting yourself and your family from natural hazards. In particular, it is important that your household have a stock of emergency supplies, an evacuation kit, and an evacuation plan, for a hurricane, tornado, and/or flooding event, since they will differ based on the type of hazard. You should discuss and practice the plan with your family once a year, or whenever there is a major lifestyle change (for example, when a member of the family goes to a new school or is working in a different location).

3.1 EMERGENCY SUPPLIES FOR THE HOME

The general rule when preparing for a hazard event is to be self-sustaining for a minimum of 72 hours.[13] Depending on the severity and impact of the event, basic supplies may be unavailable or inaccessible for several days thereafter. If you are sheltering in place or returning home while utilities are still disrupted, one to two weeks' worth of supplies is advised. If the space is available and the house is well-protected, stocking up is worthwhile. Emergency supplies should be assembled as soon as possible; do not wait until an emergency to gather supplies. Items should be checked monthly to ensure they are fresh; do not keep expired supplies. Emergency supplies should include at least the following:

Food

- Non-perishable food – dry or canned goods, snacks
- Manual can opener
- Paper plates, plastic utensils, cups, etc.
- Baby food, formula, and bottles, if needed

Water

- Supply: 1-2 gallons per person per day for drinking, cooking, and hygiene. Remember that children, nursing mothers, the elderly, and sick individuals require more water.
- Storage: Large, reusable containers should be well-rinsed and filled prior to the storm. Empty 14- or 15-gallon barrels can also be purchased online.

First Aid and Sanitation Items

- General first aid kit – bandages, aspirin, coldpacks, etc.
- Special medications and a list of prescriptions
- List of physicians providing care for specific or chronic health conditions
- Personal hygiene items, toilet paper, feminine products, and diapers, as needed
- Disinfectant, hand sanitizer
- Sunscreen, bug repellant

Other Items

- Cell phone and charger
- List of emergency telephone numbers, in case cellphones are not working
- Extra cash, since ATMs may not be working
- Flashlight and extra batteries
- Portable radio or a NOAA all-hazard weather radio, with extra batteries
- Matches and a lighter
- Copies or electronic back-up of important documents, including driver's license, social security card, proof of residence, insurance policies, deeds, birth and marriage certificates, and medical records
- Bedding and clothing (including rain gear) for each person

- Paper and pencils
- Games and books for children
- Pet supplies and documentation (vaccines, microchip number, etc.)
- Waterproof plastic sheeting or tarp, adhesive tape, and rope
- Alternate power supplies: inverters, power stations, generators (with gas tanks if needed)

Examples of Emergency Supplies

Source: retrieved April 24, 2018, from www.cdph.ca.gov/Programs/EPO/Pages/PrepareanEmergencySupplyKit.aspx

3.2 EVACUATION KIT

An evacuation kit differs from a stock of emergency supplies because this kit is taken with the homeowner if an evacuation is necessary and is subject to the space available in a car, on public transportation, or at an evacuation shelter. The components of the evacuation kit should be stored in one place so that everything is ready to go at a moment's notice. Keep this kit in a designated place and make sure all family members know where the kit is kept. It is still recommended that you pack enough supplies to last at least 72 hours.

The kit should include the following at a minimum:

- Cell phone and charger
- List of emergency telephone numbers, in case cellphones are not working

- Cash, since ATMs may not be working
- Key personal records – driver's license, birth certificate, and proof of residence, homeowner's insurance, and health insurance, etc.
- One gallon of potable water per person per day
- Supply of nonperishable foods
- Change of clothes, personal hygiene items, and towels
- Prescription medications and list of any medical care directives
- First aid kit
- Flashlights, portable radio, and batteries
- Pillows, blankets, sleeping bags, or air mattresses
- Gas tanks for refueling a car, if applicable
- Pet supplies and documentation

3.3 EVACUATION PLANNING

3.3.1 PREPARE YOUR FAMILY

An evacuation plan should be created and reviewed with all participants every year. When forming an evacuation plan, here are some things to consider:

- Stay alert, stay calm, and be informed. Tuning in to local radio and television stations is important. Listen to your local radio and television stations carefully as there may be additional or modified directions based on the best available information at that time.
- The Texas Department of Transportation has hurricane information, evacuation maps, and up-to-date road conditions available on their website. Visit these webpages for assistance: https://www.txdot.gov/inside-txdot/division/traffic/safety/weather/hurricane.html and https://drivetexas.org.
- Evacuation plans should consider all members of a household, especially those with special health needs. Practice evacuation procedures annually. Parents should learn their child's school's evacuation plans and confirm where students will be held and for how long in the event of a disaster. Parents should not drive to school to pick up their children unless directed to do so by school officials.

- If needed, develop a plan to help the disabled or those with limited mobility. If people with special health needs are with a care-provider, confirm that the care-provider has an evacuation plan.
- Develop a plan for your pets. Be advised that not all shelters take pets. Listen to local radio or check with the American Red Cross to determine if there are any pet-friendly shelter locations nearby. Plan ahead and visit the Humane Society of the United States for information on creating evacuation kits for your pet: http://www.humanesociety.org/issues/animal_rescue/tips/pets-disaster.html?credit=web_globalfooter_id93480558. Microchip pets at your veterinarian's office or local Humane Society well in advance of a storm event to aid in the quick identification and return of your pet in case you are separated during an emergency.
- Consider how family members and friends will communicate if they become separated. Create a list of telephone numbers and email addresses of everyone in the family and phone numbers of a few contacts outside of the family.
- Vehicles should be kept in good operating condition and gas tanks should be full. Ensure all emergency kits are packed.

3.3.2 PREPARE YOUR PROPERTY

In addition to preparing a stock of emergency supplies, an evacuation kit, and an evacuation plan, there are preparations you and your family should take to secure your property before you evacuate.

- Wedge sliding glass doors with a brace or broom handle to prevent them from being lifted from their tracks or being ripped loose by wind vibrations.
- Deploy window protections well in advance of the arrival of any winds.
- Bring in any outdoor objects such as patio furniture, hanging plants, trashcans, large planters, and barbecue grills.
- Adjust refrigerator temperatures to the coldest settings to reduce the potential for food spoiling if the power is temporarily lost. If power is lost during the event, try not to open the refrigerator unless necessary. Put several containers of water in the freezer — this will help keep items frozen or cold longer.

- Package valuables, such as jewelry, titles, deeds, insurance papers, licenses, etc., for safekeeping in waterproof containers. Do not forget to protect your family photos. Large plastic zipper seal bags make for quick and secure storage of your irreplaceable family memories.
- All digital information should be fully backed up, preferably offsite. If you leave your home, it is wise to take your hard drive with you. If you have everything already backed up on an external drive, take that with you as well. Protect any hard drives that remain in your home.
- If an evacuation is necessary, shut off electricity at the main switch near the meter, turn off gas to prevent leaks from occurring, and turn off water to prevent flooding from broken pipes.
- Store chemicals, fertilizers, or other toxic materials in a safe section or secure area of the premises. Propane tanks should not be stored near sources of heat.
- Moor boats securely or move them to designated safe areas well in advance of hurricanes. Do not attempt to tow a trailer or boat in high winds.

3.3.3 EMERGENCY ALERTS

The Emergency Alert System (EAS) is the official source of natural hazard information and instructions in Texas. This information can originate from county, state, or federal agencies. The statewide network may be activated by the National Weather Service to disseminate weather-related watches or warnings.

If an alarm sounds, turn on the radio. Some radios with the NOAA weather radio band turn on automatically when an emergency broadcast through the EAS is announced. The NOAA weather radio station broadcasts round-the-clock weather information and announcements from the EAS system. Many local radio stations voluntarily agree to participate in the EAS system (see the coastal radio stations in Table 3-1). Apps are also available for download that will deliver weather alerts to your smart phone. Additional information may be issued on local or cable television networks, and through local community websites or social media.

Table 3-1. Emergency Alert System – Radio Stations
Source: retrieved April 24, 2018,
from www.tab.org/emergency-systems/texas-state-eas-plan

City	Local Primary 1	Local Primary 2	Local Primary Spanish	National Weather Service
Austin	KLBJ 590 AM	KASE 100.7 FM		WXK-27 162.4 VHF
Beaumont	KLVI 560 AM	KQXY 94.1 FM		WXK-28 162.475 VHF
Bryan-College Station	KJXJ 103.9 FM	KSAM 101.7 FM		WXK-30 162.55 VHF
Corpus Christi	KNCN 101.3 FM	KZFM 95.5 FM		KHB-41 162.55 VHF
Houston	KTRH 740 AM	KUHF 88.7 FM	KLAT 1010 AM	KGG-68 162.4 VHF
Laredo	KRRG 98.1 FM	KJBZ 92.7 FM		WXK-26 162.475 VHF
McAllen	KFRQ 94.5 FM	OPEN		KHB-33 162.4 VHF
San Antonio	WOAI 1200 AM	KKYX 680 AM		WXK-67 162.55 VHF
Victoria	KIXS 107.9 FM	KVNN 1340 AM		WXK-34 162.4 VHF

When listening to alerts, note the difference between a hazard watch and a hazard warning. Definitions of watches, warnings, and hazards are provided below. Depending on the alert, there are different actions to take. Also, note that civil defense or emergency management agencies may issue a mandatory evacuation in the case of a hurricane warning.

Familiarize yourself with these terms:

Flood Watch. Issued when flash flooding or flooding is possible within the designated watch area. Homeowners should be prepared to move to higher ground and should listen to NOAA weather radio, local radio, or local television stations for information.

Flood Warning. Issued when flash flooding or flooding has been reported or is imminent. Take necessary precautions at once and avoid going through flooded areas as the force of the water may cause your vehicle to drift into the water. Turn around, don't drown. If advised to evacuate to higher ground, do so immediately.

Tropical Depression. An organized system of clouds and thunderstorms with a defined surface circulation and maximum sustained winds of 38 miles per hour (33 knots) or less. Sustained winds are defined as one-minute average wind measured at about 33 feet (10 meters) above the surface.

Tropical Storm. An organized system of strong thunderstorms with a defined surface circulation and maximum sustained winds of 39-73 miles per hour (34-63 knots).

Tropical Storm Watch. Issued when there is a good possibility of tropical storm conditions and associated damaging winds, surf, and flooding rains occurring anytime within 36 hours. Homeowners should prepare their homes and review plans for evacuation in case a tropical storm warning is issued.

Tropical Storm Warning. Issued when there is a high probability of tropical storm conditions occurring anytime within 24 hours. Homeowners should complete all storm preparations and leave the threatened area if directed by local officials. A tropical storm warning may not always be preceded by a tropical storm watch.

Hurricane. An intense tropical weather system of strong thunderstorms with a well-defined surface circulation and maximum sustained winds of 74 miles per hour (64 knots) or higher.

