2018 FloodWarn Training

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National Weather Service- Houston/Galveston, TX
National Weather Service

Weather Forecast Offices

River Forecast Centers

Click city for local weather information

Click RFC area for local information

[Maps showing locations of Weather Forecast Offices and River Forecast Centers]
Outline

Flooding Importance
Flooding Types and Causes
Flood Products
Coastal Flooding
River Flooding
Partners
Flood Safety
Reporting Flooding
Flood Risk

(REUTERS/Richard Carson)
Flooding Importance
Flooding is Deadly!

In the 5 year period from 2013 to 2017*, more people have died in Texas from flooding than all other weather hazards combined.

*2017 Data: 70 Flood Related Deaths in TX out of 138 Total Weather-Related Fatalities

Data from NWS National Hazard Statistics
Flood Fatalities

Over half of the flood fatalities in Texas occurred while people were in their car.

Texas Flood Fatalities by Shelter from 2013-2016

- Vehicle: 51.0%
- Permanent Home: 10.6%
- In Water: 26.0%
- Other: 12.5%

Data from NWS National Hazard Statistics
Houston Floods: April 18, 2016
Recent Big Floods...

Memorial Day 2015
Tax Day 2016
Brenham 2016
Harvey 2017

And other historic floods...
Tropical Storm Allison
1994 Flood
Tropical Storm Claudette
Ike 2008
Flooding Types and Causes
What Causes Flooding?

- Intense rainfall
- Rain over several days
- Dam/levee failures
- High tides or storm surge
- Snowmelt
- Ice or debris jams
Types of Flooding

Ponding & Sheet Flow Flooding
Flooding that occurs gradually over time, usually 6 hours after the rain begins or longer (longer duration).

Flash Flooding
Flooding that develops quickly (typically 6 hours or less) either from heavy rainfall or dam/levee failure (shorter duration).

River Flooding
Flooding that occurs from water escaping river banks.

Coastal Flooding
Flooding along a coastline either from high tides or storm surge during a tropical storm or hurricane.
Flood Products
Watch vs Warning

A **Watch** is issued when conditions are favorable to occur.

A **Warning** is issued when the threat is *occurring or imminent*, threatening life or property.
Flood vs. Flash Flood

A **Flood** is an overflow of water onto normally dry land likely caused by rising water in a river/bayou or poor drainage. Flooding is a longer term event than flash flooding. It may last days or weeks.

A **Flash Flood** is a flood caused by heavy or excessive rainfall in a short period of time, typically 6 hours or less. Flash floods are defined as:

- $\geq 3$ feet of standing water (less if threatening life or property), and/or
- $\geq 6$ inches of fast flowing water across a road or bridge, or
- Water in a stream or bayou flowing rapidly out of its banks, or
- A dam break (even on a sunny day)
# Understanding Flooding

<table>
<thead>
<tr>
<th><strong>Urban / Small Stream/Coastal Flood Advisory</strong></th>
<th><strong>Flood Watch</strong></th>
<th><strong>Flash Flood Watch</strong></th>
<th><strong>Flood Warning</strong></th>
<th><strong>Flash Flood Warning</strong></th>
<th><strong>Flash Flood Emergency</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>WHAT IS IT?</strong></td>
<td>Flooding of small streams, streets and low-lying areas.</td>
<td>Flooding is possible – typically within a 6 to 48 hours before rain is expected to reach the area.</td>
<td>Flooding impacts are occurring or imminent.</td>
<td>Flooding impacts are occurring or imminent.</td>
<td>Flooding situation that presents a clear threat to human life due to extremely dangerous flooding conditions.</td>
</tr>
<tr>
<td><strong>WHAT TO DO?</strong></td>
<td>Stay away from areas that are prone to flooding and stay clear of rapidly moving water</td>
<td>Stay tuned to local river forecasts; prepare for areas near rivers to spread towards nearby roads and buildings</td>
<td>Stay alert for inundated roadways and follow all local signage! Additional impacts include homes and structures could become flooded and need to be evacuated</td>
<td>Conditions will rapidly become hazardous! Do not cross flooded roadways or approach inundated areas as water may still be rising</td>
<td>Immediately reach higher ground by any means possible</td>
</tr>
</tbody>
</table>
You make the call...
What type of flooding is this?
What type of flooding is this?

