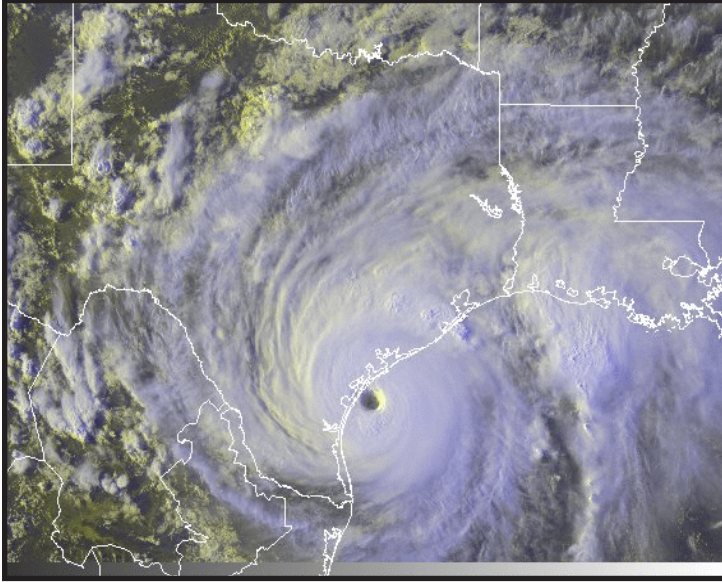


HOUSTON/GALVESTON National Weather Service



HURRICANE & SEVERE WEATHER GUIDE



Hurricane Harvey. Photo credit: NOAA.



Tornado. Photo credit: NOAA.



Flooding of Cypress Creek at Hardy Toll Road.
Hurricane Harvey. Photo credit: HCFCD.



Tornado damage, Onalaska, April 2020.
Photo credit: NWS.

INTRODUCTION

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9	Disaster Kit/Contacts
10	Preparing Your Home
11	Preparing Business/Pets
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Severe thunderstorms can bring tornadoes, large hail, damaging winds, flooding rains and lightning. Hurricanes and tropical storms can bring many of the same hazards but also high surf, rip currents and storm surge flooding.

This guide will cover how to prepare for and be safe when facing these different weather hazards. There are numerous checklists on what to do before, during and after the storm. The guide contains contact information for your local emergency managers and numerous resources/links where you can find more information.

In this years guide you'll also find an article looking back at Tropical Storm Imelda which struck the Upper Texas coast in 2019. The slow moving storm brought torrential rains and severe flooding over portions of East Texas. Imelda developed quickly as it approached the Texas coast. Imelda was another reminder of how quickly these storms can form and their ability to produce extreme rainfall and flooding. Imelda was one of the wettest storms on record, occurring just two years after Harvey which produced the record rainfall for any tropical cyclone.

We hope you find this guide useful and will share the information with your family, friends and coworkers. An electronic version of this guide will be found on the National Weather Service Houston/Galveston Forecast Office web site [weather.gov/houston](https://www.weather.gov/houston) and at the Extreme Weather Expo page [extremeweatherexpo.com](https://www.extremeweatherexpo.com). You are encouraged to place the link to the guide on your web site and share it out through email and social media.

Dan Reilly
Warning Coordination Meteorologist
National Weather Service Houston/Galveston

ABOUT THE HURRICANE



A tropical cyclone is a large low pressure system that derives its energy from warm ocean waters of the tropics. It is characterized by a closed counterclockwise circulation in the Northern Hemisphere and thunderstorms organized near the center of circulation. The hurricane, the strongest classification of a tropical cyclone, typically has an eye at the center with a ring of thunderstorms around it, and spiral bands of thunderstorms extending outward from the center.

In the North Atlantic, the tropical cyclone is defined as a tropical depression, tropical storm or hurricane, depending on the strength of the maximum winds in the storm. Every tropical cyclone brings some combination of the following hazards: damaging winds, storm surge flooding, tornadoes, flooding from heavy rainfall, high surf and rip currents.

TROPICAL DEPRESSION:

A tropical cyclone with maximum sustained winds of 38 mph or less.

TROPICAL STORM:

A tropical cyclone with maximum sustained winds between 39 and 73 mph.

HURRICANE:

An intense tropical cyclone with sustained winds of 74 mph or higher.

TROPICAL STORM WATCH/WARNING:

Tropical Storm force winds are possible/expected in the watch/warning area generally within 48/36 hours.

HURRICANE WATCH/WARNING:

Hurricane force winds are possible/expected within the watch/warning area within 48/36 hours.

STORM SURGE WATCH:

The possibility of life-threatening inundation from rising water moving inland from the shoreline (storm surge flooding) somewhere within the specified area, generally within 48 hours.

STORM SURGE WARNING:

The danger of life-threatening inundation from rising water moving inland from the shoreline (storm surge flooding) somewhere within the specified area, generally within 36 hours.

SAFFIR-SIMPSON HURRICANE WIND SCALE

Category	Sustained Wind Speed (mph)	Damage
One	74 to 95	Dangerous, some damage
Two	96 to 110	Extremely dangerous, extensive damage
Three	111 to 129	Devastating damage
Four	130 to 156	Catastrophic damage
Five	157 or higher	Catastrophic damage

Useful Links

www.nhc.noaa.gov/aboutsshws.php

<https://www.aoml.noaa.gov/hrd-faq/>

<https://www.nhc.noaa.gov/aboutgloss.shtml>

Storm Surge Flooding

Storm surge is the abnormal rise of water generated by a storm, over and above the predicted astronomical tides. The storm tide is the height of water relative to a reference level or datum that includes storm surge and astronomical tide. The combination of storm surge flooding and battering waves can be very destructive as seen with Hurricanes Ike (2008), Carla (1961), the 1900 Galveston Hurricane and many others.

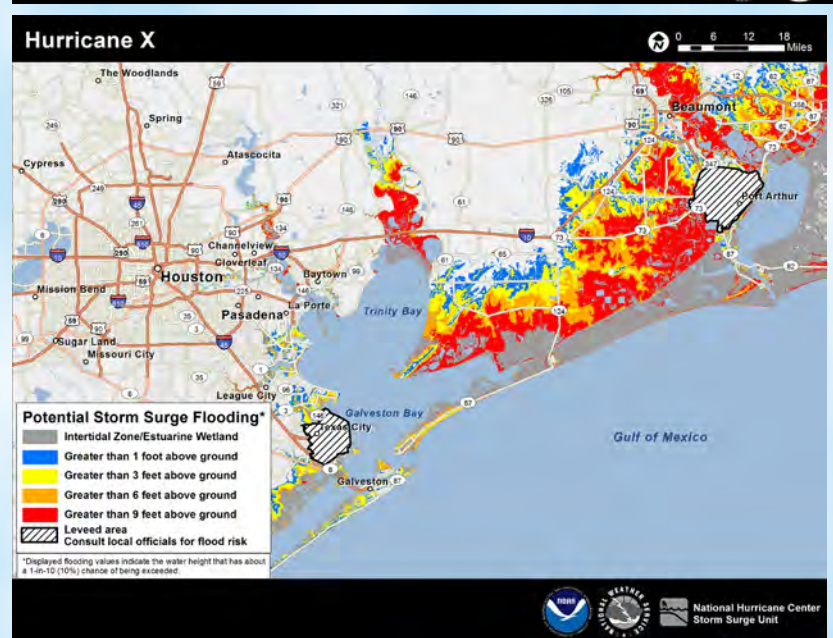
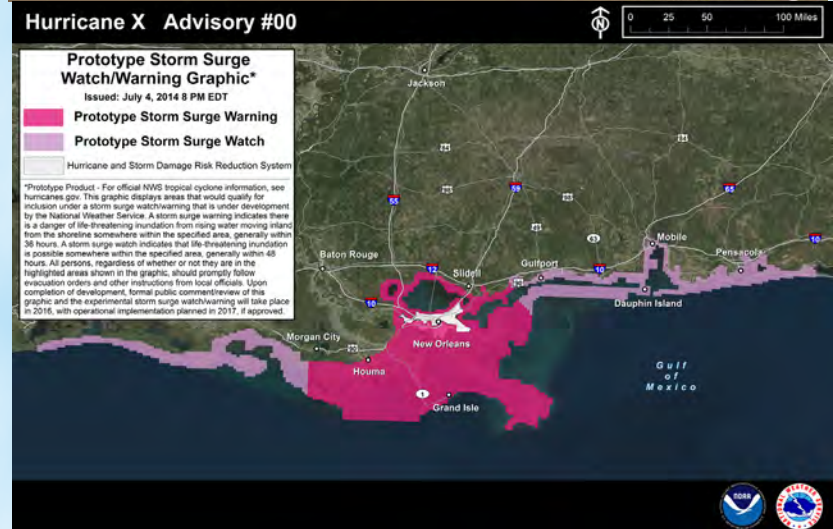
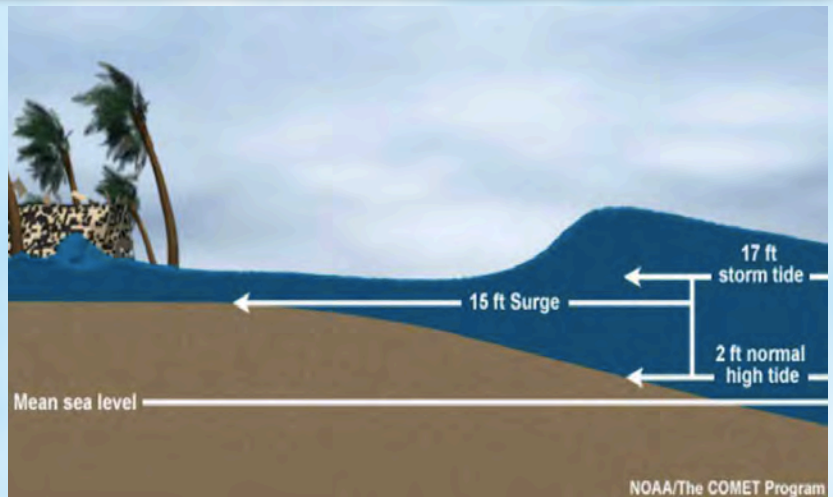
When a hurricane or strong tropical storm approaches, the National Weather Service (NWS) will produce two maps to convey the storm surge flood threat. The first is the storm surge watch and warning map showing areas at risk for life threatening surge. See example to the right.

The other type of map is the Potential Storm Surge Flooding map. It shows the reasonable worst case scenario for depth of water above ground due to storm surge flooding for a given storm. See an example on the lower right.

See the links below to learn more about storm surge flooding and to assess our risk to this hazard.

All about storm surge:
<https://www.nhc.noaa.gov/surge/>

Hazard Risk Maps. Check out to gauge your risk/vulnerability.
<https://www.nhc.noaa.gov/nationalsurge/>



Flooding from Heavy Rain

Texans are all too familiar with catastrophic flooding from slow moving hurricanes and tropical storms. Examples include Claudette (1979), Allison (2001), Harvey (2017) and Imelda (2019). Slow storm motion and high rain rates produced extremely high rainfall totals in these storms with catastrophic flooding the result. The map at the bottom of the page shows the rainfall from Harvey. Harvey set the record for most rainfall from a tropical cyclone in the United States with 60.58 inches of rain measured in Nederland, TX. Harvey was also noteworthy by the large area over which this extreme rainfall fell. Tropical Storm Claudette was another record breaker with 43 inches of rain falling over 24 hours in Alvin, TX.