Hurricane Watch. Issued when there is a good possibility of hurricane conditions and associated damaging winds, surf, and flooding rains occurring anytime within 36 hours. Homeowners should prepare their homes and review plans for evacuation in case a hurricane warning is issued.

Hurricane Warning. Issued when there is a high probability of hurricane conditions occurring anytime within 24 hours. Homeowners should complete all storm preparations and leave the threatened area if directed by local officials. A hurricane warning may not always be preceded by a hurricane watch.

Storm Surge. A dome of water pushed onshore by hurricane and tropical storm winds. Storm surges can reach 25 feet high and be 50-100 miles wide.

Storm Tide. A combination of storm surge and the normal tide (i.e., a 15-foot storm surge combined with a 2-foot normal high tide over the mean sea level creates a 17-foot storm tide).

3.4 EVACUATION PROCEDURES

If an evacuation has been called, follow the order issued by officials. Emergency and rescue services may not be available for assistance during the storm, and other communications may be rendered inoperable. Get out of the danger area as soon as authorities indicate it is time to do so. Leave as early as possible to avoid traffic, preferably in daylight, and have your destination planned well in advance. However, evacuate only when it is your area's time — not before!

Listen to your local TV or radio station for shelters that are open to the public. You can also search for open shelters on an interactive map online on the Red Cross webpage http://www.redcross.org/get-help/disaster-relief-and-recovery-services/find-an-open-shelter. Evacuation shelters have a maximum space of 10 square feet of bare floor per individual. Bedding, food, water, and other essentials may or may not be provided, so your evacuation kit (see section 3.2) should contain these important items.

3.4.1 EVACUATION FOR A HURRICANE

Do not be deceived into disregarding an evacuation order for a Category 1 or 2 hurricane. Hurricane Ike was a Category 2 hurricane based only on sustained wind speed; however, the overall size and 15-foot storm surge made it one of the most destructive and deadly hurricanes to strike the

Texas coast. "Run from the water, hide from the wind" is a hurricane adage that has been used from Florida to Texas by emergency management teams for hurricane response.[14] Despite the adage, you should especially abide by the evacuation order if any of the following conditions apply:

- You live in a mobile home or temporary structure.
- You live in a high-rise building.
- You live on the coast, in a floodplain, near a river, or on a peninsula or barrier island.
- You live in a Special Flood Hazard Area (Zone A) or a high-velocity wave/storm surge zone (V zone).
- You live in a certain type of wood frame structure (e.g., single wall without a continuous load path design) or lightly constructed building.
- You live in an area that has been directed to evacuate by local authorities.

County judges and city mayors have the authority to order an evacuation. When you evacuate, locate a place that is far from flood or inundation zones and far from the projected track of the storm, and stay in a structure that is able to withstand strong winds and rain. To implement a large-scale, multi-jurisdictional evacuation, evacuation zones have been designated by the Texas Department of Public Safety and are based on the severity of the storm.

3.4.2 EVACUATION FOR A FLOOD

The general rule for evacuating from a flood is to stay away from floodwaters and head to higher ground. In flooded areas, you may not be able to perceive the depth of the water, the condition of the ground under the water, or debris contained in the water. This is especially true at night, when vision is limited. Never attempt to cross through flooded roadways – roadbeds may be washed out. If caught in a home during a flood, go to the second floor or the roof, but do not go into the attic where ventilation is limited.

Basic Safety Tips [15]

- **Turn Around, Don't Drown!®**
- Avoid walking or driving through floodwater. Just 6 inches of moving water can knock you down, and 1 foot of moving water can sweep your vehicle away. Water may also contain dangerous debris, chemicals, or insect swarms.
- Do not drive on bridges that are over fast-moving floodwater. Floodwater can scour foundation material from around the footings and make the bridge unstable.
- If there is a chance of flash flooding, immediately move to higher ground.
- If floodwater rises around your car, do not open your doors, but unbuckle your seatbelts and roll down your windows. Get all passengers out through the windows and onto the top of the car until help comes.
- During heavy rainfall, avoid camping or parking along streams, rivers, and creeks. These areas can flood quickly and with little warning.

3.5 EMERGENCY INFORMATION AND CONTACTS

The NOAA Extreme Weather Information Sheet (NEWIS) for each state, including Texas, is updated each year with current information, phone numbers, and websites relevant to weather emergencies (Figure 3-1). To download the latest version of this sheet, go to https://service.ncddc.noaa.gov/rdn/www/activities/weather-ready-nation/newis/documents/Texas.pdf.

The Texas Division of Emergency Management website at http://www.dps.texas.gov/dem/ is also an important source of information. The best time to contact them is not during an emergency, but during the planning and preparing phase of emergency preparedness. For general emergency information, contact your local Office of Emergency Management.

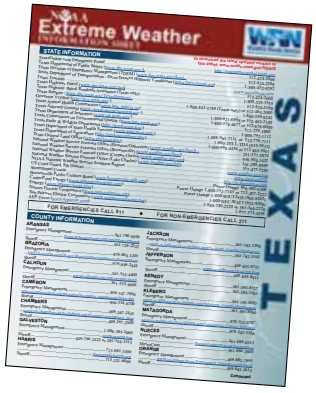


Figure 3-1. NOAA Extreme Weather Information Sheet

Source: retrieved August 8, 2018, from http://service.ncddc.noaa.gov/rdn/www/activities/weather-ready-nation/newis/documents/Texas.pdf.

3.6 ELECTRICAL AND POWER ISSUES

By following key safety precautions when dealing with electricity during and after storms and other disasters, you can help prevent death, injuries, and property damage. Take care when stepping into a flooded area and be aware that submerged outlets or electrical cords may energize the water, potentially posing a lethal trap.

In case of an emergency, the power to your house should be turned off through the main breaker switch, circuit breaker panel, or fuse box. In addition, all homes should be equipped with ground fault circuit interrupters (GFCIs). GFCIs are inexpensive electrical devices that, if installed in household branch circuits, are designed to protect people from severe or fatal electric shocks. GFCIs could prevent over two-thirds of electrocutions.[16] Because a GFCI detects ground faults, it can also prevent some electrical fires and reduce the severity of others by interrupting the flow of electric current. GFCIs are commonly found in kitchens, bathrooms, laundry rooms, or other places where water and electricity are close together. If you do not have them, consider having them installed by a licensed electrician.

Flooded Areas

Wet Electrical Equipment

Do not use electrical appliances that have been wet. Water can damage the motors in electrical appliances such as furnaces, freezers, refrigerators, washing machines, and dryers.[17] For more information, the National Electrical Manufacturers Association (NEMA) has produced a brochure, Guidelines for Handling Water Damaged Electrical Equipment, for use by suppliers, installers, inspectors, and users of electrical products to provide advice on the safe handling of electrical equipment that has been exposed to water. It outlines which items will require complete replacement or can be reconditioned by a trained professional. Equipment covered includes electrical distribution equipment, motor circuits, power equipment, transformers, wire, cable and flexible cords, wiring devices, GFCIs and surge protectors, lighting fixtures and ballasts, motors, electronic products including signaling, protection, communication systems, industrial controls and cable trays.[18] The NEMA brochure can be downloaded free of charge at http://www.nema.org/Communications/Pages/Publications.aspx.

Downed Power Lines

These can carry an electric current strong enough to **cause serious injury or death** (Figure 3-2). The following tips can keep you safe around downed lines:[19]

Figure 3-2. Damaged power line poses danger to neighborhood.

Source: EPA

- If you see a downed power line, move away from the line and anything touching it. The human body is a ready conductor of electricity.
- The proper way to move away from the line is to shuffle away with small steps, keeping your feet together and on the ground at all times. This will minimize the potential for a strong electric shock. Electricity wants to move from a high voltage zone to a low voltage zone — and it could do that through your body.
- If you see someone who is in direct or indirect contact with the downed line, do not touch the person. You could become the next victim. Call 911 instead.
- Do not attempt to use another object such as a broom or stick to move a downed power line or anything in contact with the line. Even nonconductive materials like wood or cloth, if slightly wet, can conduct electricity and then electrocute you.
- Be careful not to put your feet near water where a downed power line is located.
- If you are in your car and it is in contact with the downed line, stay in your car. Tell others to stay away from your vehicle.

- If you must leave your car because it is on fire, jump out of the vehicle with both feet together and avoid contact with the live car and the ground at the same time. This way you avoid being the path of electricity from the car to the earth. Shuffle away from the car.
- Do not drive over downed lines.

3.6.1 ALTERNATIVE POWER SOURCES

Energy efficient equipment will be especially useful during an emergency, when you may be on alternative forms of power with limited supply. For example, a regular 100-watt lamp running off an emergency power station (essentially built around a car battery) may run for two hours. That same emergency station can run a fuel-efficient 23-watt compact fluorescent light for about 8-9 hours with the same light output. As another example, a refrigerator with U.S. Environmental Protection Agency's (EPA) Energy Star label can run on a fuel-efficient generator for 16 hours on one gallon of gas. Since most refrigerators do not need to run continuously, it may be possible to run the efficient refrigerator on one gallon of gas for one or two days.

Therefore, you should strive to make your house as energy efficient as possible as you replace equipment and appliances in your house at the end of their normal life. For example, if the lights, television, or refrigerator need replacing, consider products with the Energy Star label (Figure 3-3). These products may cost slightly more, but over their lifetime, the energy savings will far outweigh the small initial cost increase.

Figure 3-3. Energy Star appliances use less energy than standard appliances.

Source: EPA

3.6.2 GENERATORS

Some households may require uninterrupted power because of the critical needs of some family members. For example, the elderly, disabled, or sick may require a respirator, dialysis machine, or other medical equipment. Some medicine such as insulin, which is stored over a month, may need to be refrigerated. For many families, the most important major power requirement is to run a refrigerator or freezer. If your family cannot get

by without the refrigerator, or there are other critical power needs for medical or other purposes, then you may want to consider a portable generator (Figure 3-4).

Figure 3-4. Example of a Generator

While portable electric generators can provide a good source of power, if improperly installed or operated, they can become deadly. Do not connect generators directly to household wiring. Power from generators can backfeed along power lines and electrocute anyone coming in contact with them, including utility workers making powerline repairs. A qualified, licensed electrician should install your generator to ensure that it meets local electrical codes.[20]

Other generator-related tips include:

- Make sure your generator is properly grounded.
- Keep the generator dry.
- Plug appliances directly into the generator.
- Make sure extension cords used with generators are rated for the load, and are free of cuts or worn insulation and have three-pronged plugs.
- Do not overload the generator.
- Use a ground fault circuit interrupter (GFCI) to help prevent electrocutions and electrical shock injuries.

Most importantly, **never run a generator indoors or in your garage** because of the possibility of carbon monoxide gas accumulation, which cannot be detected by smell. Good ventilation is required. Operate your generator outside and away from open windows. Do not hook up a generator to your house power supply without a licensed electrician.