This image depicts what conditions may look like during a flood advisory.
What type of flooding is this?

This image depicts what impacts may result from a Flash Flood Emergency. A rapidly moving flood wave resulted in this roadway being completely washed out.
What type of flooding is this?
Flood Advisory
Increasing Impact Potential
ALL Situations Represent Threatening Conditions to Life and/or Property

Note: Flooding can (and does) occur without a Flash Flood Watch!
Ways to Receive a Warning

- NOAA Weather Radio
- Wireless Emergency Alerts and Weather Apps
- TV and Radio
- Social Media

Be sure to have multiple ways to receive warnings.

NWS Website: https://www.weather.gov/hgx/
Coastal Flooding
What impacts water levels locally?

- **Ekman Transport**: Water is deflected/transported 45° (at the surface) to 90° (330-500 feet) to the right of the wind.

- **Wind direction**: An easterly wind component will typically produce higher water levels. Opposite is true about northwesterly directions.

- **Wind speed**: Higher speeds have a more significant impact than lower speeds.

- **Duration**: The longer elevated winds persist, the more significant the impacts.

- **Fetch**: The longer the distance the elevated winds, the more significant the impacts.

- **Miscellaneous**: Astronomical tides, seas, shelf slope, shape of the coast, etc.
You make the call...
Which scenario is more likely to produce higher water levels?

- **#1**: East wind 20 knots
- **#2**: NW wind 20 knots
Which scenario is more likely to produce higher water levels?

#1

- East wind 20 knots
- Water transport

#2

- NW wind 20 knots
- Water transport
Which scenario is more likely to produce higher water levels?

**#1**
- ESE wind 20-25 knots
- 2 days

**#2**
- ESE wind 20-25 knots
- 5 days
Which scenario is more likely to produce higher water levels?

**#1**
- Water transport
- ESE wind 20-25 knots
  - 2 days

**#2**
- Water transport
- ESE wind 20-25 knots
  - 5 days

The second scenario (#2) is more likely to produce higher water levels due to the longer duration of the ESE wind.
Which scenario is more likely to produce higher water levels?

#1

ESE wind 20-25 knots

#2

ESE wind 20-25 knots
Which scenario is more likely to produce higher water levels?

**#1**
- Water transport
- ESE wind 20-25 knots

**#2**
- Water transport
- ESE wind 20-25 knots

The scenario on the right (#2) is more likely to produce higher water levels.
Coastal Flood Timeline

Before Event Onset  Coastal Flood Watch  Coastal Flood Advisory  Coastal Flood Warning

Increasing Impact Potential
ALL Situations Represent Threatening Conditions to Life and/or Property
Storm surge

- Storm surge is an abnormal rise of water generated by a storm, over and above the predicted astronomical tides.

- Storm surge is produced by water being pushed toward the shore by the force of the winds moving counter-clockwise around the storm.

- Storm surge is often the greatest threat to life and property from a hurricane.
Storm Surge

Waves on top of surge are highly destructive. Water weighs approximately 1,700 pounds per cubic yard.
Storm Surge

Sensitive to the slightest changes in:

- Storm track.
- Storm intensity.
- Forward speed.
- Size (radius of maximum winds).
- Angle of approach to the coast.
- Shape and characteristics of coastal features such as bays and estuaries.
- Width and slope of the continental shelf. A shallow slope will potentially produce a greater storm surge than a steep shelf.