Preparedness Tips

Buy flood insurance, even if not in the 100-year flood plain. Your homeowners policy will not cover flood loss. A separate policy will likely be needed through the National Flood Insurance Program. Speak with your insurance agent. For more information click here:

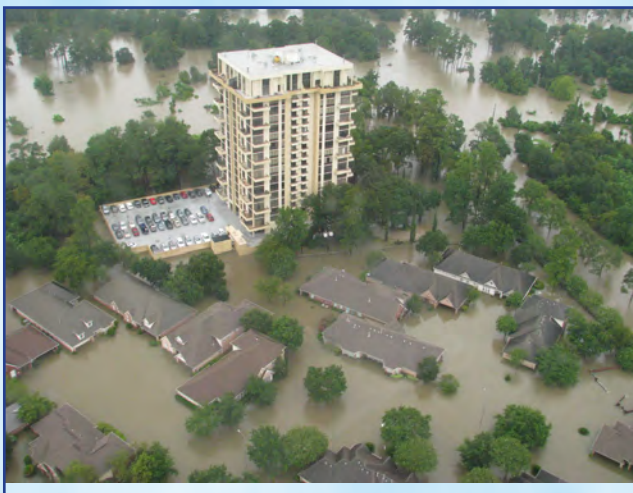
www.floodsmart.gov

Never attempt to drive across flooded roadways. Turn Around, Don't Drown! It only takes a few feet of water to float a vehicle and it can be difficult to gauge the depth of the water.

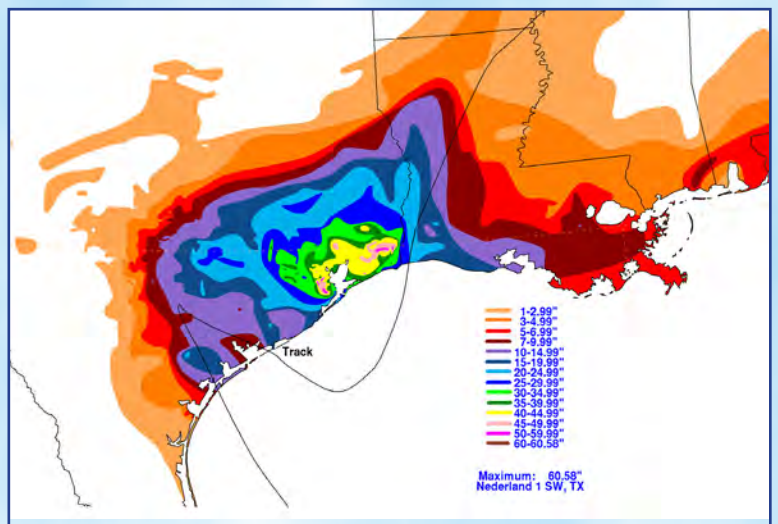
www.weather.gov/tadd

Know your flood risk. You can find out the flood zone your are in by entering your address at the FEMA flood portal. <https://msc.fema.gov/portal>

Protect your personal documents and special items. Consider storing critical documents in a safe deposit box if in a flood prone area, or in a sealed plastic container on high shelves off the floor.

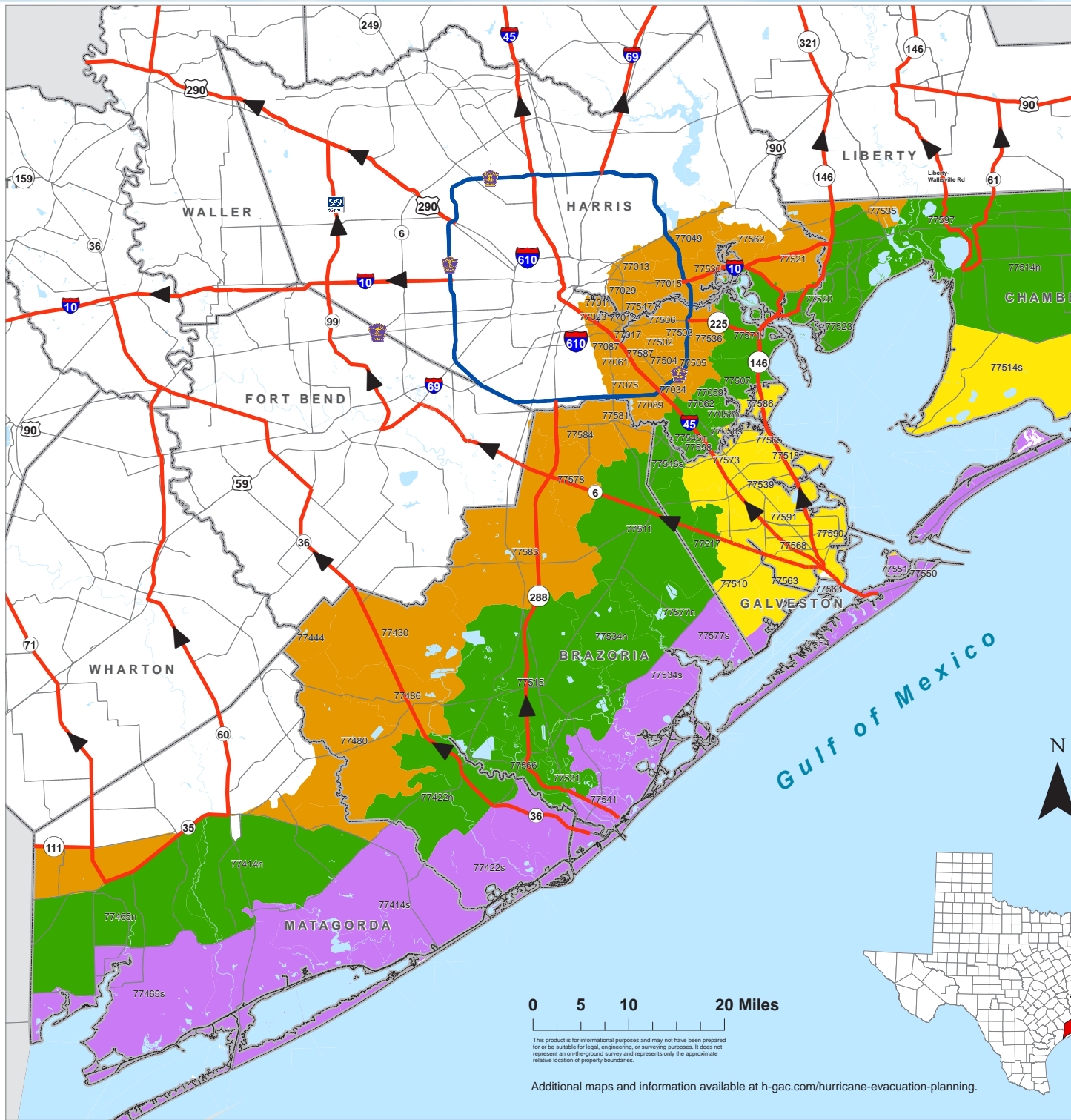


Flooding of Cypress Creek near Champions Forest Drive. Hurricane Harvey. Photo Credit: HCFCD.



Total rainfall from Harvey (2017). Record rainfall 60.58 inches Nederland, TX. NWS

Evacuation Zones by Zip Code







Evacuation zones loosely correspond to the following hurricane categories. However surge depends on other factors like storm size and speed. Its best to heed recommendations and any evacuation orders made by local officials. Purple - Cat 1; Yellow - Cat 1 or 2; Green - Cat 3; Orange - Cat 4,5.

Brazoria, Chambers, Galveston, Harris, and Matagorda Hurricane Evacuation Zip-Zones Coastal, A, B, C

ZIP ZONE COASTAL				
77414s	77422s	77465s	77534s	77541
77550	77551	77554	77563	77577s
77623				
ZIP ZONE A				
77058s	77510	77514s	77518	77539
77563	77565	77568	77573	77586
77590	77591			
ZIP ZONE B				
77058n	77059	77062	77414n	77422n
77465n	77507	77511	77514n	77515
77517	77520	77523	77531	77534n
77546n	77546s	77560	77566	77571
77577n	77597	77598	77665	
ZIP ZONE C				
77011	77012	77013	77015	77017
77023	77029	77034	77049	77061
77075	77087	77089	77430	77444
77480	77486	77502	77503	77504
77505	77506	77521	77530	77535
77536	77547	77562	77578	77581
77583	77584	77587		

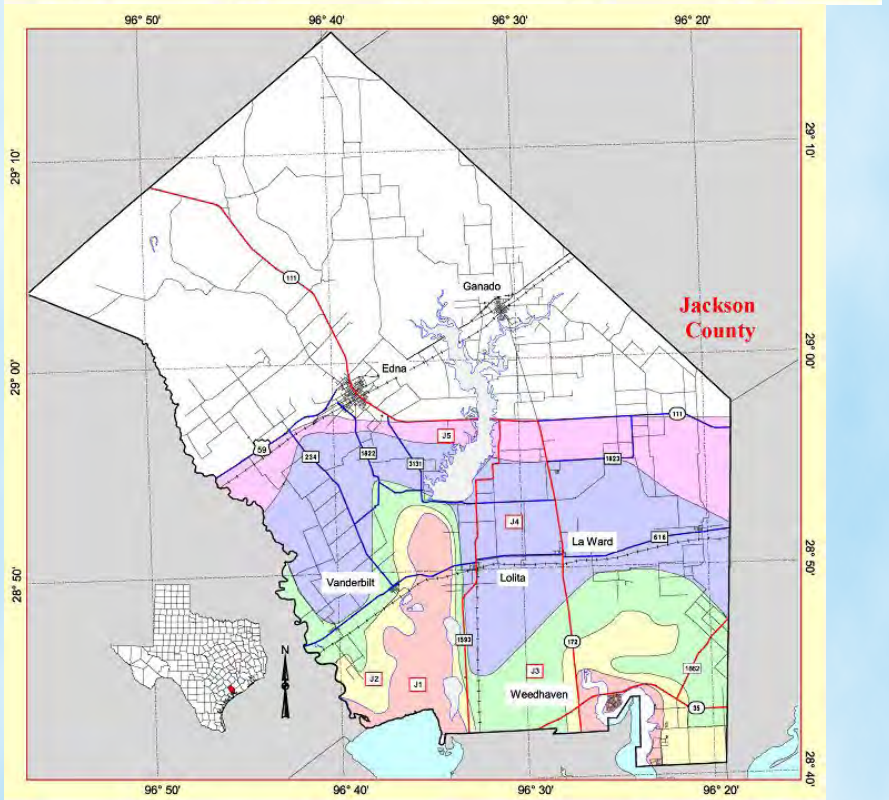
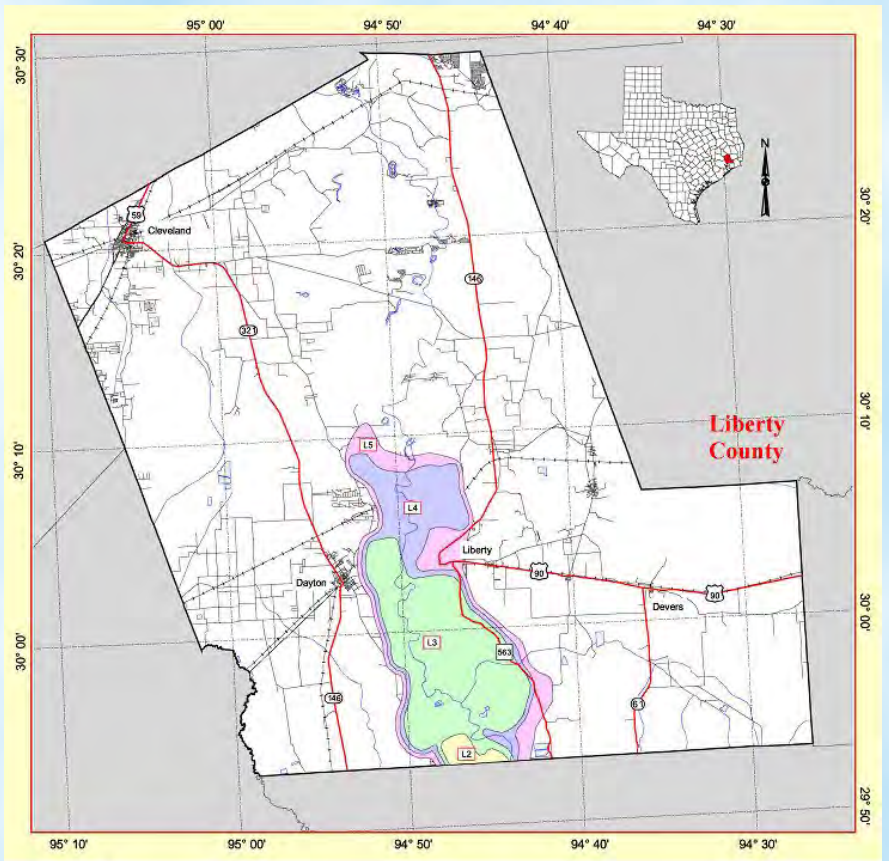
Some zip codes are split into north (n) and south (s) for evacuation purposes.