In general, when running your refrigerator with a generator, keep the refrigerator and freezer at the coldest setting. Refrigerators may only need to run a few hours a day to preserve food. Using a refrigerator thermometer, you should aim to maintain 40 degrees in the refrigerator compartment and 0 degrees in the freezer. Open the refrigerator door as little as possible.

3.6.3 POWER STATIONS

Power stations are found in many hardware stores and may have a radio, flashlight, air compressor, battery jump starter, AC outlet, or DC outlet built around a modified car battery (Figure 3-5). These units can come in handy during a power outage, since they fulfill part of your stock of emergency supplies and provide limited emergency power.

Figure 3-5. Example of a Power Station

3.6.4 PORTABLE CHARGERS

Several models of small, portable chargers are available that can be used to charge electronic devices like smart phones, tablets, or laptop computers. It should be noted that during or after an emergency, there might be other reasons the devices do not work that are beyond your control, such as heavy traffic or a disrupted internet connection.

3.6.5 INVERTERS

Inverters take the 12-volt DC power from your car battery and convert it to 115-volt AC power that can run household appliances. This can be very important if you need to use power tools in an emergency and the power is out. The inverter will drain your car battery, but you can find inverters that have a low battery shutdown feature to prevent total battery drain. You should not run an inverter with the car running unless the manufacturer provides specific instructions with safety guidelines. In addition, the car should not be run in a garage, but rather in a well-ventilated area, if the manufacturer approves of such procedures.

3.6.6 BATTERY CHARGERS

Your car battery can be an important source of DC and AC power with an inverter. To keep the car battery charged, you should consider a battery charger as part of your emergency supplies. The charger only works when there is household power or backup power through a generator, but it can recharge your car battery if it is needed. New units are small and portable and provide a quick charge to a dead battery in only a few minutes and a total charge in a few hours.

Part 4
Protecting Your Home and Property

Homeowners can take several steps to protect their property and reduce property damage caused by natural disasters. This section of the Homeowner's Handbook briefly covers roof and foundation enhancements, flood prevention measures, and coastal velocity flood-zone concerns. Additional details on structural protection are available from FEMA.

The Mitigation Directorate of FEMA is continuously researching hurricane-resistant designs and building methods for the construction and performance of structures impacted by storms. Numerous FEMA publications are available online at https://www.fema.gov/building-science-publications-flood-wind.

A particularly important manual to reference is the Home Builder's Guide to Coastal Construction (FEMA P-499). The manual contains 37 fact sheets providing technical guidance and recommendations concerning the construction of coastal residential buildings. The fact sheets present information aimed at improving the performance of buildings subject to flood and wind forces in coastal environments. Many of the fact sheets also include lists of FEMA's and other resources that provide more information about the topics discussed. The fact sheets can be accessed at https://www.fema.gov/home-builders-guide-coastal-construction-technical-fact-sheet-series-fema-p-499.

Another important document to reference is the Wind Retrofit Guide for Residential Buildings (FEMA P-804), which summarizes the technical information needed for selecting and implementing cost-effective wind retrofit projects for residential buildings. The guide presents mitigation measures in packages, which are required sets of retrofit measures that must be implemented for a home to provide a consistent level of protection, and identifies three successive protection packages: Basic, Intermediate, and Advanced. Implementing the mitigation packages in this guide on existing vulnerable homes within the hurricane-prone regions of the United States will result in their improved performance in high-wind events. The guide can be downloaded as a PDF at https://www.fema.gov/media-library-data/20130726-1753-25045-2304/508versioncombined_804.pdf.

4.1 CREATING THE WIND- AND RAIN-RESISTANT STRUCTURAL ENVELOPE

The building envelope consists of the roof, exterior walls, and exterior doors and windows. Protecting the structural envelope during a storm is essential to preventing water intrusion associated with roof and window damage.

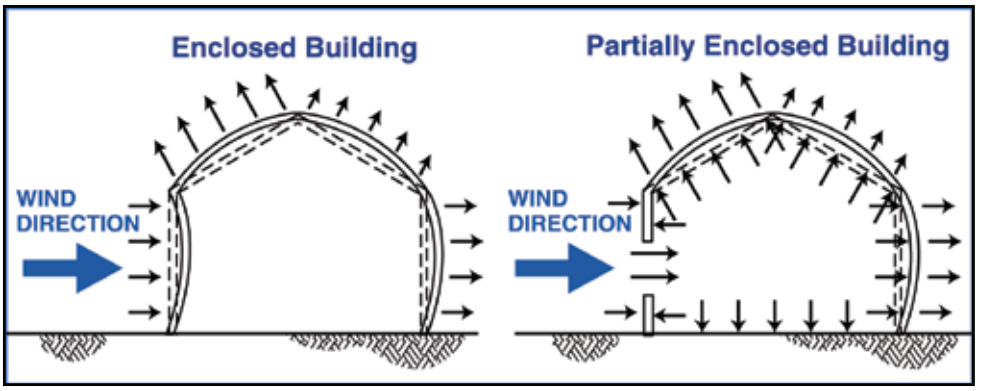


Figure 4-1. The Wind- and Rain-Resistant Structural Envelope

Source: FEMA Coastal Construction Manual

In Figure 4-1, the structure on the left has its wind- and rain-resistant envelope intact. Pressure on the walls and roof comes from the outside only. The wind- and rain-envelope for the structure on the right, however, has been breached due to a broken window. Now, pressure on the walls and roof comes from outside and inside the structure. The total amount of pressure on the roof and leeward wall increases significantly and can lead to the roof flying off and complete structural failure.

It is important to recognize that strengthening your home for wind resistance is a top-down process. Strong winds create uplift on homes and cause them to lift off the ground rather than fall over vertically. By connecting the highest components of the home with lower components, the connected system gets progressively heavier and harder for the wind to pick up. Wind design and retrofitting of homes should start at the top of the roof and work down, ideally into the foundation and the ground. Conversely, designing and retrofitting for flood protection are bottom-up processes, for which floodproofing and freeboarding are common techniques (see section 4.2).

4.1.1 STRUCTURAL STABILITY

Roof Framing and Bracing

There are two common types of roof framing for a house (see Figure 4-2). Gable-end roofs have two flat ends that are A-shaped, and two sloped sides. Hip roofs have all four sides of the roof sloping towards the center of the roof. Hip-style roofs do not need as much bracing, as they are aerodynamically superior and have the bracing built into the design. During a hurricane, gable-end roofs are vulnerable to intense winds battering on their flat ends. If one of these ends collapses, it can damage or knock down other trusses in a domino effect.

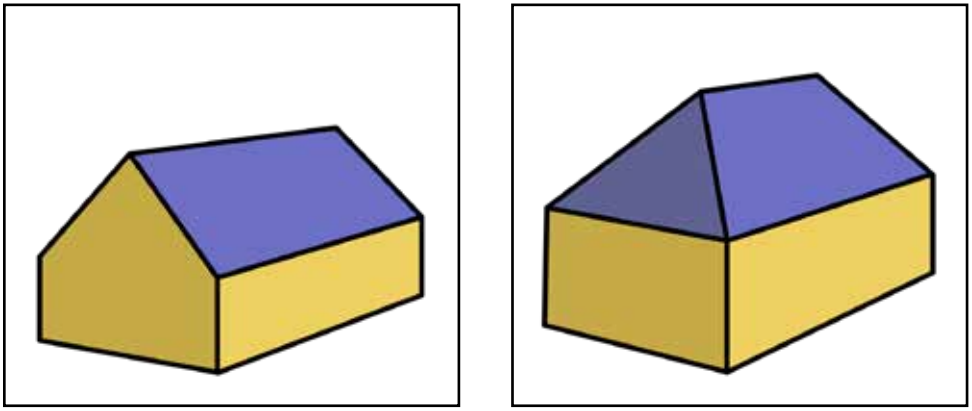


Figure 4-2. Gable-end roof on the left. Hip roof on the right.

Source: retrieved April 24, 2018, from www.commons.wikimedia.org/wiki/Category:Roof_forms

Strengthening a gable-end roof is recommended and can be done by adding lateral and diagonal bracing. Figures 4-3 and 4-4 demonstrate gable end bracing. These images can be found in the FEMA brochure "Against the Wind" (FEMA 247). For lateral bracing, 2x4s are attached to the trusses and run the length of the roof. Several runs should be made from the ridge down to the wall; spacing depends on the height of your roof. Diagonal bracing runs from the top of the gable end to the bottom of the fourth truss, and from the top of the fourth truss to the bottom of the gable end.

Many FEMA publications can be found at https://www.fema.gov/media-library#{}. Additional information regarding roof bracing can be found at the Insurance Institute for Business and Home Safety (IBHS) website at http://www.disastersafety.org.

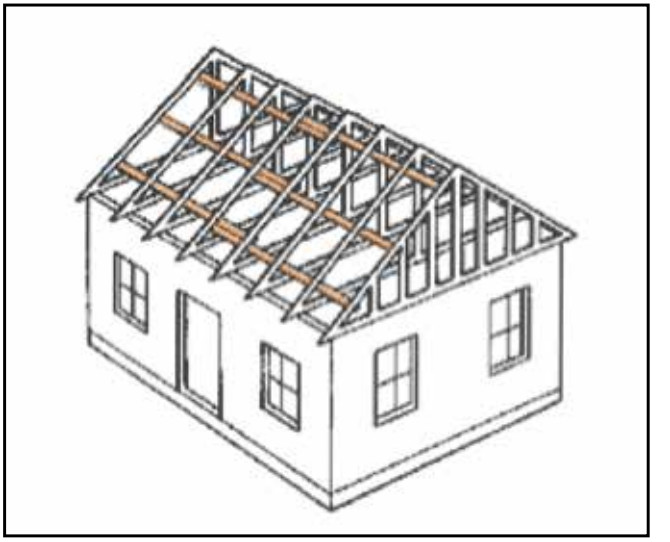


Figure 4-3. Lateral bracing consists of 2x4s running the length of the roof and overlapping where they meet each other.

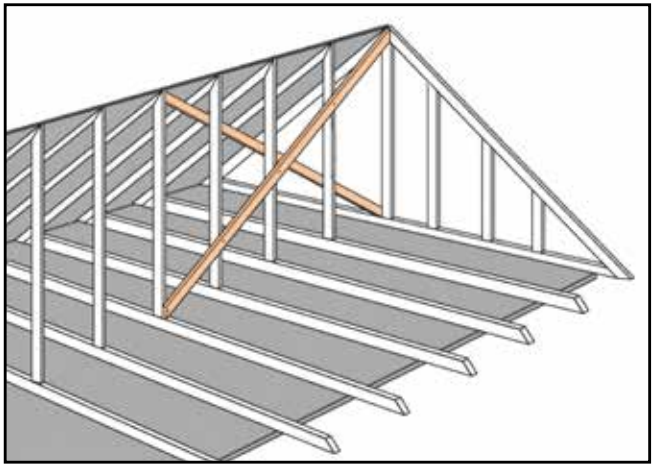


Figure 4-4. Diagonal bracing runs from the top of the gable end to the bottom of the fourth truss, and from the top of the fourth truss to the bottom of the gable end.

Continuous Load Path Connections

All houses have some connection from the roof to the foundation; otherwise, they would fall apart. The continuous connection from the roof to the foundation is often called a "Load Path" and it is analogous to a chain — it is only as strong as the weakest link. In response to recent hurricane damages, much stronger connections are now required to protect against hurricane winds. New homes are designed with continuous load path connections; older homes may need to be retrofitted to add load path components. The specifics of the continuous load path connection are illustrated in Figure 4-5. The roof is tied to the wall, typically with hurricane clips and plate ties. The wall of a higher story is tied to a lower story with straps. The walls are tied to the foundation with plate ties and anchors.

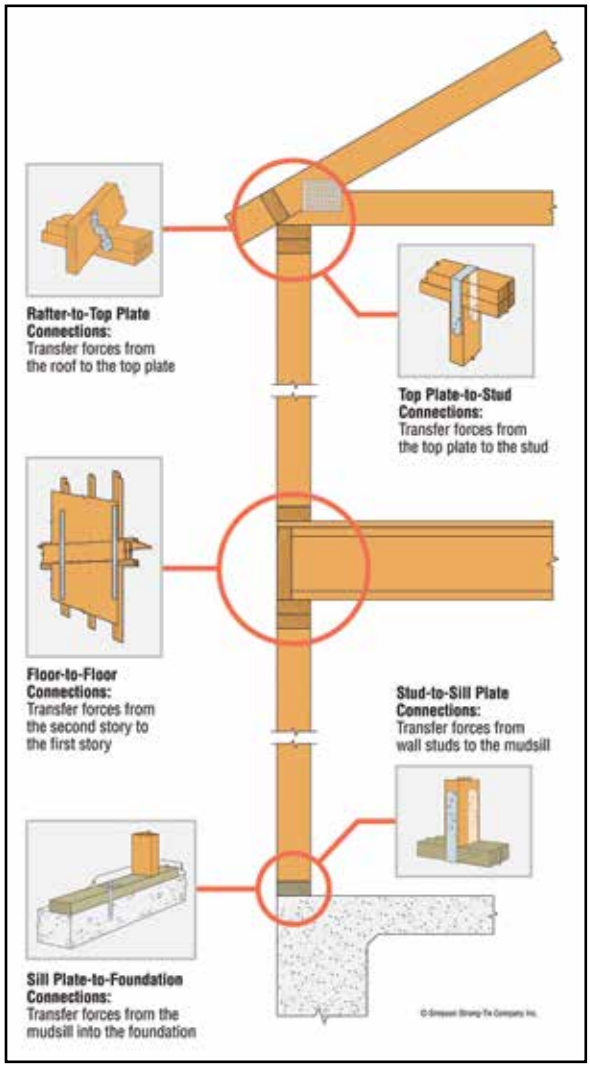


Figure 4-5. Continuous Load Path Connections

Source: Simpson Strong-Tie Company, Inc.

The weakest link for many homes is the roof-to-wall connection. The hurricane clip (aka hurricane tie) was created to improve this connection. There are several types of hurricane clips (Figure 4-6); which one should be used on your home depends on the design and the load of the house. A properly selected hurricane clip is required for each truss or rafter.

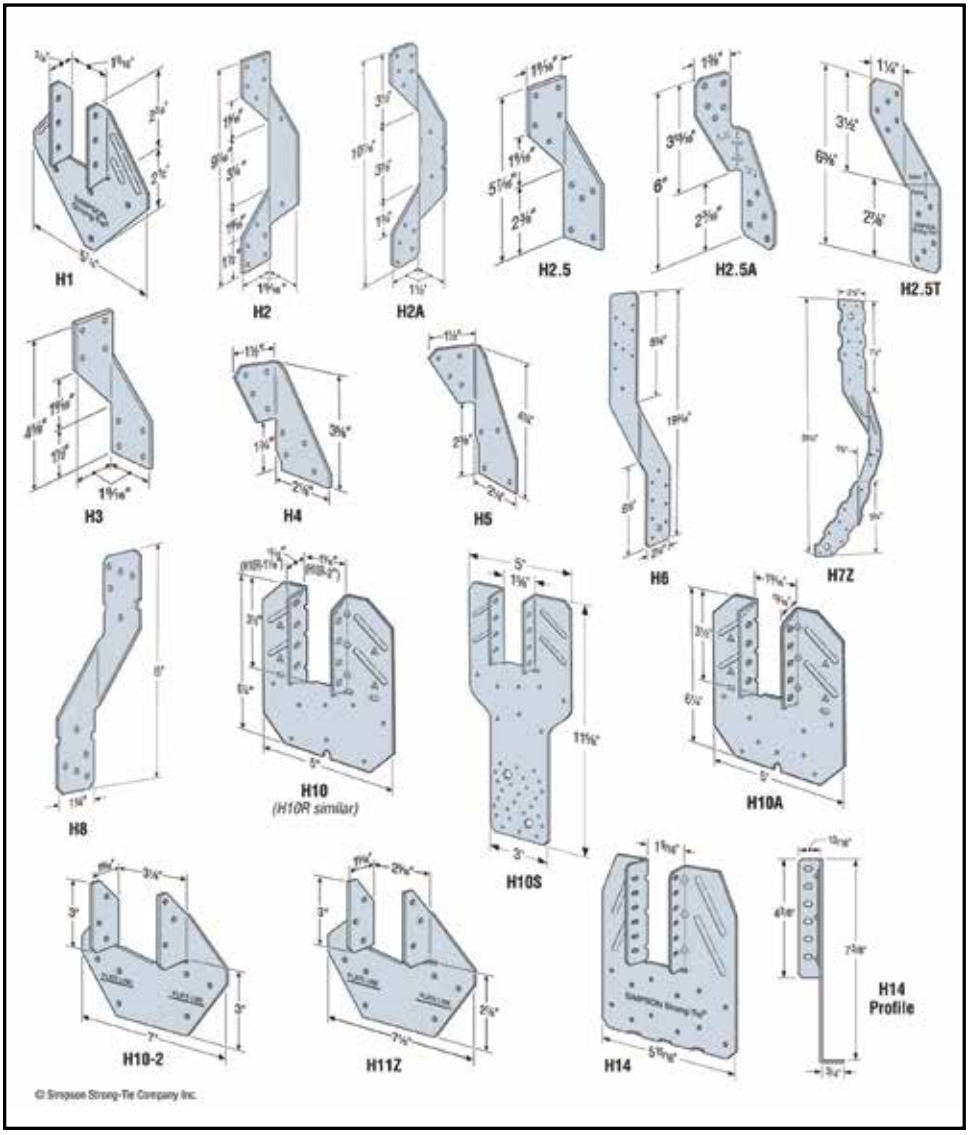


Figure 4-6. Examples of Hurricane Clips

Source: Simpson Strong-Tie Company, Inc.

For older houses, it is possible to add load path connections. Each house is different but, in general, it will be easier and less expensive to put in hurricane clips than to add wall to foundation ties. Hurricane clips help to keep your roof from blowing off during a hurricane. Check with a licensed structural engineer or architect to determine what is a feasible retrofit for your house. You can then determine if you can do the retrofitting yourself, or if you will need to hire a licensed contractor.

4.1.2 KEEPING WATER OUT

Roofing Materials

Several layers of materials add to the structural strength of a roof and keep water out from the interior of the house. After the roof decking goes on, the next layer on top is called an underlayment. Felt material is the most common underlayment that is paired with shingles. Synthetic roof underlayment recently began replacing traditional roofing felt. Synthetic materials were used as an expedient material for temporary roof repair after hurricanes in the southern United States. It was then discovered that they resisted tearing, moisture, and ultraviolet rays better than asphalt-saturated felt.

Window Coverings

Protection of your home's envelope from breaches during a windstorm is critically important, particularly its vulnerable windows and doors. If your home is located in a windborne debris zone (any location where the basic wind speed for code purposes is 120 miles per hour or greater), it is important that window coverings not only withstand hurricane-force winds, but also withstand impacts. The usual standard for impact resistance is known as the "Large Missile Impact Test" as defined by several similar norms. Essentially, these tests determine whether a given shutter can withstand the impact of a 9-pound 2x4 fired at the shutter at 30+ miles per hour, followed by cyclic wind load testing.

Coverings that are installed should be tested and approved to meet industry standards for hurricane impact. Check with the manufacturer, and always use only licensed contractors and reputable dealers.

The International Hurricane Protection Association (a trade association group comprising manufacturers, contractors and other industry professionals) has several tips regarding selection of projects, selection of installing contractors, and other useful information on its website: http://www.inthpa.com.

Several types of window coverings available are described on the following pages. Within each category, numerous reputable manufacturers provide different products, each with individual features, benefits, and cost. Pricing will vary between providers and will change over time. We encourage you to consult with a competent contractor specializing in supplying and installing these systems.

Roll-Down Shutters

Roll-down shutters represent the window covering type that is easiest to deploy and offers the best overall protection features (Figure 4-7 and 4-8). These are permanently attached to the building. The shutter consists of a movable "curtain" of slats that is held in place by vertical tracks. When not deployed, the shutter stores in a hood that is housed above the window or door being protected. Most of the components of roll-down shutters are made from extruded aluminum.

Because the roll-down shutter makes solid contact with the window sill, patio deck or other structure at the bottom, this shutter type demonstrates

Figure 4-7. Interior of home with deployed roll-down shutters. Roll-down shutters can be used not only for storm protection, but also for security, privacy, light, heat, and noise control.

Source: Roll-a-way/QMI.

Figure 4-8. Coastal home protected with roll-down shutters on all windows and doors. The shutter is held in place by vertical guide tracks and can be deployed manually or with an integrated electric motor.

Source: Roll-a-way/QMI.

the highest level of protection against wind-driven rain in addition to wind and debris. Roll-down shutters can be deployed using a variety of operators, both manual and electric motor types. These can be installed directly over windows and doors, or in some cases, at balcony's edge to form an enclosure.

Since roll-down shutters are easily deployed, these often are used on a regular (non-storm) basis for light control, insulation against heat and noise, or for privacy and security. The variety of features and methods of operation lead to a wide range of costs for this shutter type.

Accordion Shutters

One of the most commonly used shutter types in hurricane-prone regions is the accordion shutter (Figure 4-9). This is a permanently installed system with interconnected "blades" that operate between horizontal tracks. When not in use, the blades fold and are stored on either side of the door or window being protected. Accordion shutters are manually deployed and can be deployed from the inside of the home, if the opening is a single- or double-hung window or an in-swinging window or door.

Figure 4-9. Accordion shutter (shown in open position) installed over a large window group of a coastal home. Shutter has been installed to allow deployment from inside the home.

Source: Roll-a-way/QMI.