Route Designation

-  Evacuation Corridors
-  Evacuation Connections
-  Other Roads
-  County Boundary

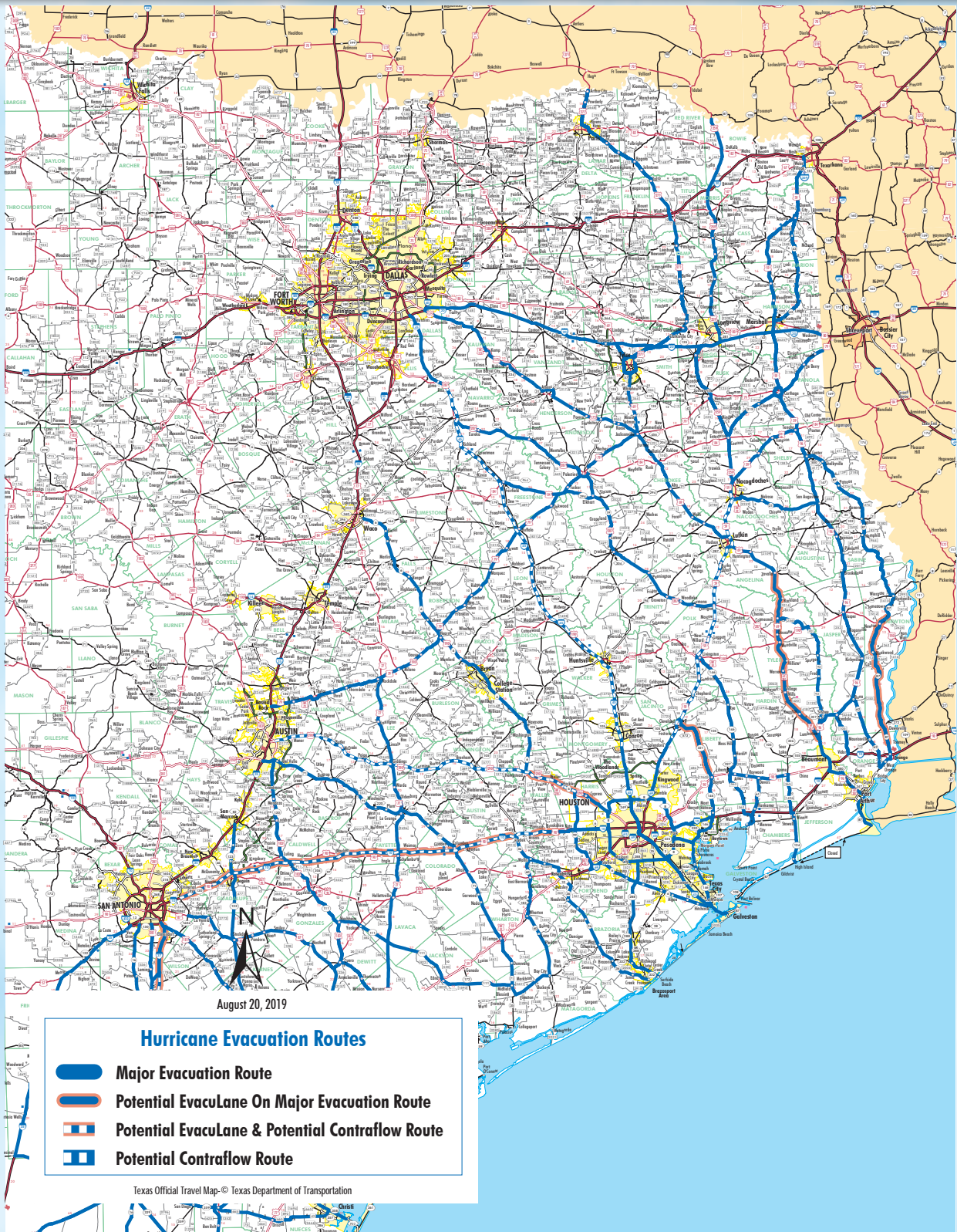


Revision Date: March 31, 2020
 Expiration Date: December 31, 2020
 Map Created by:
 Houston-Galveston Area Council



For Liberty and Jackson Co. maps, evacuation zones correspond to the following hurricane categories. However surge depends on other factors like storm size and speed. Its best to heed recommendations and any evacuation orders made by local officials. Orange-cat 1; Yellow-cat 2; Green-cat 3; Purple-cat 4, Pink-cat 5.

Evacuation Route Maps From TxDOT



Click on this link to view more detailed maps which you can zoom in and out of.
<https://www.txdot.gov/inside-txdot/division/traffic/safety/weather/hurricane.html>



Damaging Winds and Tornadoes

Hurricane force winds can damage or destroy structures, trees and infrastructure like power, phone and water. Signs, roofing material, siding, and small items left outside can become flying missiles in a hurricane. The strongest winds occur in a region of the hurricane called the eyewall, the ring of thunderstorms that surround the eye. Wind gusts in the right side of the track in the eyewall are the most destructive. Hurricane force wind gusts can be felt well inland, far from the coast, especially for stronger fast moving hurricanes.



Photo credit FEMA.

Tropical cyclones can also produce tornadoes which most often occur in thunderstorms in outer rain bands on the right hand side of the track, away from the center of the hurricane. They can also occur in the eyewall. Tornadoes produced by tropical cyclones are usually relatively weak and short-lived but not always. A strong tornado that developed in Hurricane Carla's outer bands killed 6 in Galveston in 1961. Twenty-three tornadoes were confirmed with Harvey, all forming in the outer rainbands on the right side of the storm.



Photo credit NOAA.

Mobile homes are especially vulnerable to hurricane winds and tornadoes. Its important for mobiles homes to be properly strapped down, but even then a mobile home is not a safe place to be in a hurricane or tornado! It is better to seek shelter in a more sturdy structure ahead of the storm, prior to the arrival of the stronger winds. Think about where that structure would be, whether with friends or relatives or in a neighborhood shelter. Include that as part of your pre-season hurricane planning.



Photo credit NOAA.

More information on tornado safety can be found on page 24

Contacts and Disaster Supply Kit

Maintaining Contact List

Many people keep their contacts on their phone or computer. It's a good idea to keep a paper copy of your key contacts in case you lose power and your phone is out of charge. This might include family members, loved ones, your local emergency management office, insurance agent, doctor, bank, etc. For families it is good to have an out of town contact that family members can check in with, verify they are okay, and can share their location, especially if evacuated.

Hurricane/Disaster Supply Kit

At least a 7 day supply of non perishable food and water. Have a manual can opener on hand.	Photocopies or scanned images of identification, insurance, prescriptions, proof of residence such as latest utility bill
Battery powered television or radio with extra batteries.	Photocopies or scanned images of proof of identification such as birth and marriage certificates and titles
Flashlights with extra batteries	Extra medications
First Aid Kit and manual	Tire repair kit, booster cables and flares
Sanitation and hygiene items such as hand sanitizer, toilet paper, moist towelets	Toys and games for children; car chargers.
Matches in a waterproof container	Road maps
Whistle	List of contacts, important phone numbers.
Extra cash	Cell phone charger, portable battery

FEMA: [ready.gov/kit](https://www.fema.gov/readiness)

American Red Cross:

<https://www.redcross.org/get-help/how-to-prepare-for-emergencies/survival-kit-supplies.html>



Preparing Your Home Before the Storm

Doors and Windows

- Reinforce garage doors and tracks or replace with a hurricane rated door.
- Doors may be shuttered but one entry must be left easily accessible.
- Use a security dead bolt at least 1 inch long.
- If possible, install tested, manufactured hurricane shutters or hurricane-rated windows.
- Alternately may use 5/8" or greater exterior grade plywood secured by 2 1/2" screws and/or special clips.
- Taping windows is not recommended! It offers very little protection and may be dangerous.

Mobile Homes

- Check tie-downs for rust or breakage.
- Mobile or manufactured homes are more vulnerable to wind hazards. Residents should consider evacuation, especially when recommended by local officials. Plan where you would go to shelter if needed.

Landscaping

- Trim trees, shrubs and any dead limbs, especially close to home.
- Repair or replace damaged fences.
- Secure any loose items in your yard, on your property ahead of the storm.

Roofing

- Inspect roof for loose or damaged shingles. Consider replacing with shingles that are rated for hurricane force winds. Check and/or install hurricane clips to secure roof trusses to side walls.



Useful links: www.flash.org,
<https://www.ready.gov/hurricanes#prepare>

Preparing Your Business, Boats and Pets

Businesses

- Understand your risk, develop a preparedness, mitigation and business continuity plan.
- Conduct an employee awareness campaign including who will need to evacuate and who will shelter. Make sure emergency supplies are on hand.
- Conduct periodic severe weather/hurricane drills to practice the plans.
- Review insurance coverage including flood and injury policies.
- Evaluate surroundings, make sure any loose objects are secured.
- Evaluate risk including awareness of local flood plains and any flood walls or levees. Elevate structures if feasible, necessary, otherwise consider building levees or flood walls to repel floodwaters. Locate critical contents within the structure to at least one foot above Base Flood Elevation.
- Make sure any chemicals onsite are safeguarded.
- Keep any critical systems maintained, including communications, power, electrical, water, etc. Have a backup if possible (e.g. generator, UPS, etc).
- Make sure the structure is strong enough to withstand a hurricane and its effects; have it evaluated by a professional engineer.
- For more information click on [ready.gov/business](https://www.ready.gov/business)

Boat Owners

- Plan to secure or move your boat ahead of a storm. Check with your marina and boat manufacturer for best ways to do this. Plan ahead of season where you would move your boat.
- Purchase necessary hurricane materials such as additional mooring lines, crew anchors, fenders, fender boards, chafing gear, and anchors.
- Safe storm moorings should consist of good condition ropes of sufficient diameter and length, with at least three or four substantial anchor points. Do not moor parallel to bank. Receding tides often capsize boats in this type of anchorage.