Decorative/Protective Shutters

For homeowners who wish to add a decorative flair to their home's exterior, Bahama or Bermuda and colonial-type shutters are available for window protection (Figures 4-10 and 4-11). These are most commonly made using extruded aluminum frames and louvers, although some composite materials are also used. Typically, these are finished using a durable exterior-grade powder coating or automotive-grade polyurethane paint system. However, it should be noted that neither traditional wood shutters, nor these wood look-alike shutters, have been tested and approved for any category of hurricane or windspeed.

Figure 4-10. Bahama shutters made from durable extruded aluminum components add "Island" flair to a home and provide opening protection.

Source: Roll-a-way/QMI.

Figure 4-11. Colonial shutters made from durable extruded aluminum components add a traditional look to the home and protect window openings.

Source: Roll-a-way/QMI.

Storm Panels

Removable storm panel systems (Figures 4-12 and 4-13) are one of the most widely used and cost-effective systems available for opening protection. These consist of a series of panels, made from steel, aluminum, or impact-resistant polycarbonate.

Figure 4-12. Although installation varies, this example shows panels that slip into a track above the window. The bottoms of the panels are secured by bolts that permanently attach to the window.

Source: Hurricane Secure.

Figure 4-13. These 0.050 gauge aluminum storm panels offer cost-effective storm protection. In this example, panels slip into a track above the window and secure onto a bottom track using wing nuts.

Source: Roll-a-way/QMI.

When not in use, panels are stackable for convenient storage. Wide varieties of track options are possible. While these systems are relatively inexpensive, they require much more effort for the homeowner to deploy than the other types mentioned above.

In-Place Systems

Requiring no advance deployment, impact-resistant systems that are permanently installed on a structure can be an attractive option for opening protection. Two types currently on the market are 1) impact-resistant stainless steel screen units, and 2) installed flat impact polycarbonate. Both of these have little, if any, negative aesthetic impact on the home.

Figure 4-14. In-place stainless steel impact screen protecting several windows of a coastal residence. This system requires no deployment and provides shade.

Impact-resistant stainless steel screen systems (Figure 4-14) consist of a heavy-gauge stainless steel screen mesh that is secured in an extruded aluminum frame. This unit is installed over the window to be protected. These are available as operable units, which facilitates cleaning and emergency egress. Screen units also provide excellent solar shading characteristics.

Figure 4-15. Flat impact polycarbonate panels are installed directly over windows of a coastal home. This window covering provides excellent storm protection with minimal aesthetic impact.

Source: Roll-a-way/QMI.

Flat impact polycarbonate units (Figure 4-15) are available to protect most single and double window sizes and types found in residential homes. These are made from UV-stable optical-quality grades of polycarbonate and provide excellent protection against all storm forces. Because

these systems are not operable from the inside of the home, emergency egress from the home must be considered before installing this system.

Figure 4-16. Polyethylene basket-weave fabric windscreen is deployed at the edge of a patio, enclosing the entire area.

Source: Roll-a-way/QMI.

Fabric Windscreen

Impact-resistant fabric panels made from high-tensile-strength geosynthetic fibers such as polyethylene or from reinforced polyvinyl chloride (PVC) have become increasingly popular for use as window and door protection. These systems are attached on two opposite sides of the window or door, usually to permanently installed panel mates or tracks with mounting studs. The panels include integrated grommets, which facilitate the deployment of the windscreens. These systems are also relatively inexpensive.

Figure 4-17. This attractive window can be fitted with energy-efficient glass, impact-resistant glass, or both. The impact-resistant glass consists of a laminate or film sandwiched between two glass panes. The frames are reinforced and the hinges have an extra fastener to withstand high winds. During a wind event, debris may crack the glass, but the laminate will hold the windowpane together in the frame and prevent breaching of the wind- and rain-resistant envelope. After the storm, the glass will need to be replaced.

The polyethylene fabric types, which are basket-weave systems, allow some light and visibility through the deployed screens. Some models incorporate emergency egress zippers. The PVC types are somewhat translucent, allowing light in the dwelling, but do not allow visibility through the screen.

The geosynthetic screens have also been extensively employed to enclose large, even irregularly shaped openings (Figure 4-16). Because of the installation requirements of such systems, site-specific engineering is often required, and consultation with a contractor is recommended.

Impact-Resistant Windows and Glazed Doors

Window and door manufacturers have developed products with both sturdier frames and laminated (impact-resistant) glazing to better withstand wind forces and debris (Figure 4-17). Such systems are available in a variety of styles, options, and costs. When installing any window or door, be sure to follow the manufacturer's installation standards.

While impact-resistant openings offer deployment-free protection, the glass can still be broken (but remains in the frame). In addition, while these products are often available to the consumer through home improvement stores, professional installation is highly recommended to ensure proper attachment of the windows to the structure.

Plywood

Plywood has been the most commonly used option for protection of window openings due to its low cost and ease of availability. Plywood covers (Figures 4-18 and 4-19) should be secured with fasteners, screws, or clips depending on the type of construction and exterior veneer of the

Figure 4-18. After the plywood is cut for each window, each piece should be labeled so the panels for one window are not mixed with those for another. It would also save time to indicate on the panels, well before any threat of a storm, where the fasteners will be attached.

Figure 4-19. For larger windows, such as this sliding glass door, two 2x4s face outside and are oriented with the narrow end against the plywood. The fastening screws attach from the plywood into the 2x4.

structure. To ensure performance, nails should never be used to secure plywood. Plywood offers a limited amount of protection in moderate level storms and only if it is properly installed.

The disadvantages of plywood are that it can rot or warp if stored in a wet or warm area. In addition, plywood sheets are relatively heavy. You will need two people to help with the preparation and deployment of these window coverings. Because of their weight, if would be difficult, or even dangerous, to install plywood sheets if a ladder is needed.

Most significantly, however, plywood is increasingly viewed by both code and insurance entities as an inadequate means of protecting openings. While the International Residential Code (and other similar codes) allows some use of plywood under very specific conditions, these are restricted to areas where the design wind speed is 130 miles per hour or less. Simply put, plywood does not demonstrate the levels of performance achieved by the engineered shutter types.

Window Film

An after-market product used to enhance glass breakage characteristics is commonly known as security window film. Such products are often touted as "hurricane film" or similar, claims that cannot be substantiated by testing. Application of any of these window films to existing windows does NOT constitute adequate opening protection and should not be considered for use as opening protection. For more information, visit the website of the International Window Film Association (IWFA) at http://www.iwfa.com.

For further information regarding opening protection, visit the IBHS website and review its Fortified for Existing Homes program http://disastersafety.org/fortified/homeowners/. Table 4-1 lists the advantages and limitations of each type of window covering discussed above. For most homes, a combination of different covering types is employed, based on the needs and budget of the homeowner.

Table 4-1. Pros and Cons of Various Protective Window Coverings

Type of Protection	Pros	Cons
Roll-Down Shutters	Easiest to deploy; best overall protection, especially wind-driven rain	Expensive
Accordion Shutters	Easily deployed; simple manual operation; good overall protection; modest cost	Possible aesthetic issues
Bahama Shutters	Easily deployed; "Islands" decorative flair; provides shade	Blocks some light and view
Colonial Shutters	Easily deployed; "traditional" decorative flair	Cost; requires adequate room for "swing" of shutters
Storm Panels	Removable; inexpensive	Manual deployment required; must be stored when not in use
Stainless Steel Impact Screens	Always in place; provides shade	Some aesthetic impact; egress issues must be considered; less effective for wind-driven rain
Flat Impact Polycarbonate Units	Always in place; minimal aesthetic impact	Egress issues must be considered; care must be taken in cleaning
Fabric Windscreen (Direct Mount)	Inexpensive; easy to handle and store	Manual deployment required; greater shutter deflection than metal systems
Impact-Resistant Windows and Doors	Always in place; many styles and options	Costs vary widely and can be high; glass can still break, requiring expensive replacement
Plywood	Inexpensive; available	Manual deployment is difficult; must be properly stored; doesn't provide impact-resistance for winds > 130 mph

Impact-Resistant Garage and Entry Doors

One of the most important yet frequently overlooked openings in a home that also requires protection are its doors — both the garage door and entry doors. Most major suppliers of both types of doors offer products (with or without glazing options) that meet both wind and impact resistance requirements. Often, replacement of a non-rated door with one of these newer types is cost-effective when compared to the cost of providing a covering for the door. As with impact-resistant glazed windows and doors, any replacement of a door with an impact-resistant garage or entry door should be done by a qualified professional installer.

The garage door is a significant weakness during a hurricane due to its large area and the stress it is subject to, and its failure can cause extensive damage to a structure. Garage door options include: (i) replacement with a stronger door, (ii) horizontal bracing, (iii) vertical bracing, or (iv) other types of bracing kits (see Figure 4-20). For many garage doors, vertical bracing is a popular and reasonably priced option.

Double entry doors should have slide bolts at the top header and bottom threshold of the inactive door, a deadbolt with at least 1-inch throw length between each door, and three hinges attaching the door to the frame. Single entry doors should have three hinges and a bolt long enough that it goes into the 2x4 framing of the door. Whenever entry doors are fortified, at least two of them must be operable for access and exiting at any time.

Figure 4-20. Fortified Garage Door. This replacement garage door is fortified with heavy duty metal bracing on every panel and stronger brackets connecting it to the door frame.

Source: Texas Sea Grant

4.1.3 TREES

Figure 4-21. FEMA Recommended Distance from Tree to House

Source: FEMA's "Protecting Your Property from Wind"

Cutting or trimming trees that overhang your house is an additional measure you can take to protect your property during a hurricane. Even though trees provide a buffer to the full strength of the wind, there is a serious danger if there are large trees or limbs that are close enough to fall on the house. Tree limbs or branches falling onto or impacting your house will cause considerable damage — few roofs are strong enough to withstand a falling 20-inch diameter tree. FEMA recommends that the distance between a tree and your house should always be greater than the height of the tree when it is fully grown (Figure 4-21). This is to prevent a tree from falling on the roof, either at its current size or in the future.

If it is not possible to remove a tree, you can at least cut off all branches that hang over the roof of the house. Generally, you should hire a licensed tree trimmer to perform this work. A Tree Care Kit related to disaster preparation and recovery is available from the Texas A&M AgriLife Extension Service at https://agrilife.org/treecarekit/.

4.2 FLOOD PREVENTION

Protecting your property from flooding can involve a variety of actions, from inspecting and maintaining the building to installing protective devices. Most of these actions, especially those that affect the structure of your building or its utility systems, should be carried out by qualified maintenance staff or professional licensed contractors. The most important information to know about your home when considering flood prevention techniques is the base flood elevation (BFE) shown on the Flood Insurance Rate Map (FIRM) for your community.