Pet and Farm Animals

- Make sure pets and animals have enough food and water.
- If staying be sure animals have a safe, secure location to ride out the storm, clear of hazards such as tools, debris or toxic products.
- If evacuating make sure you have an appropriate pet carrier or vehicle and have identified a shelter or location ahead of the season.
- Keep an emergency kit for your pet complete with food, water, medicines, basic first aid, collar or harness with ID tag (to be worn at all times), favorite toys, treats.
- Keep a picture of you and your pet together.
- Have newspapers and trash bags for sanitation.
- Always plan to bring pets inside, take them with you if evacuating. Never keep a pet chained, whether indoors or outdoors.
- For more info on preparing your pet click here: <https://www.ready.gov/pets>
<https://www.fda.gov/animal-veterinary/animal-health-literacy/taking-care-your-pets-during-hurricanes-and-floods>

Helping Others

Preparations for People with Medical, Functional or Access Needs



FEMA News Photo

If you or someone you know have medical, functional or access needs, such as impaired vision, hearing loss, or limited mobility, make sure there is a support structure in place to help that person respond to a hurricane threat. Such individuals can often benefit from a caretaker or “hurricane helper,” someone who can look out for that individual and ensure they have the necessary resources to evacuate and/or shelter when the storm threatens.

For more information:

Identify things you need every day such as food, medicines, water and other items you may rely on such as a walker, oxygen tanks or medical equipment. Start building up a supply before the hurricane season of non-perishable food items, bottled water, medicines, etc. that can be used in the event you lose power and/or water supply. Have at least two weeks’ supply of food and water, and 1 month supply of medications. If you have vital medical equipment that you rely on that requires power, be sure to have a back-up source of power such as a battery or generator. Store important documents in a plastic bag such as prescriptions, emergency contact information for family and doctor, insurance cards, identification etc. If evacuation is necessary, identify where you will evacuate to, who you will stay with and how you will get there. If you cannot drive, make sure you have someone designated who will drive you where you need to go in advance of the hurricane. Make sure your transportation can accommodate any equipment or other supplies that need to be taken with you.

For more information:

www.ready.gov/disability

www.togetheragainsttheweather.com

State of Texas

Emergency Assistance Registry (STEAR) - Dial 211

If you will need help evacuating from a hurricane or any other hazard, dial 2-1-1 to register with STEAR. You will be asked a series of questions which will allow emergency managers to identify those who need extra assistance evacuating. It is necessary to do this each calendar year. There is also an option to register online.

For more information:

<https://tdem.texas.gov/stear/>

www.galvestontx.gov/561/Need-A-Ride-Program

Insurance Tips

Before the Storm

Keep a written inventory of your possessions. Take photos or video of each room and the exterior of your home and business.

Gather important insurance documents such as insurance cards and policies. Keep them with you or stored at a safe location.

Review your insurance policies with your insurance agent. Understand what is and is not covered, what limits there may be. Make adjustments if necessary.

If you rent, consider renter's insurance to protect damage or loss of your belongings.

National Flood Insurance Program (NFIP)

Homeowners and commercial property policies typically exclude coverage for damage from flooding. Speak to your insurance agent about purchasing a separate flood insurance policy from the National Flood Insurance Program (NFIP). For more information about flood insurance, contact the NFIP 1-800-427-4661. www.floodsmart.gov

Texas Windstorm Insurance Association (TWIA)

If your property is located in one of Texas' 14 coastal counties, or parts of southeastern Harris County, you will likely only be able to obtain insurance coverage for windstorm or hail damage from a special insurance pool called the Texas Windstorm Insurance Association (TWIA.) To qualify for TWIA coverage, your property must pass a windstorm inspection and must meet certain windstorm-resistant building standards. You cannot buy or change TWIA coverage once a hurricane has entered the Gulf of Mexico. For more information about windstorm coverage call TWIA or visit its website 1-800-788-8247. www.twia.org

Insurance Tips - After the Storm

Contact your insurance agent or company promptly. Keep a record of all contacts, interactions you have with your company. Be prepared to answer questions about the extent and severity of the damage. Videos and photos may be very helpful.

If your home is not insured, contact your local Red Cross or FEMA Disaster Recovery Center for assistance. Call FEMA at 1-800-621-FEMA (3362).

Make a list of your damaged property. Photograph or video the damage if possible. Don't throw away damaged items until your insurance adjuster has had a chance to view them.

If there is partial damage to your home, make reasonable and necessary temporary repairs to protect your home and property from further damage. Cover broken windows and holes to keep rain out. Don't make permanent repairs until instructed by your insurance company. Keep a record of your repair expenses and save all receipts.

Texas Department of Insurance
www.tdi.texas.gov
Consumer help line 1-800-252-3439

Texas Windstorm Insurance Association
www.twia.org
Consumer help line 1-800-788-8247

Final Checklist

Hurricane in the Gulf

Monitor the latest forecast from trusted sources like the NWS and local media.

Make sure emergency kit is complete.

Make sure vehicles are fueled and serviced. Garage any vehicles not being used.

Shutter or board up windows if possible. Taping windows is NOT advised.

Store lawn furniture and other loose, light-weight items.

Get extra cash; make sure have adequate supply of medicines.

Listen for any evacuation orders from local officials.

If Leaving/Evacuating

Turn off propane tanks. Unplug small appliances.

Turn refrigerator and freezer to lowest setting.

Notify family members of your evacuation plans. Identify a family member who all can check in with.

Lower water in swimming pool by at least one foot.

Lock home securely.

Take pets with you.

Bring your supply kit with you!

If Staying

Close storm shutters if available.

Turn refrigerator and freezer to lowest setting and open only if necessary.

Beware of calm winds in the eye of the storm, do not venture outside. The strongest, most dangerous winds in the hurricane often occur just prior to and just after the passage of the eye.

Lower water in swimming pool by at least one foot.

Its best to follow evacuation recommendations of local officials. If you decide to stay and conditions deteriorate, first responders will not be able to help you. Don't endanger yourself or your family.



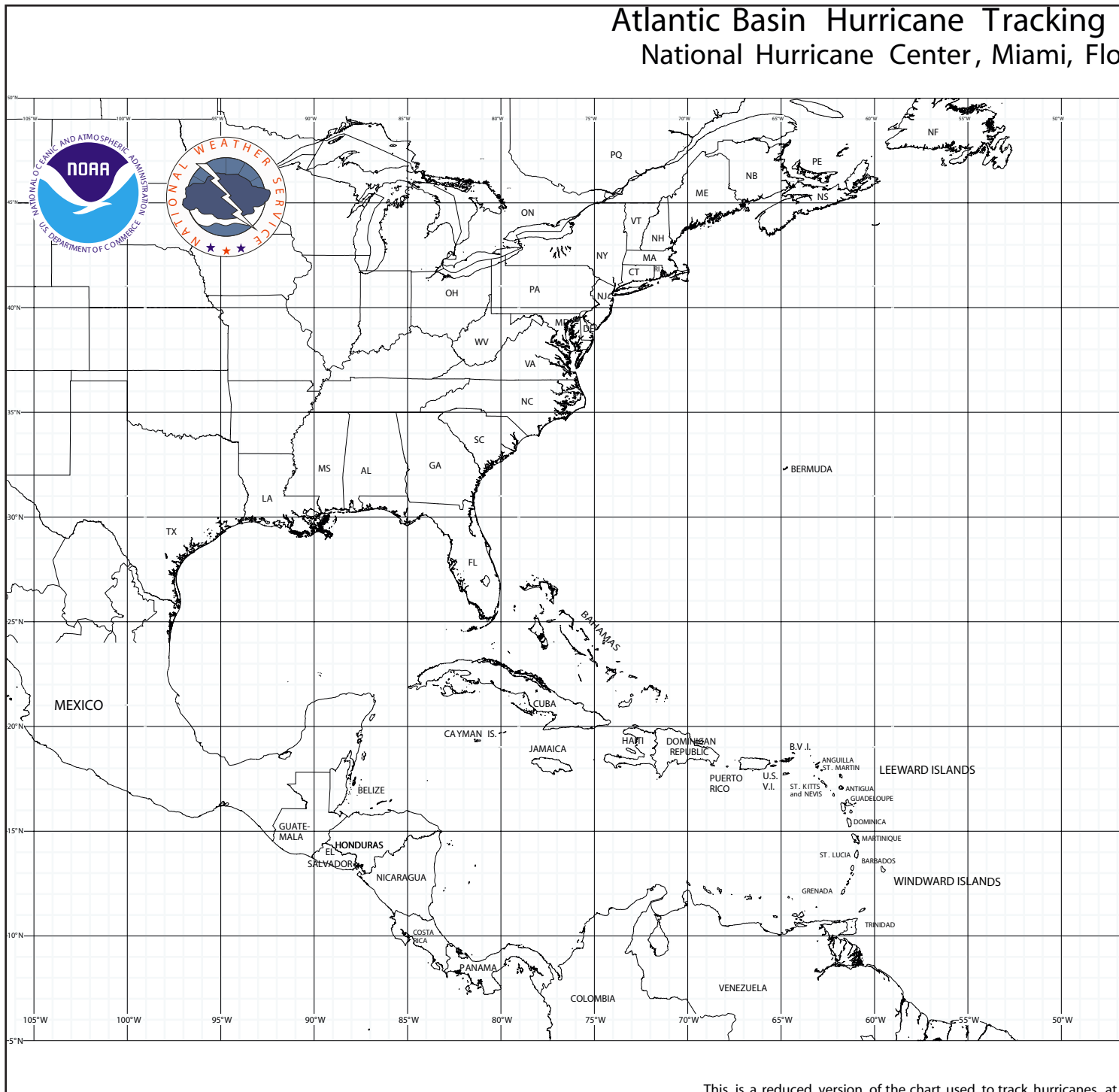
Hurricane Rita 2005. Photo Credit NASA.



Evacuation Hurricane Rita 2005.
Photo Credit FEMA.

Hurricane Tracking Chart

Atlantic Basin Hurricane Tracking
National Hurricane Center, Miami, Fla



This is a reduced version of the chart used to track hurricanes at

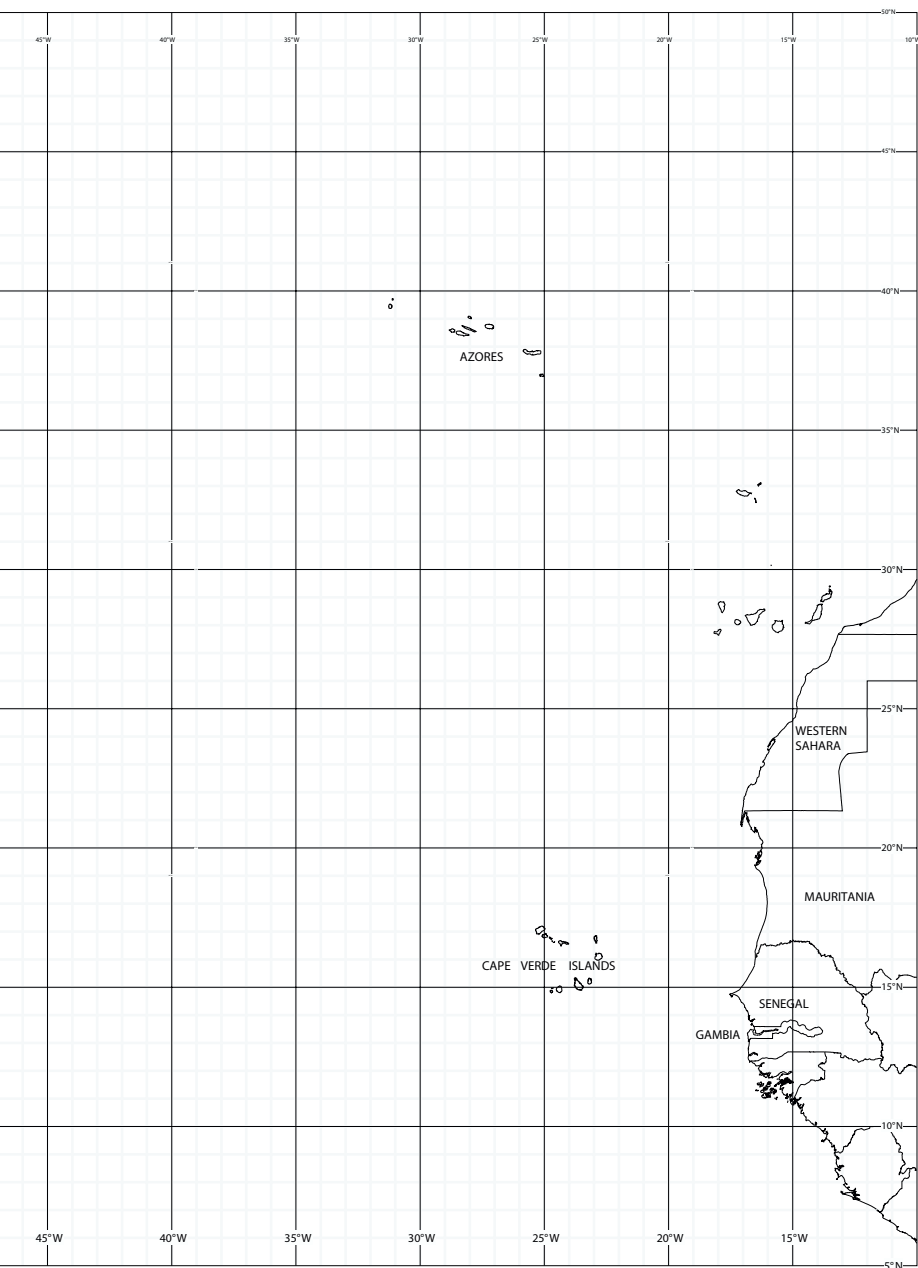
You can print your own here!

https://www.nhc.noaa.gov/pdf/AT_Track_chart1.20060925.pdf

https://www.nhc.noaa.gov/pdf/AT_Track_chart2.20060925.pdf

Hurricane Names

Chart
Florida



the National Hurricane Center

2020 Hurricane Names

- | | |
|------------------------------------|-----------------------------------|
| <input type="checkbox"/> Arthur | <input type="checkbox"/> Laura |
| <input type="checkbox"/> Bertha | <input type="checkbox"/> Marco |
| <input type="checkbox"/> Cristobal | <input type="checkbox"/> Nana |
| <input type="checkbox"/> Dolly | <input type="checkbox"/> Omar |
| <input type="checkbox"/> Edouard | <input type="checkbox"/> Paulette |
| <input type="checkbox"/> Fay | <input type="checkbox"/> Rene |
| <input type="checkbox"/> Gonzalo | <input type="checkbox"/> Sally |
| <input type="checkbox"/> Hanna | <input type="checkbox"/> Teddy |
| <input type="checkbox"/> Isaias | <input type="checkbox"/> Vicky |
| <input type="checkbox"/> Josephine | <input type="checkbox"/> Wilfred |
| <input type="checkbox"/> Kyle | |

2021 Hurricane Names

- | | |
|------------------------------------|-----------------------------------|
| <input type="checkbox"/> Ana | <input type="checkbox"/> Larry |
| <input type="checkbox"/> Bill | <input type="checkbox"/> Mindy |
| <input type="checkbox"/> Claudette | <input type="checkbox"/> Nicholas |
| <input type="checkbox"/> Danny | <input type="checkbox"/> Odette |
| <input type="checkbox"/> Erika | <input type="checkbox"/> Peter |
| <input type="checkbox"/> Fred | <input type="checkbox"/> Rose |
| <input type="checkbox"/> Grace | <input type="checkbox"/> Sam |
| <input type="checkbox"/> Henri | <input type="checkbox"/> Teresa |
| <input type="checkbox"/> Ida | <input type="checkbox"/> Victor |
| <input type="checkbox"/> Joaquin | <input type="checkbox"/> Wanda |
| <input type="checkbox"/> Kate | |

2022 Hurricane Names

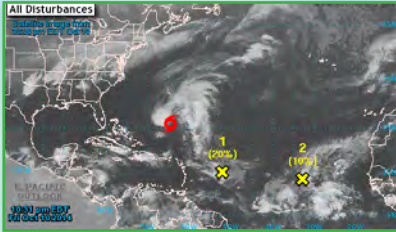
- | | |
|-----------------------------------|-----------------------------------|
| <input type="checkbox"/> Alex | <input type="checkbox"/> Lisa |
| <input type="checkbox"/> Bonnie | <input type="checkbox"/> Martin |
| <input type="checkbox"/> Colin | <input type="checkbox"/> Nicole |
| <input type="checkbox"/> Danielle | <input type="checkbox"/> Owen |
| <input type="checkbox"/> Earl | <input type="checkbox"/> Paula |
| <input type="checkbox"/> Fiona | <input type="checkbox"/> Richard |
| <input type="checkbox"/> Gaston | <input type="checkbox"/> Shary |
| <input type="checkbox"/> Hermine | <input type="checkbox"/> Tobias |
| <input type="checkbox"/> Ian | <input type="checkbox"/> Virginie |
| <input type="checkbox"/> Julia | <input type="checkbox"/> Walter |
| <input type="checkbox"/> Karl | |

Hurricane Forecast Graphics

The National Hurricane Center (NHC) in Miami, FL is responsible for issuing tropical cyclone watches and warnings for the United States. For the local area these forecasts are coordinated with and communicated by the Houston/Galveston Weather Forecast Office. Follow the websites to the right and the forecast products below to stay informed during the hurricane season.

Weather Information

National Weather Service
www.weather.gov/houston
National Hurricane Center
www.hurricanes.gov



Graphical Tropical Weather Outlook

- Provides an overview of all tropical cyclone activity.
- Indicates areas of interest where tropical cyclones could develop over next 5 days. A percent chance that it will develop is assigned.
- Moving the cursor over the highlighted areas will provide a more detailed text description.



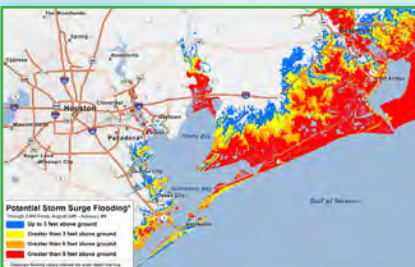
NHC Forecast Advisory

- Most recent position for a storm along with all coastline watches and warnings. Includes a 3 or 5 day track with error cone.
- Error cone represents a 5 year average error. The center of the storms only stays within the error cone 67% of the time.
- DO NOT focus too closely on the exact track forecast - the little black line. If you are in or near the cone, the center of the storm could head your way. Impacts are often felt well outside the cone.



Tropical Storm Wind Time of Arrival Graphic

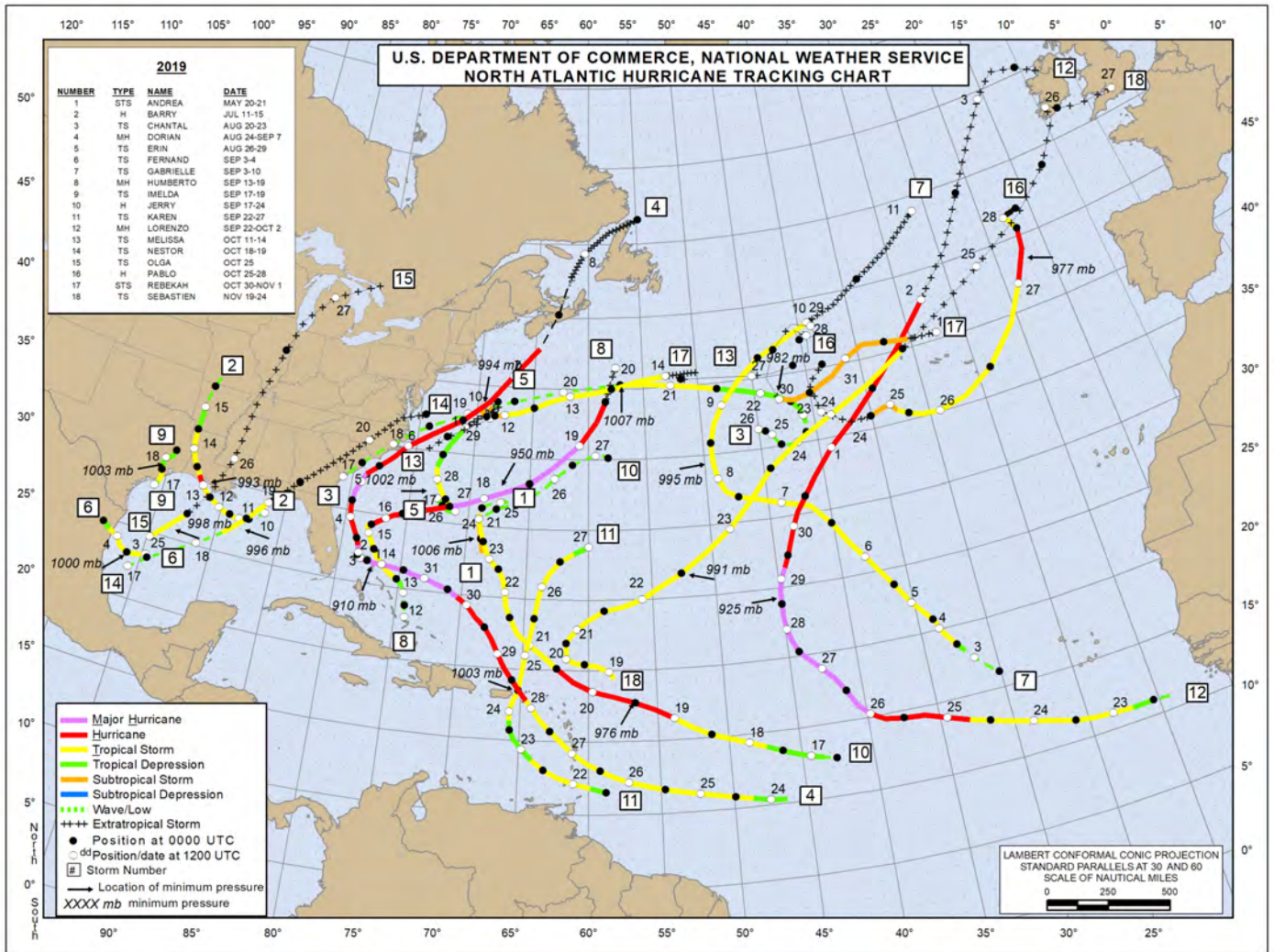
- Graphic shows estimated time of arrival of tropical storm force winds, both most likely time and earliest reasonable time.
- Designed to account for forecast uncertainty.
- May be useful for evacuation planning.



Potential Surge Inundation Graphic

- Issued by National Hurricane Center about 48 hours prior to impacts being felt at the coast.
- Shows reasonable worst case for storm surge flooding, inundation. Data is plotted as depth of water above ground.
- Storm Surge watch/warning also may be issued. See page 3 in this guide for more information on storm surge and related products.