4.2.1 DRY FLOODPROOFING

One way to protect a structure and its contents from flood damage is to seal the building so that floodwaters cannot enter. This method, referred to as "dry floodproofing," encompasses a variety of measures: [21]

- 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 flotation.
- Installing backflow valves in sanitary and storm sewer lines.
- Raising HVAC and electrical system components 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 flood-borne debris.
- Building with materials that can withstand flood waters for at least 72 hours (examples: concrete, ceramic tile, pressure-treated lumber, steel, metal, brick, epoxy paint, foam, and closed cell insulation).
- Ensuring wells are properly constructed to avoid contamination from flood waters.

Keep these points in mind when you dry floodproof: [22]

- Dry floodproofing is appropriate primarily for slab-on-grade buildings with concrete or solid masonry walls. Concrete and masonry are easier to seal, more resistant to flood damage, and stronger than other conventional construction materials.
- If you dry floodproof a "substantially damaged" or "substantially improved" building (as defined by the National Flood Insurance Program [NFIP] regulations) or a newly constructed building, and if the building's lowest floor (including any basement) is below the BFE shown on the FIRM map for your community, your dry floodproofing must be certified as providing protection from the BFE. To obtain this certification, you must floodproof your building to a height at least 1 foot above the BFE. Check with your local floodplain manager or building official for more information.

- The height of your dry floodproofing should not exceed 3 feet. The pressures exerted by deeper water can cause walls to buckle or collapse. Before you use dry floodproofing to protect against greater flood depths, have a structural engineer evaluate the strength of your walls.
- If your dry floodproofing measures require human intervention before flood waters arrive, such as placing shields over doors and windows, you should have an operations and maintenance plan that describes all the actions that must be taken and lists the persons who are responsible. It must also include a schedule of periodic maintenance that states how often the dry floodproofing measures will be inspected and who will perform the inspections.
- The cost of individual dry floodproofing measures will vary with the size, condition, and use of your building, the dry floodproofing height, and the extent to which you use contractors and engineers.

In many cases, flooding on a property can be caused by poor drainage. If this is the case, it may be of great benefit to address the drainage issue with the professional advice of a licensed civil engineer.

An excellent source of information for protecting your property from flooding is FEMA's Coastal Construction Manual, downloadable at https://www.fema.gov/residential-coastal-construction, or visit https://www.fema.gov/media-library/assets/documents/13261 for other relevant documents.

4.2.2 ELEVATING EXISTING STRUCTURES

Elevation Certificates are required for new construction and substantial improvements to existing structures within Coastal V-Zones and other floodplain areas; the forms demonstrate a structure's compliance with local floodplain ordinances. It is recommended that a structure be surveyed by a registered professional after major storm events or when purchasing a home in a Coastal V-Zone. The elevation certificate needs to be completed by a registered professional land surveyor, engineer, or architect to ensure that all elevations and requirements are met per the community's flood damage prevention ordinance.

The lowest floor elevation of a structure that is new or substantially improved (where repairs are 50% or more of the market value of the structure) must be at or above the BFE. Any area below the BFE in a

Figure 4-22. Two Neighboring Homes in Aransas County after Hurricane Harvey. The elevated house on the left received no damage, while the at-grade house on the right has been boarded up due to extensive damage.

Source: Texas Sea Grant

Coastal V-Zone can only be used for parking, storage, or access. The area below the base flood level must be free of obstruction, and any enclosure must be made of breakaway walls. In Coastal V-Zones, a breakaway wall certification letter may be required. FEMA's publication Free-of-Obstruction Requirements (Technical Bulletin 5) provides more information on building and protecting homes located in Coastal V-Zones. When constructing in V-Zones, elevation is the single most important factor in reducing the risk of flooding. Major storms and flash floods can cause waters to rise higher than the BFE; therefore, it is always a good investment to build in a safety factor that is several feet above the BFE.

Even if you are not in an official flood zone, you may be at risk from flooding. You can go to the FloodSmart website and type in your street address to determine a very general estimate of the flood risk for your property: http://www.floodsmart.gov.

Figure 4-23. The house on the left is elevated with freeboarding. The house on the right is elevated at the minimum requirement.

Source: FEMA

For those properties located within a flood zone, elevating a building's lowest floor above predicted flood elevations by a small additional height (known as "freeboard") has very little effect on the look of a home yet can lead to substantial reductions in damages caused by flooding as well as reductions in flood insurance premiums (Figure 4-23).

FEMA has several other tools and resources designed to help citizens build safely and cost-effectively in the Coastal V-Zone, including the *Home Builder's Guide to Coastal Construction* fact sheet series (FEMA P-499) and *Recommended Residential Construction for Coastal Areas: Building on Strong and Safe Foundations* (FEMA P-550, second edition).

4.3 RETROFITTING AN EXISTING HOME

When retrofitting an existing home, you should consult with a licensed structural engineer or architect. The structural engineer can go over the costs and benefits of installing the following common retrofit options:

- Roof-to-wall and wall-to-foundation connections,
- Hurricane clips only without additional foundation connection, or
- Stronger connectors than those required in the current building code.

4.3.1 ROOF-TO-WALL CONNECTION

Concepts regarding the roof-to-wall connection were covered in Part 4.1. A properly selected hurricane clip is required for each rafter. In addition, the rafters at gable end eaves should be strapped down. Exterior beams supported by corner columns also require strap down. For houses with post-and-beam roof construction, fasteners should be for roof rafter to roof beams, top of post to horizontal ridge beam, and post to beam connections located at the exterior wall.

Example of Retrofitting. Here, a metal strap connects the vertical post to the foundation, which finishes the continuous load path from the roof to the foundation.

Source: Hurricane Protection Services

You should seek a licensed structural engineer or architect to select the proper connectors and nails for your house. You can then do either all or part of this work yourself, or hire a licensed contractor.

4.3.2 ROOFING

The wind from a hurricane attacks any weaknesses in the roof. Once a weakness is exposed, adjacent areas can be more easily damaged and peeled away. Thus, strengthening the roof is important and it should be considered for new construction and when a roof is replaced after its expected life. The roofing option involves installing a continuous structural sheathing (for example, plywood where it is missing or damaged). Additional fasteners and a secondary waterproof membrane are required. You should seek a licensed roofing contractor to do this work.

As a side note, there are small things you can do to strengthen the roof even if is relatively new. For example, if you climb in your attic and see nails that are supposed to attach the plywood sheathing to the truss have missed the truss, then you have found what could be a structural weakness. The joint can be strengthened with a wood epoxy or the application of closed cell foam insulation.

4.3.3 FOUNDATION UPLIFT STRENGTHENING RESTRAINT

Strengthening the foundation to resist uplift will generally require the removal of interior finishes. The installation of uplift connections should be planned by a licensed structural engineer and only after they have inspected the home to understand materials and methods used to construct the home and have calculated the uplift requirements.

4.4 CONCRETE STRUCTURES

Concrete structures, even for residential units, are becoming much more popular in coastal areas. Concrete homes were some of the few left standing in storm surge zones after Hurricanes Katrina and Ike. Well-built concrete structures can withstand winds in excess of 200 miles per hour.[23]

Concrete may be somewhat more expensive initially than a wood-frame home, but in the long run the thermal properties mean overall lower costs. Concrete by itself does not provide adequate thermal properties, but the advent of insulated concrete forms (ICF) allows for a structurally sound, hurricane-resistant house with excellent insulation. In a coastal surge zone, elevation is still an important factor, even with an ICF structure.

4.5 SAFE ROOMS

A safe room is a room designed to withstand winds from the strongest hurricanes (Categories 3-5) and strong tornadoes. This option should only be considered if the house is outside of all known flood and storm surge zones and is strengthened to the highest level. Safe rooms should not be built in a flood zone, where there is a threat of moving water. During a hurricane or other high flood event, even these areas need to be evacuated, no matter how fortified the room is against the wind.

Although costs vary nationwide, it is much less expensive to build a safe room during the original construction of a house. The safe room can also double as a master closet, bathroom, or utility room. The additional cost can be wrapped into the original home mortgage. This is a good investment that yields a sizable return in that it adds value to your house as well as protection and peace of mind for your family.

More information regarding design and construction of safe rooms can be found in FEMA Publication 361, *Design and Construction Guidance for Community Safe Rooms*, and FEMA Publication 320, *Taking Shelter from the Storm*.

Part 5
Recovery & Mitigation

One of the most important ways to protect yourself and your assets from natural hazards is insurance coverage. Wind and flood insurance programs provide resources to aid recovery in the event of property damage. Insurance policies are essential for all residents living in areas subject to hurricanes and tornadoes, and those living in coastal flood zones or other areas subject to periodic flooding. There are other types of programs, on a state or a federal level, that can assist with disaster recovery and hazard mitigation. Some of these programs must be implemented on a community-wide level but can still benefit individual homeowners.

5.1 INSURANCE PROGRAMS

Disasters can result in physical damage or complete loss of property. When purchasing property in an area prone to hurricanes or floods, it is important to have sufficient coverage to protect your investment from considerable damage and loss. Some standard homeowner's insurance will cover wind and flooding events. If your policy does not cover these hazards, there are other options for coverage.

5.1.1 WIND INSURANCE

The Texas Windstorm Insurance Association (TWIA) can provide wind and hail coverage when insurance companies exclude it from homeowner or other property policies sold to coastal residents. TWIA is the state's only insurer of last resort for wind and hail coverage in the 14 coastal counties and the parts of Harris County east of Highway 146. However, to qualify for TWIA coverage, a homeowner's residence must be built according to windstorm-resistant building standards and pass a windstorm inspection.

TWIA
TEXAS WINDSTORM
INSURANCE ASSOCIATION

Check with an insurance agent about the specific requirements for TWIA, the availability of discount programs from private insurance companies, and the specific requirements needed to qualify for each.

TIPS FOR PREPAREDNESS

1. Be sure you have BOTH flood and windstorm insurance coverages. Flood insurance does not cover wind damage and windstorm insurance does not cover flood/storm surge damage.
2. Read your insurance policies and know what is covered and what is not covered. If you are not sure, talk with your agent.
3. Insure your home or business for what it will cost to REPLACE the buildings. Deductibles vary; be sure you have chosen deductibles that you can afford should you have a loss.
4. If changes to your insurance coverage are needed, plan ahead. It may be too late to make changes if a hurricane is already in the Gulf.
5. At least once a year, take an inventory of your property. Consider videotaping a "tour" of your belongings. Keep all property records in a location away from your home or business. Schedule an insurance "check-up" with your agent well ahead of hurricane season.
6. Be sure you know how to report an insurance claim. Keep your agent's contact information and policy numbers for your flood and TWIA policies with you at all times.
7. Protect your home by keeping up with routine home maintenance and trimming trees surrounding your home. You may be able to lessen wind damage to your home by making some simple structural upgrades.
8. Keep receipts for any minor work completed. You should not make major repairs or changes unless a TWIA-assigned adjuster has inspected your property.