Review of 2019 Hurricane Season and 2020 Forecast



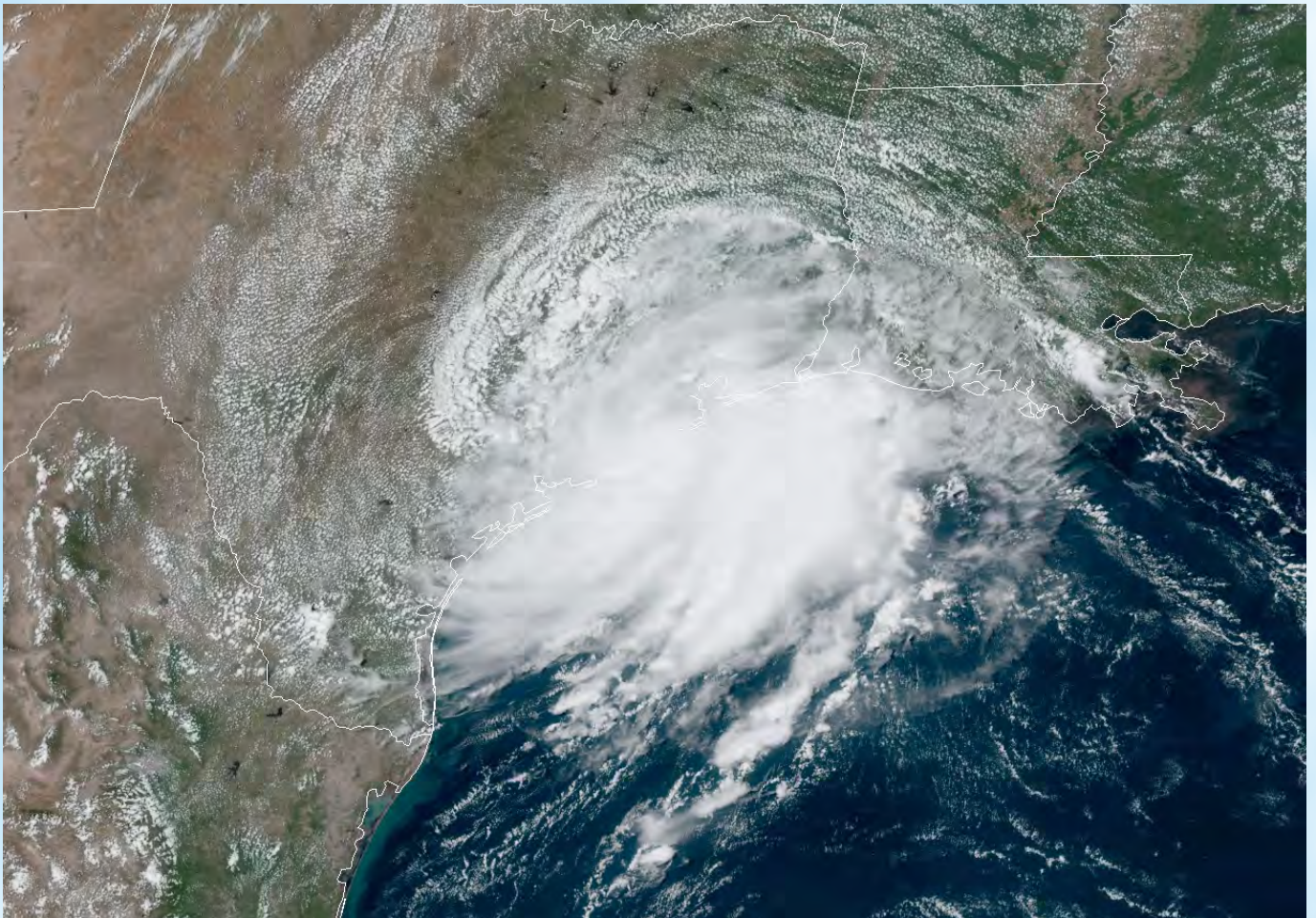
The 2019 Atlantic hurricane season activity was near to above normal with 18 named storms, including 6 hurricanes, 3 major (defined as category 3 or greater). This compares to the long term averages of 12 named storms, 6 hurricanes and 3 major. Hurricane Dorian was one of the strongest hurricanes on record, tied with "Labor Day Hurricane of 1935), Gilbert (1988) and Wilma (2005) for second in terms of maximum wind speed with 185 mph, ranking only behind Hurricane Allen in 1980. In 2019, 5 tropical cyclones formed in the Gulf of Mexico which ties a record set previously in 2003 and 1957. These Gulf developers are of special concern to residents along the Texas coast as they can arrive with relatively little time to prepare. Tropical Storm Imelda was such a storm, bringing torrential rains and catastrophic flooding to portions of the region. Imelda is described in more detail on pages 19-20. What is ahead for 2020? The NOAA hurricane forecast is for an above-average hurricane season with 13 to 19 named storms, 6 to 10 hurricanes, 3 to 6 major hurricanes. It's not possible to determine if any storms will impact the local area. No matter what the forecast, it is important to prepare every year.

<https://www.noaa.gov/media-release/active-2019-atlantic-hurricane-season-comes-to-end>

<https://www.noaa.gov/media-release/busy-atlantic-hurricane-season-predicted-for-2020>

Tropical Storm Imelda

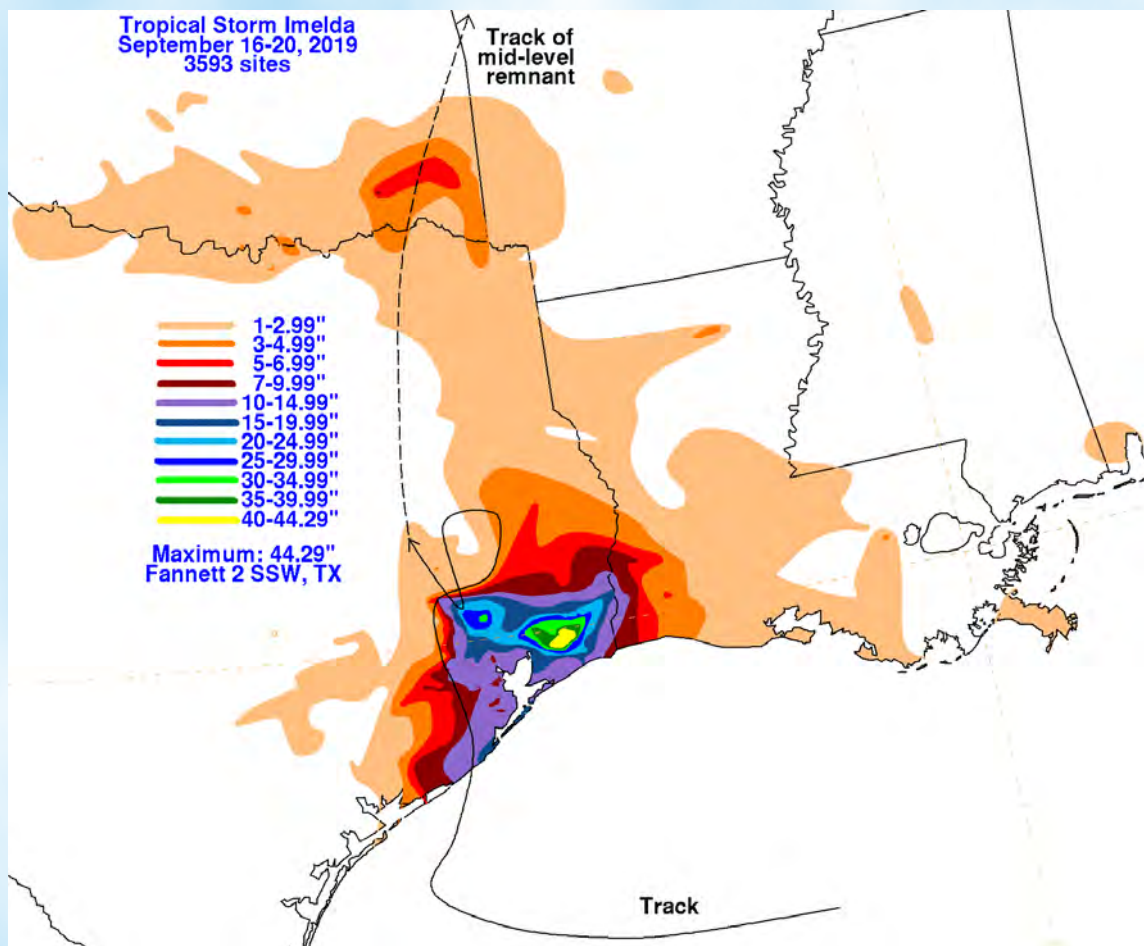
Tropical storm Imelda was a short-lived tropical storm that moved inland over Texas just after it developed on September 17, 2019. Looking back at the origins of Imelda reveals that the storm can be traced to a portion of a large scale upper-level trough that was located over the eastern United States. An upper level low developed out of this large scale feature and moved southwest into the eastern Gulf. Shower and thunderstorm activity gradually increased over the eastern Gulf and a weak surface trough developed on September 14th. This trough of low pressure then moved westward across the Gulf of Mexico. On September 16th, a broad surface low formed as the system approached the Texas coast, and later that night, showers and thunderstorms became more concentrated near the center of this low. Early on September 17th, the low became better defined with thunderstorms becoming more organized, and a tropical depression formed during the morning hours while it was located about 50 miles southwest of Freeport, Texas. The depression became a minimal tropical storm later that morning, while located about 25 miles south-southwest of Freeport, and made landfall near Freeport at 1245 PM CDT. (Fig. 1)



Now inland, Imelda moved slowly northward during the afternoon and evening hours bringing bands of heavy rainfall to coastal areas of southeast Texas. During the overnight hours on the 17th into the 18th, very slowly moving rainbands produced 5 to 20 inches of rainfall across the coastal counties of southeast Texas. There was a maximum of 23 inches near Sargent in Matagorda county during this initial 24 hours of Imelda's heavy rainfall.

Unfortunately, the heavy rainfall/flooding threat was only beginning with Imelda as the weak surface low began to drift and slowly loop over east Texas on the 18th and into the 19th. (Fig. 2) This slow motion looping motion coupled with deep tropical moisture remaining in place, resulted in the development of quasi-stationary rainband on the evening of the 18th that persisted throughout the morning of the 19th. The result was a NW to SE oriented swath of extreme rainfall ranging between 20 and 45 inches and falling within 24 hours. The heaviest rainfall stretched from just east of Conroe to southwest of Beaumont, with a maximum of 44.29 inches near Fannett, Texas.

The ensuing flash flood emergency resulted in 5 direct fatalities and hundreds of high water rescues. The damage caused by Imelda was almost entirely from flooding with Jefferson county reporting 5,100 flooded homes and Harris, Liberty, and Montgomery counties reporting up to 3100 flooded homes. There was an EF-1 tornado that touched down in Harris county that damaged trees and a barn. The total damage from Imelda is estimated to be near 5 billion dollars.



Reference: Tropical Storm Imelda Report, Andy Latto and Robbie Berg - National Hurricane Center

After the Storm

- Listen to local officials for updates and instructions. Don't return until it is safe to do so. A list of emergency manager contacts is included in the back of this guide.
- Watch out for debris and downed power lines.
- Avoid flood waters. It takes less than a foot of flowing water to knock over a pedestrian and just a few feet of water to float a vehicle. Alligators, fire ants and snakes can also be found in flood waters.
- Photograph the damage to your property in order to assist in filing an insurance claim.
- Make sure to inspect your home after a hurricane. Do what you can to prevent further damage to your property, (e.g., putting a tarp on a damaged roof); work with your insurance company to schedule permanent repairs.
- Continue listening to local news for updated information and instructions. Consult the web sites and social media of your local office of emergency management, or call for more information.
- Do not use water that could be contaminated to drink, wash dishes, brush teeth, prepare food, wash hands, make ice or make baby formula. Use only bottled, boiled or treated water until you know that the water is safe.
- Keep away from loose or dangling power lines. Report them immediately to the power company. Check for gas leaks. If you smell or hear gas leaking leave immediately and call the gas company or fire department.
- Wear protective clothing, including rubber gloves and boots, and be cautious.
- DO NOT run generators indoors but only in well ventilated outdoor areas. Many deaths after the storm are due to carbon monoxide poisoning due to improper use of generators.
- Do not use open flames indoors. Be extremely cautious if using candles. Many fires have resulted due to candles getting knocked over.
- Listen for instructions on debris clean up and pick up for your community. You may be instructed to sort the debris and put by curb side.
- Be careful of over-exertion. There is typically a jump in heart attacks post storm due to the physical and mental stress of the disaster.
- Check on your neighbors, especially the elderly. Make sure they are well and taken care of.