5.1.2 FLOOD INSURANCE

Flooding is the most common natural disaster in the United States. Flood insurance is recommended for those who live near coastlines, rivers, stream systems, or any other body of water. Flooding and mudflows (movement of land by viscous, water-saturated soil) are covered, but landslides (movement of land by earthquakes) are not covered.

Maintaining flood insurance is mandatory if you have a mortgage and live within a Special Flood Hazard Area, also known as an area with a 1.0% annual chance of flooding. Outside this area, insurance is not required, but many people have policies because flooding often does not stop at a boundary line on a map. If you are a first-time applicant for flood insurance, please be aware that there is a 30-day waiting period before a flood insurance policy goes into effect. Hence, new policies will not be written and existing policies cannot be modified when a storm is predicted or approaching your area.

National Flood Insurance Program (NFIP)

In 1968, the U.S. Congress enacted the National Flood Insurance Program (NFIP), primarily because flood insurance was nearly unavailable from the private insurance market. The federal government had been providing most of the funding for recovery after flooding events, but this system was not sustainable. Under the NFIP, homeowners pay premiums that contribute to their recovery should there be a flooding event.

Communities must decide to join the NFIP, but the individual premiums vary according to the location of the property. Homeowners must also maintain certain requirements, such as elevating or floodproofing structures. Homeowners can learn more about flood insurance, perform an address-based risk assessment, and locate an insurance agent serving their address at http://www.FloodSmart.gov, a website maintained by the NFIP.

NFIP Reforms

Although both individual premiums and federal funding contribute to disaster recovery from catastrophic flood events, the cost of recovery in recent decades has overwhelmed the NFIP. To address the issue, the U.S. Congress passed the Biggert-Waters Flood Insurance Reform Act in 2012 and the Homeowner Flood Insurance Affordability Act in 2014 to shift the NFIP toward risk-based premiums, remove subsidized premiums, and create a Reserve Fund.

Because more than 80% of policies do not involve subsidized rates, and the reforms do not affect all subsidized rates, only a small percentage of current policies are affected by the reforms. In addition, most rates increase gradually per year, rather than incurring a steep one-time fee. Most policies affected involve the following situations:

- Residential properties that are not primary
- Business properties
- Severe repetitive loss properties (i.e., properties with multiple loss claims)
- Structures that have incurred substantial damage or have been improved before Flood Insurance Rate Maps
- Any new policy, lapsed policy, or when a property/policy changes owners

Preferred Risk Policy (PRP)

A Preferred Risk Policy (PRP) is available for a property located in a low-risk area (e.g., B, C, and X zones) in a community that already participates in the NFIP. The PRP premiums are lower than those for standard policies. If your property was newly mapped into a high-risk flood zone on or after October 1, 2008, you may still be eligible for a PRP.

Talk to your insurance agent. Previous and current flood zone documentation for your property must be validated for eligibility. Likewise,

your property must meet certain loss history requirements, even if you are the new owner. The requirements involve the number of flood claims and the cost of the claims. You can also decide between two types of policies: building-and-contents coverage or contents-only coverage.

Community Rating System (CRS)

The Community Rating System (CRS) is a program that rewards communities for floodplain management activities that exceed the minimum NFIP requirements. Individual insurance premium rates are discounted to reflect the reduced flood risk resulting from those activities. You can contact your insurance agent for more information. The three goals of the CRS program are:

- Reduce flood damage to insurable property
- Strengthen and support the insurance aspects of the NFIP
- Encourage a community's comprehensive approach to floodplain management

5.1.3 FILING INSURANCE CLAIMS AFTER A DISASTER

After a disaster, it is easy for anyone to feel overwhelmed; there are countless things to deal with. Yet, when you return to your property, there are certain things that you must do in order to file an insurance claim for any damage to your property and your home. The following list compiles advice from FEMA and TWIA regarding what to have ready before an insurance agent or adjuster arrives:

- An adult 18 or older, who lived in the residence before the disaster; this person must be present for the inspection, with photo identification
- Proof of ownership and occupancy of the damaged residence such as property tax bill, mortgage payment bill or receipt, or utility service bill
- Insurance documents and policy numbers
- Detailed descriptions of the damage to the home and its contents
- Brief description of what caused the damage (e.g., wind, flooding, debris)
- Photographs of the damage (very important before you begin any repairs)
- List of persons living in residence at time of disaster

- Best contact information for reaching you (consider that you may not be able to stay in your house or receive mail at your address, and your phone may not have service)

You may receive visits from more than one inspector. Other inspectors may represent federal, state, county, or local government agencies, the U.S. Small Business Administration, or the National Flood Insurance Program. Representatives of volunteer agencies may also contact you to offer their services.

It is also important to be aware of individuals who may be posing as insurance inspectors and FEMA representatives. Inspectors from any governmental agency and FEMA representatives will show photo ID badges. If you are not shown photo identification, then do not allow the inspection. If you suspect someone is posing as an inspector, call your local law enforcement agency.

Increased Cost of Compliance (ICC) Coverage

Flood damage to homes can vary greatly for different reasons. Sometimes the damage is far greater than a homeowner can afford with a direct loss insurance claim, especially when the homeowner must upgrade the home to meet current codes and requirements.

FEMA TERMS TO LEARN BEFORE FILING INSURANCE CLAIMS

Repetitively Damaged (or Repetitive Loss - RL) means the building must have had flood damage on at least two occasions during a 10-year period, and the cost to repair the flood damage, on average, equaled or exceeded 25 percent of the market value of the building on each occasion.

Substantially Damaged (SD) means damages of any origin sustained by a structure in which the cost of restoring the structure to its before-damaged condition would equal or exceed 50 percent of the market value of the structure before the damages occurred.

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 (or smaller percentage if established by the community) before the "start of construction" of the improvement. This term includes structures that have incurred "substantial damage," regardless of the actual repair work performed.

Increased Cost of Compliance (ICC) coverage may fulfill the gap between repairing your house to its pre-existing condition and complying with current codes and requirements.

For an example, flooding causes $200,000 of damage to Jane's house. After speaking with her insurance adjuster and the local building inspector, she finds out that she needs to elevate the house to meet new floodplain requirements. Jane can file for her direct loss claim and for ICC coverage, if she needs the additional financial assistance. The ICC coverage will provide no more than $30,000 (for any policy holder). Also, the combined amount of the claim and the ICC coverage cannot exceed $250,000 (the maximum limit of coverage for any residence).[24]

Your community's building department must determine the extent of damage and what is necessary to bring your home up to compliance with current codes and requirements (whether you file for ICC or not). The department must then give you a written letter with those terms, which you will turn in to process your claim and ICC coverage.

5.2 STATE & FEDERAL ASSISTANCE PROGRAMS

Your first avenue for financial assistance after a disaster is to work with your insurance agent and file a claim. Whether you have insurance or not, it is also possible to receive assistance from several state and federal programs. Eligibility is always determined on a case-by-case basis, especially if you do receive money from an insurance claim. Programs are not only available for home repair; they can include new construction, relocation, and rental units. In Texas, some federal programs are administered by state-run agencies. This will be explained more in the following sections. The availability of each program also depends on whether the disaster is a local declaration, state declaration, or presidential declaration.

Local Disaster Declaration is handled by the local emergency management plan. If the local community (e.g., city or county) does not have the capacity to handle the circumstances, it can appeal to the state.

State Disaster Declaration is decided by the Governor, even if the disaster does not affect the whole state. Texas has its own agencies that can offer assistance to communities affected by state declared disasters.

Texas Department of Housing and Community Affairs (TDHCA) can apply funds that it regularly receives from federal housing programs to assist in disaster recovery. The most common program is the HOME Investment Partnerships Program (HOME). HOME provides states and localities with grant money for various activities including building, buying, and/or rehabilitating affordable housing for rent or homeownership, and for providing direct rental assistance, especially for low-income households.[25] For more information, visit their website at http://www.tdhca.state.tx.us/home-division/home.htm.

Presidential Disaster Declaration may be granted only when the Governor requests federal assistance, either during or after the disaster event. With a presidential declaration, many more opportunities are available for communities to pass down financial assistance to homeowners and renters.

FEMA Individual Assistance (IA) is administered directly to homeowners and renters and is not dependent on community participation in any program. It is typically the second avenue of financial assistance after an insurance policy. It pays for a variety of services in addition to housing.

FEMA Public Assistance (PA) helps communities to get back up and running again by paying for debris removal and infrastructure repairs in neighborhoods.

Hazard Mitigation Grant Program (HMGP) is funded by FEMA but is administered by the Texas Division of Emergency Management (TDEM). Hazard Mitigation in theory is implemented before a disaster, in order to reduce the risk from hazards. However, communities can receive recovery funding if their state has or agrees to develop a state-wide Hazard Mitigation Plan. Whether projects are implemented before or after a disaster, they are intended to benefit the whole community. Projects can be structural (e.g., levees and floodwalls) or non-structural (e.g., protecting wetlands and land use planning). Sometimes these projects benefit individuals as well, especially when local government can buy properties located in the floodplain and assist homeowners in relocating to non-hazardous areas. More information is available in this fact sheet provided by the Texas Department of Public Safety: http://www.dps.texas.gov/dem/Mitigation/hmgp_fact_sheet.pdf.

Flood Mitigation Assistance (FMA) is administered by the Texas Water Development Board (TWDB) but is only available to communities that participate in the NFIP. The supported projects are similar to HMGP projects, such as relocation, building elevation, and flood control.[26]

Flood Protection Planning is also administrated by TWDB and is focused on early warning systems and other response efforts in NFIP-participating communities.

Community Development Block Grant – Disaster Recovery (CDBG-DR) is administered by the Texas General Land Office (GLO), but the funding comes from the U.S. Department of Housing and Urban Development (HUD). GLO must create a state-wide action plan explaining how it will use the funding, and HUD must approve the plan, before the funds are released. The action plan is posted for public comment for a limited time, so Texas residents can advocate for different projects if they disagree with the plan. Like many other programs, CDBG-DR is only available at a community level, but it is also specifically for low-income and other socially vulnerable neighborhoods. The projects are aimed at elimination of blight and slums, and supporting fair and affordable housing, infrastructure upgrades, and economic development. Individuals could benefit from the projects in a multitude of ways, so reading and understanding the action plan is advised. More information is available in this fact sheet provided by HUD: https://www.hudexchange.info/resources/documents/CDBG-DR-Fact-Sheet.pdf and this fact sheet provided by GLO: http://www.glo.texas.gov/recovery/files/cdr-division-overview.pdf.