Beach Safety/Rip Currents

What is a Rip Current?

Rip currents are channelized currents of water flowing away from shore at surf beaches. They can sweep even the strongest swimmers from shore.

Rip currents typically form near breaks in sandbars and near structures such as jetties and piers.

There are estimated over 100 deaths per year due to rip currents and account for most lifeguard rescues.

How Can you Protect Yourself?

Always swim in an area protected by lifeguards.

Learn to swim in the surf and make sure your children know how.

If caught in a rip current try to get out of it by swimming parallel to the shore.

If you can't escape and need help, draw attention to yourself by yelling and waving.

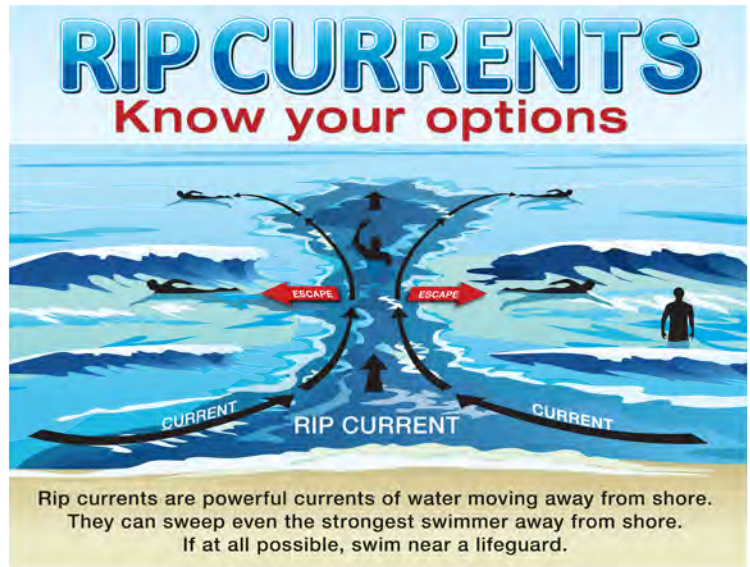
Never swim alone. Always swim near a lifeguard.

For more information:

<https://www.usla.org/page/RIPCURRENTS>

<https://www.weather.gov/safety/ripcurrent>

<https://www.weather.gov/safety/ripcurrent-beach>



IF CAUGHT IN A RIP CURRENT

- ◆ Relax, rip currents don't pull you under.
- ◆ Don't swim against the current.
- ◆ Swim out of the current, then to shore.
- ◆ If you can't escape, float or tread water.
- ◆ If you need help, yell or wave for assistance.

SAFETY

- ◆ Know how to swim.
- ◆ Never swim alone.
- ◆ If in doubt, don't go out.
- ◆ Swim near a lifeguard.

More information about rip currents can be found at the following websites:
[weather.gov/safety/ripcurrent/](https://www.weather.gov/safety/ripcurrent/)
[usla.org](https://www.usla.org)



Beach and Water Safety Tips

- **Swim Near a Lifeguard**
- **Learn to Swim**
- **Never Swim Alone**
- **Don't Dive in Headfirst**
- **Obey Warning Signs and Flags**



United States Lifesaving Association
WWW.USLA.ORG

Flood Safety

Flash floods from heavy rains are the most dangerous hazard for Southeast Texas. With flow off the Gulf of Mexico providing abundant moisture, high rain rates are not uncommon, with greater than 4 inches per hour observed on occasion. When thunderstorms follow each other or “train” over one area, rainfall of several inches over a short period is not uncommon with flash flooding a result. It is important to understand what actions to take to protect yourself from flash flooding hazards.

Flood Related Watches, Warnings, Advisories

Flash Flood Watch: *Be Prepared, Stay Alert, Keep Watch.* A watch is issued when conditions are favorable for flash flooding but occurrence, timing, and location is still uncertain.

Flood Advisory: *Be advised, be cautious.* A Flood Advisory is issued when flooding may cause significant inconvenience and if caution is not exercised, could lead to situations that may threaten life and/or property. Conditions are not quite as severe as with a warning.

Flash Flood Warning: *Take Action!* A warning is issued when potentially life threatening flash flooding is imminent or occurring. A flash flood is a sudden violent flood that can develop quickly...within hours.

Flash Flood Emergency: *Extreme Danger!* Rarely used. Reserved for rare cases of extreme danger to life and property from flash flooding, a historic event with an extreme threat to life and property.

During a Flood

- Avoid walking or driving through flood waters. Turn Around, Don't Drown! Just 6 inches of moving water can knock you down, and 2 feet of water can sweep your vehicle away. Most flash flood fatalities occur in vehicles.
- If floodwaters rise around your car, abandon the car immediately and move to higher ground. Best option is to get out through the windows. Force door open if necessary before becoming completely submerged.
- Avoid camping or parking along streams, rivers and creeks during heavy rainfall. These areas can flood quickly and with little warning.
- If in a flood prone area from a nearby stream or creek you may be asked to evacuate and move to higher ground. Obey evacuation orders if given.
- Never drive around barricades.

After A Flood

- Return home only when authorities say it is safe.
- Be aware of areas where floodwaters have receded and watch out for debris, snakes, fire ants, alligators, etc. Floodwaters often erode roads and walkways.
- Do not attempt to drive through areas that are still flooded.
- Avoid standing water as it may be electrically charged from underground or downed power lines.
- Photograph damage to your property for insurance purposes.

3 SIMPLE STEPS FOR FLASH FLOOD SAFETY

During a flood, water levels and the rate at which the water is flowing can quickly change. Remain aware and monitor local radio and television.

1 GET TO HIGHER GROUND
Get out of the areas subject to Flooding

2 DO NOT DRIVE INTO WATER
Do NOT drive or walk into flooded areas. It only takes 6" of water to knock you off your feet.

3 STAY INFORMED
Monitor local radar, television, weather radio, internet or social media for updates.

WHEN FLOODED TURN AROUND DON'T DROWN

weather.gov/flood



For more information, click here:
weather.gov/floods
www.ready.gov/floods

Tornado Safety

Tornadoes are fairly common in Southeast Texas. A tornado can strike very quickly with little warning. It's important to know what to do should a tornado approach so you can take quick protective action. First a few terms and then tips on what to do.

Tornado Watch - Conditions favor the development of tornadoes. Stay alert, be ready to act should a tornado threaten. Watch the sky and have a way to receive warnings (smart phone apps, NOAA Weather Radio, commercial radio or television).

Tornado Warning - A tornado has been sighted or indicated by weather radar. Take shelter immediately if in the warned area.

Tornado Emergency - Issued in exceedingly rare circumstances when there is a severe threat to human life and/or catastrophic damage is imminent or ongoing and reliable sources confirm tornado.

If you are in a structure (e.g. residence, small building, school, nursing home, hospital, factory, shopping center, high-rise building) go to the center of a small interior room or interior hallway on the lowest level, away windows, doors, and outside walls. Put as many walls as possible between you and the outside. Avoid large rooms with large span roofs (gymnasiums, cafeterias, etc). If in a high-rise building go to a small interior room or hallway on the lowest floor possible away from windows. Have a pair of sturdy shoes stored in your shelter room and put them on. Do not open windows.

If you are in a manufactured or mobile home get out immediately and go to a pre-identified location such as the lowest floor of a sturdy, nearby building or storm shelter. Mobile homes, even if tied down, offer little protection from tornadoes. It is important to identify such a sturdy shelter you can get to quickly as part of your severe weather plan.

If caught outside with no shelter make every effort to get to a safe shelter. If this is not possible your best course of action is to lie in a low spot or ditch and cover your head with your hands. It is not advisable to get under a bridge or overpass.



For more information, click here:
[weather.gov/tornado](https://www.weather.gov/tornado)
[ready.gov/tornado](https://www.ready.gov/tornado)

Other Thunderstorm Hazards: Hail, Damaging Winds, Lightning

Thunderstorms can bring a variety of hazards including tornadoes, flash flooding, hail, lightning and damaging winds. The National Weather Service issues Severe Thunderstorm Warnings for thunderstorms believed to contain large hail (One inch or greater in diameter) and/or damaging winds. Here are some guidelines on how to stay safe when dealing with thunderstorm hazards lightning, hail and high winds.

Lightning Safety:

- A good rule of thumb, if you can hear thunder you are close enough to be struck by lightning. **"When Thunder Roars, Go Indoors!" "See a Flash, Dash Inside."**
- Get inside a home, building, or closed automobile (not a convertible). You are much safer inside a vehicle than outside.
- Avoid open fields, the top of a hill or a ridge top.
- Stay away from tall, isolated trees or other tall objects (power poles, antennae). If you are in a forest, stay near a lower stand of trees.
- Stay away from water, wet objects and metal objects, such as fences and poles.
- Unplug any electronic equipment well before the storm arrives.
- If planning an outdoor event, make sure you have a lightning safety plan; have a designated weather watcher; identify shelters that can be reached quickly.

www.lightningsafety.noaa.gov

www.ready.gov/thunderstorms-lightning

www.ncaa.org/health-and-safety/lightning-safety

Large Hail and High Winds:

- Seek shelter in a sturdy structure away from windows
- Close your drapes or blinds; this offers extra protection from flying glass.
- Shelter your vehicle if possible ahead of the storm.
- Inspect your home and roof after a large hail storm. Cover any damaged areas to prevent leaks.



For more information click here: <https://www.weather.gov/safety/thunderstorm>

Weather Alerts to Your Cell Phone

Wireless Emergency Alerts (WEA)

What are WEA messages?

Wireless Emergency Alerts (WEA) are emergency messages sent by authorized government alerting authorities through your mobile carrier. Government partners include local and state public safety agencies, FEMA, the FCC, the Department of Homeland Security, and the National Weather Service. No sign up is required! Alerts are sent automatically to WEA-capable smart phones and watches during an emergency.

Why is this important to me?

Alerts received at the right time can help keep you safe during an emergency. With WEA, alerts are sent to your mobile device when you are in a warned area, without need to download an app or subscribe to a service.

What types of alerts will I receive?

- Extreme weather warnings
- Local emergencies requiring evacuation or immediate action
- AMBER Alerts
- Presidential Alerts during a national emergency

What types of weather warnings are included?

Flash Flood, Tornado and Hurricane Warnings

Less Common: Tsunami, Extreme Wind, Storm Surge and Dust Storm Warnings.

What does a WEA message look like?

WEA will look like a text message. The WEA message will show the type and time of the alert, any action you should take, and the agency issuing the alert. The message will be no more than 90 characters on most phones, but this limit has recently been expanded to 360 characters with a Spanish-language message as well (will be evident on newer phones).

Will I receive a WEA message if I'm visiting an area where I don't live, or outside the area where my phone is registered?

Yes, if you have a WEA-capable phone.

How will I know the difference between WEA and a regular text message?

WEA messages include a special tone and vibration, both repeated twice.

What if I don't want to receive these emergency messages?

You can opt out of the Amber or Extreme Weather WEAs. Details on how to set your phone up for these alerts including opt out instructions can be found by searching your wireless carrier's website for WEA or wireless emergency alerts. The details on how to set these up are dependent on your carrier and smart phone model.

Other weather alert apps

There are many weather alert apps, many free, that have some of the same functionality as the WEA system in that they will send you a weather alert usually as a text message for your location and any others you specify. Do a search for "weather alerts" at the App Store or wherever you find apps on your phone.



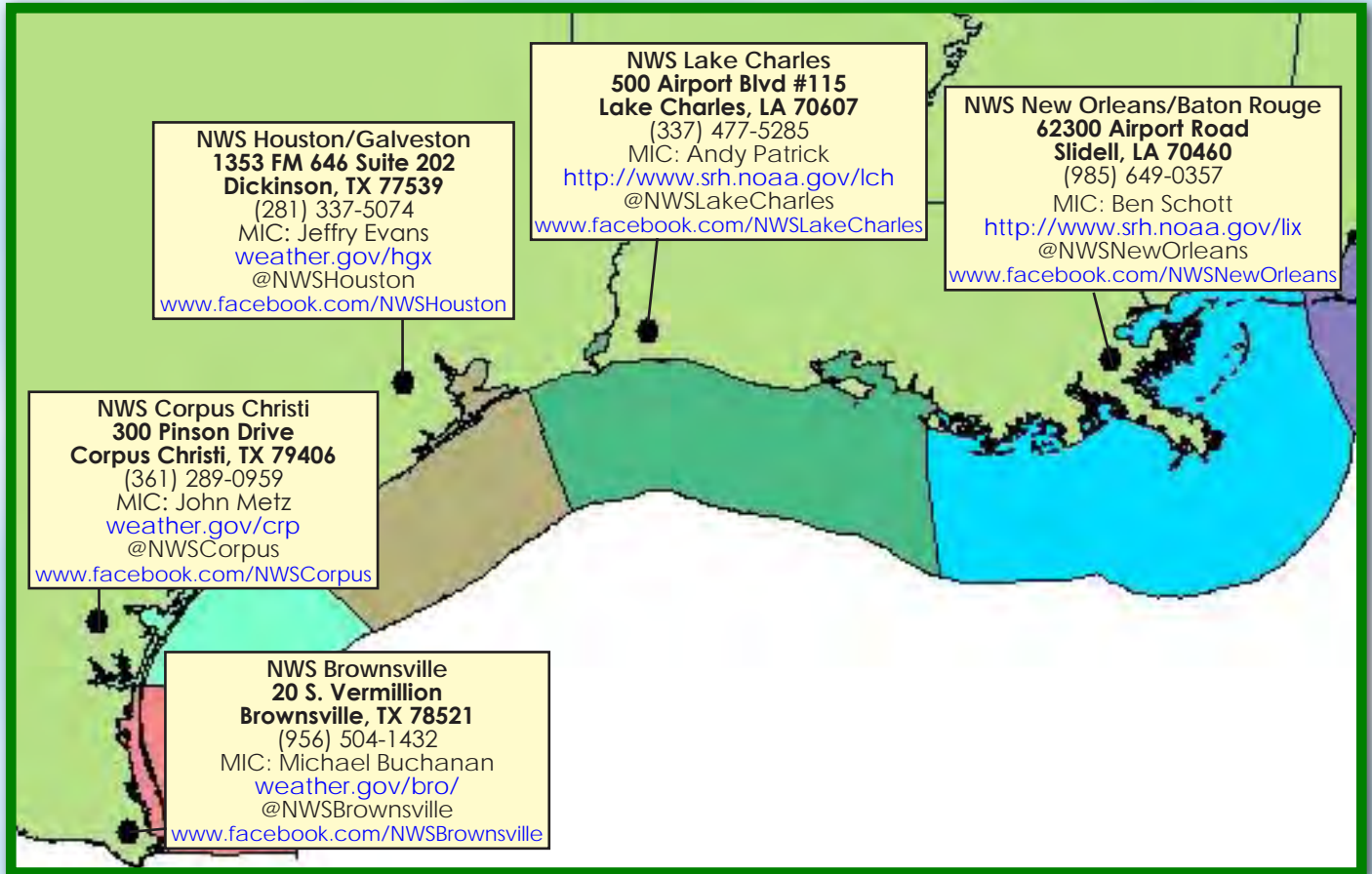
For more information check out these links.

www.ready.gov/alerts

<https://www.fema.gov/integrated-public-alert-warning-system>

<https://www.weather.gov/wrn/wea>

Regional National Weather Service Offices



The National Weather Service would like to acknowledge the Greater Houston LEPC for their assistance in the production of this severe weather guide. An LEPC (Local Emergency Planning Committee) is a gathering of representatives in your community that have an interest in hazardous materials safety. As a group, they are tasked with identifying potential risks that your community faces, from chemicals stored in and/or transported throughout your community. The LEPC seeks ways to help minimize the risk, prevent accidents and assist in the development of plans to deal with a chemical emergency. Education and community outreach is another core component of an LEPC. Through the LEPC, the public will be able to seek out information about chemicals in their communities and learn how to safely shelter in place. For more information on LEPCs in Texas go to this link:
www.tceq.texas.gov/assets/public/permitting/tier2/LEPC-contact-list.pdf



Emergency Management Contacts

Jurisdiction	Contact Info	Jurisdiction	Contact Info
Austin County	979-865-5911 austincounty.com	Chambers County	409-267-2445 www.chamberstx.gov
Brazoria County	979-864-1201 brazoriacountytx.gov/ departments/emergency- management	Mont Belvieu	281-576-2021
Alvin	281-388-4363 www.alvin-tx.tov	Colorado County	979-733-0184
Angleton	979-849-2383	Fort Bend County	281-342-6185 www.fbcoem.org
Bailey's Prarie	979-849-0134	Arcola	281-431-0606
Brazoria	979-798-2489	Beasley	979-387-2775
Brookside	281-485-3048	Fairchilds	281-341-4638
Clute	979-265-6194	Fulshear	281-346-1796
Danbury	979-922-1551	Kendleton	979-532-8240
Freeport	979-239-1211	Meadows Place	281-983-2900
Hillcrest Village	281-748-7149	Missouri City	281-403-8500 www.missouricityready.com
Iowa Colony	281-369-3444	Needville	979-793-4255
Jones Creek	979-233-3091	Orchard	979-478-6893
Lake Jackson	979-415-2500	Pleak	281-239-8504
Liverpool	281-581-2342	Richmond	281-342-5456 www.richmondtx.gov
Manvel	281-489-1212	Rosenberg	832-595-3700 www.rosenbergtx.gov
Oyster Creek	979-233-8481	Simonton	281-533-9809
Pearland	281-997-4640 pearlandtx.gov/preparedness	Stafford	281-261-3950
Richwood	979-265-8157	Sugar Land	281-275-2700 sugarlandtx.gov/105/Emergency- Management
Surfside Beach	979-239-1151	Thompsons	281-343-9929
Sweeny	979-548-3321 www.sweenytx.gov	Weston Lakes	281-533-0907
Quintana	979-233-0848	Galveston County	281-309-5002, 888-384-2000 www.gcoem.org
West Columbia	979-345-5121	Bayou Vista	409-935-0449
Brazos County	979-821-1011 www.bcdem.org	Clear Lake Shores	281-334-1034, 281-334-2799
Bryan	979-821-1030	Dickinson	281-337-4700 www.ci.dickinson.tx.us
College Station	979-821-1000 www.cstx.gov/dem	Friendswood	281-996-3335 www.ci.friendswood.tx.us
Burleson County	979-567-2001 co.burleson.tx.us/burleson- county-alert-system/	City of Galveston	409-765-3710 galvestontx.gov

Emergency Management Contacts

Jurisdiction	Contact Info	Jurisdiction	Contact Info
Galveston Co. (continued)		Morgans Point	281-471-2171
Hitchcock	409-986-5559 www.hitchcockpd.com	Nassau Bay	281-333-4211 www.nassaubay.com
Jamaica Beach	920-572-4073 www.ci.jamaicabeach.tx.us	Pasadena	713-475-5588 www.pasadenatx.gov
Kemah	281-334-5414	Seabrook	281-291-5700
La Marque	409-938-9269 www.cityoflamarque.org	Shoreacres	281-471-2244
League City	281-554-1000 www.leaguecity.com	South Houston	713-947-7700
Sante Fe	409-925-2000	Taylor Lake Village	281-326-2843
Texas City	409-643-5840	Tomball	281-290-1301
Tiki Island	409-935-1427	Webster	281-332-1826
Grimes County	936-873-4404	West University Place	713-662-5836
Navasota		City of Houston (Harris)	713-884-4500 www.houstonoem.org
Harris County	713-881-3100 www.readyharris.org	Houston County	936-544-7175, 936-544-2862 hyper-reach.com/txhoustonsignup.html
Baytown	281-422-2311 www.oembaytown.org	Jackson County	361-782-3398 www.co.jackson.tx.us
Bellaire	713-662-8206 www.bellairetx.gov	Edna	361-782-3122
Deer Park	281-478-7298 www.deerparktx.gov	Ganado	361-771-2800
El Lago	281-326-5900	Liberty County	936-334-3219 www.co.liberty.tx.us
Galena Park	713-672-2556	City of Liberty	936-336-8118
Humble	281-446-4298 www.cityofhumble.com	Madison County	936-348-3810 www.co.madison.tx.us
Jacinto City	713-674-8424	Montgomery County	936-523-3900 www.mctxoem.org
Jersey Village	713-466-2130	Conroe	936-522-3080
Katy	281-574-8633 www.cityofkaty.com	Shenendoah	281-367-8952
La Porte	281-470-0010 www.lpoem.org		

Emergency Management Contacts

Jurisdiction	Contact Info	Jurisdiction	Contact Info
Polk County	936-327-6826 www.polkcountyoem.com	Washington County	979-532-1123
Alabama-Coushatta	936-563-1100	Brenham	979-337-7300
San Jacinto County	936-653-3395 sjc.oem@co.san-jacinto.tx.us	Wharton County	979-532-1123 www.co.wharton.tx.us facebook.com/Wharton-County-Office-of-Emergency-Management-221712291190574
Walker County	936-435-8740 www.facebook.com/WalkerCountyOEM walkercountyoem@co.walker.tx.us	El Campo	979-543-5311 www.cityofelcampo.org
Waller County	936-826-8282	City of Wharton	979-532-4811 x570 www.facebook.com/WhartonOEM

Hurricane Preparedness and COVID-19

Should a hurricane strike, the presence of a virus like COVID-19 creates challenges if evacuations or sheltering are called for and can add more stress to an already stressful situation. Contact your local emergency manager on how procedures may have changed due to COVID concerns.

The CDC recommends adding things to your go kit such as hand sanitizer and two cloth face coverings for each person. Make every effort to maintain social distance of at least 6 feet when assembling your kit, checking on others, etc.

If in a shelter try to maintain that social distancing. Wear a face covering if requested to do so by local officials and shelter managers.

Some general tips are found here:

<https://www.cdc.gov/disasters/hurricanes/covid-19/prepare-for-hurricane.html>

Tips specific to sheltering can be found here:

<https://www.cdc.gov/disasters/hurricanes/covid-19/public-disaster-shelter-during-covid.html>

General information on COVID 19 can be found here:

[coronavirus.gov](https://www.coronavirus.gov)

<https://tdem.texas.gov/covid-19/>

EXTREME WEATHER READY EXPO

A Free Family Preparedness Event

Sponsored By:

Supported By:

Featured Presenter:



Contributors:

Fort Bend County
Galveston County
Harris County
Montgomery County
Walmart
Houston Red Cross
The Church of Jesus Christ of Latter-day Saints
Mayor's Office for People with Disabilities
Harris County Flood Control District
Houston Commission on Disabilities
METRO Houston