Texas Rebuilds was developed by GLO as a disaster recovery program that uses funding from various organizations, including HUD. The program provides assistance to renters, current homeowners, and people interested in becoming first-time homeowners. Several options are available to people who live in designated areas and meet other requirements. Typically, assistance is given to people wishing to rebuild or to relocate. The Homeowner Opportunity Program (HOP) allows homeowners to participate in a voluntary relocation process. Relocation in this program does not refer to moving one's house, but rather to moving someone to a safer neighborhood. Individuals who choose to participate must transfer ownership of their property, usually to the local government. Structures on the property are then demolished and the land is no longer developed. In return, the homeowner receives assistance in purchasing an existing home

or in purchasing a vacant lot for building a new home. Financial assistance is provided, as well as consultations for decision-making and real estate transactions.[27]

Small Business Association (SBA) loans are available to individuals after they have already pursued insurance claims and FEMA's Individual Assistance. You do not need to be a business owner to apply for an SBA loan; you can be a homeowner, renter, or member of a common-interest development (e.g., homeowner associations or condominiums). Loans can pay for repairs, personal property, relocation assistance, and sometimes mortgage refinancing.[28]

5.3 PREVENTING FRAUD AND IDENTITY THEFT

Unfortunately, after a disaster, some individuals will choose to take advantage of people while they are displaced. Likewise, others will prey on people after they have returned home and are assessing their damage and beginning repairs. Here are some tips to follow in order to protect yourself from fraudsters and identity theft:[29]

- Ask contractors for references and proof of insurance. Check with those references regarding the contractor's dependability and quality of work.
- Get written estimates with a description of work to be done, time schedules, and payment schedules. Get estimates from more than one contractor.
- Read and understand all contracts before you sign. Never sign any forms with blanks. Keep copies of everything you sign.
- Never pay a contractor in full until the work is complete and acceptable.
- Check your bank and credit card statements for purchases you have not made. If you suspect you are the victim of identity theft, report it immediately to your bank, credit card company, and local law enforcement.

Appendix A
Emergency Contact Information

Texas Division of Emergency Management
(512) 424-2208
http://www.dps.texas.gov/dem/

Texas Department of Transportation
(800) 452-9292 (Travel Information Line)
http://www.txdot.gov/inside-txdot/division/traffic/safety/weather/hurricane.html

American Red Cross – Central Texas Region
2218 Pershing Drive
Austin, TX 78723
(512) 928-4271
http://www.redcross.org/local/texas/central-and-south-texas

Federal Emergency Management Agency (FEMA) Region 6
FRC 800 North Loop 288
Denton, TX 76209-3698
800-621-FEMA or 800-621-3362
https://www.fema.gov/region-vi-arkansas-louisiana-new-mexico-oklahoma-texas

Texas Water Development Board
Texas Floodplain Manager
1700 North Congress Avenue
P.O. Box 13231
Austin, TX 78711-3231
(512) 463-3509
http://www.twdb.texas.gov/flood/index.asp

Texas General Land Office
Coastal Management Program
PO Box 12873
Austin, TX 78711
(800) 998-4456 or (512) 463-9212
http://www.glo.texas.gov/coast/coastal-management/tools/index.html

Texas Sea Grant College Program
Texas A&M University, 4115 TAMU
College Station, TX 77843-4115
(979) 845-3854
http://texasseagrant.org/programs/hurricane-preparedness/

Appendix B
Websites and Publications

Texas.gov - Emergency Portal
https://emergency.portal.texas.gov/
Information and links related to the following topics:
Disaster Preparedness
Public Information & Education
Emergency Management
Evacuation Routes
Statewide Highway Conditions
Situation Reports
National Hurricane Center

Texas Division of Emergency Management - Public Information and Education
http://www.dps.texas.gov/dem/PublicInfo.htm
Links with useful information on the topics below:
2-1-1 Texas
Accessible Preparedness Videos
Disaster Recovery
Educación e Información Pública
Emergency Communication Plan
Emergency Planning Tips
Emergency Supply Kits
Flash Flood Safety Tips
Food Safety Tips
Hot Weather Safety Tips
Hurricane Evacuation Tips
Hurricanes Preparedness Tips
Power Outage Awareness
Power Line Safety Tips
State of Texas Emergency Assistance Registry (STEAR)
Tornado Safety Tips
Wildfire Preparedness Tips

FEMA Publications

Are You Ready?

This FEMA publication (available online at https://www.fema.gov/media-library/assets/documents/7877) provides a step-by-step approach to disaster preparedness by walking the reader through how to get informed about local emergency plans, how to identify hazards that affect their local area, and how to develop and maintain an emergency communications plan and disaster supplies kit. Other topics covered include evacuation, emergency public shelters, animals in disaster, and information specific to people with access and functional needs.

After a Flood: The First Steps

Tips for staying healthy, cleaning up and repairing, and getting help after a flood. Available online at https://www.fema.gov/media-library/assets/documents/3396.

Residential Coastal Construction Manual

Investigations conducted by FEMA and other organizations after major coastal disasters have consistently shown that properly sited, well-designed, and well-constructed coastal residential buildings generally perform well. This updated Residential Coastal Construction Manual, available online at https://www.fema.gov/residential-coastal-construction/, was prepared by FEMA with assistance from other agencies, organizations, and professionals involved in coastal construction and regulation. It is intended to help designers and contractors identify and evaluate practices that will improve the quality of construction in coastal areas and reduce the economic losses associated with coastal disasters.

Additional Coastal Construction Resources

- FEMA P-55 – Coastal Construction Manual
- FEMA P-85 – Protecting Manufactured Homes from Floods and Other Hazards
- FEMA P-499 – Home Builder's Guide to Coastal Construction
- FEMA P-550 – Recommended Residential Construction for Coastal Areas: Building on Strong and Safe Foundations
- FEMA P-762 – Local Official's Guide for Coastal Construction
- FEMA P-804 – Wind Retrofit Guide for Residential Buildings
- NFIP Technical Bulletins
- Examples of State and Local Erosion Studies and Hazard Maps

American Red Cross Publications

Repairing Your Flooded Home

This booklet about how to enter your home safely, protect your home and belongings from further damage, record damage to support insurance claims and requests for assistance, check for gas or water leaks, and clean up appliances, furniture, floors, and other belongings is available online at http://www.redcross.org/images/MEDIA_CustomProductCatalog/m4540081_repairingFloodedHome.pdf.

National Weather Service Publications

Hurricane Flooding: A Deadly Inland Danger (20052)

This brochure describes the impact of hurricane flooding and precautions to take. It is available online at http://www.weather.gov/media/owlie/InlandFlooding.pdf.

Appendix C
Disaster Supplies Checklists

The following list is taken from the FEMA publication Are You Ready? and is designed to help you determine what to include in your disaster supplies kit to meet your family's needs.

First Aid Supplies

Adhesive bandages, various sizes
5" x 9" sterile dressing
Conforming roller gauze bandage
Triangular bandages
3" x 3" sterile gauze pads
4" x 4" sterile gauze pads
Roll of 3" cohesive bandage
Germicidal hand wipes or waterless, alcohol-based hand sanitizer
Antiseptic wipes
Pairs of large, medical-grade, non-latex gloves
Tongue depressor blades
Adhesive tape, 2" width
Antibacterial ointment
Cold pack
Scissors (small, personal)
Tweezers
Assorted sizes of safety pins
Cotton balls
Thermometer
Tube of petroleum jelly or other lubricant
Sunscreen
CPR breathing barrier, such as a face shield
First aid manual

Non-Prescription and Prescription Medicine Kit Supplies

Aspirin and non-aspirin pain reliever
Anti-diarrhea medication
Antacid (for stomach upset)
Laxative
Vitamins
Prescriptions
Extra eyeglasses/contact lenses

Sanitation and Hygiene Supplies

Washcloth and towel
Heavy-duty plastic garbage bags and ties for personal sanitation uses
Towelettes, soap, hand sanitizer
Medium-sized plastic bucket with tight lid
Toothpaste and toothbrushes
Disinfectant and household chlorine bleach
Shampoo, comb, brush
Small shovel for digging a latrine
Deodorants, sunscreen
Toilet paper
Razor, shaving cream
Lip balm, insect repellent
Contact lens solutions
Mirror
Feminine supplies

Equipment and Tools

Portable, battery-powered radio or television and extra batteries
NOAA Weather Radio, if appropriate for your area
Flashlight and extra batteries
Signal flare
Matches in a waterproof container (or waterproof matches)
Shut-off wrench, pliers, shovel, and other tools
Duct tape and scissors
Plastic sheeting
Whistle
Small canister, ABC-type fire extinguisher
Tube tent

Compass
Work gloves
Paper, pens, pencils
Needles and thread
Battery-operated travel alarm clock
Gas for a portable generator

Kitchen Items

Manual can opener
Mess kits or paper cups, plates, and plastic utensils
All-purpose knife
Household liquid bleach to treat drinking water
Sugar, salt, pepper
Aluminum foil and plastic wrap
Resealable plastic bags
Small cooking stove and a can of cooking fuel (if food must be cooked)

Comfort Items

Games
Cards
Books
Toys for kids
Foods

Food and Water Supplies

Water
Ready-to-eat meats, fruits, and vegetables
Canned or boxed juices, milk, and soup
High-energy foods such as peanut butter, jelly, low-sodium crackers, granola bars, and trail mix
Vitamins
Special foods for infants or persons on special diets
Cookies, hard candy
Instant coffee
Cereals
Powdered milk

Clothes and Bedding Supplies

Complete change of clothes
Sturdy shoes or boots
Rain gear
Hat and gloves
Extra socks
Extra underwear
Thermal underwear
Sunglasses
Blankets/sleeping bags and pillows

Documents and Keys

(Make sure you keep these items in a watertight container)
Personal identification
Cash and coins
Credit cards
Extra set of house keys and car keys

Copies of the following:

- Birth certificate
- Marriage certificate
- Driver's license
- Social Security cards
- Passports
- Wills
- Deeds
- Inventory of household goods
- Insurance papers
- Immunization records
- Bank and credit card account numbers
- Stocks and bonds
- Emergency contact list and phone numbers
- Map of the area and phone numbers of places you could go

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Notes

Notes


Check with your agent
Keep your documents with you
For more info: floodsmart.gov
Know your policy
Consider flood insurance
Get an Insurance Checkup
Check in with your insurance agent well before hurricane season. Remember that flood insurance must be obtained separately. Prepare your home/vehicles according to your policy, and know where your insurance documents are located - take them with you if you evacuate. Visit floodsmart.gov for more information.


Help your neighbors prepare
Help your neighbors evacuate
Check-in after the storm passes
Help Your Neighbor
Many people rely on the assistance of neighbors before and after hurricanes. Help your neighbors collect the supplies they'll need before the storm. Assist them with evacuation if ordered to do so or check on them after it's safe for you to head outside.

Strengthen Your Home

There is a lot you can do around your home to help protect it from the strong winds that come with hurricanes. Well ahead of the approaching storm, trim trees on your property, shop for approved window coverings, collect loose outdoor items, secure all doors on your property, and find a safe location for your vehicle.

Develop an Evacuation Plan

Find out today if you live in a hurricane evacuation zone. Plan where you'll go and how you would get there. Leave immediately if ordered to evacuate and be sure to plan for your pets.