Storm surge values many times do not correspond well to the hurricane wind categories (on the Saffir-Simpson Hurricane Wind Scale) that range from 1 to 5. These categories are based only on winds and do not account for storm surge. Ike was a category 2 storm that produced a 15-20 foot storm surge.
Storm Surge

Sometimes high water levels cut off communities well before (sometimes days) bad weather arrives. First responders need to be prepared for this and also ensure your personal family members have a plan in place.
Track Errors
Storm Surge

Real scenario…NHC forecast track

NHC TRACK ERROR 12 hr. OUT

130 mph, 933 mb

Hurricane forecast track—Approximately 12 hr. before landfall

NHC TRACK ERROR 12 hr. OUT

130 mph, 933 mb

Hurricane forecast track—Approximately 12 hr. before landfall

Rmax=25 mi (forecast)

Surge Based on NHC -12 hr. Advisory

Mobile ★

Pensacola ★

MOBILE BAY

Gulf Shores

Perdido Key

Dolphin Island

Pascagoula

Fort Morgan
Storm Surge

Actual track

Observed surge

Surge Based on NHC Storm Best Track

Rmax=40 mi
Landfall 48+ hours out: pre-computed risk maps (SLOSH MOMs and MEOWs).

- Maps made by using up to 100,000 hypothetical storms to compute the maximum storm surge at an individual point.
- Varying forward speed, radius of maximum wind, intensity, landfall location, tide level, and storm direction.
- Ask your local NWS where to find these maps and how to read them.
Storm Surge - Response

<48 hours before landfall: NHC Potential Storm Surge

- Shows geographical areas where inundation from storm surge could occur and how high above ground the water could reach in those areas.
- Based on the latest forecast track and intensity of the tropical cyclone.
- Takes into account likely forecast errors.
- The shading represents inundation levels that have a 10 percent chance of being exceeded, which can therefore be thought of as representing a reasonable worst-case scenario for any individual location.
- Updated every six hours or so.
Increasing Impact Potential

ALL Situations Represent Threatening Conditions to Life and/or Property
Storm Surge + Freshwater Flooding (Harvey)

- Very difficult to forecast.
- Little guidance available.
- Cannot express how valuable local NWS hydrologists are in these complex situations!!!
Real Time Water Level Observations & Forecasts

https://tidesandcurrents.noaa.gov/inundationdb/
Real Time Water Level Observations & Forecasts

https://tidesandcurrents.noaa.gov/map/index.html?region=Texas

https://slosh.nws.noaa.gov/etsurge2.0

Probabilistic Extra-Tropical Storm Surge 1.0
River Flooding
Watershed

- A watershed is an area of land that drains runoff from rainfall (stormwater) to a body of water, either a river, bayou, creek, or lake.
- A watershed can flow into another watershed.
- Watersheds vary in shape and size which ultimately lead to unique challenges.
- Topography plays a big role in how watershed boundaries are defined.
Watershed

- A watershed is an area of land that drains runoff from rainfall (stormwater) to a body of water, either a river, bayou, creek, or lake.
- A watershed can flow into another watershed.
- Watersheds vary in shape and size which ultimately lead to unique challenges.
- Topography plays a big role in how watershed boundaries are defined.
- Galveston County deals with watersheds such as Clear Creek, Dickinson Bayou, and Highland Bayou
- NWS issues site specific river forecasts for 1 site in Galveston County.
River flooding occurs when water escapes the river banks. There are different thresholds for river flooding: action, minor, moderate, major and record flooding. This image depicts what a river flooding looks like.
Rainfall Analysis

Rainfall estimates and forecasts merged into continuous dataset

Hydrologic Modeling

Rainfall ingested into hydrologic model. Forecasters adjust model parameters in real time

Forecast

Warning

River Forecast Process
LOCATION:
Of the gage the forecast is made, AT means the gage is in the limits of the town/city, NEAR or NR means that town/city has the closest post office.
Hydrograph Basics

OBSERVATIONS:
Past river stages

Brazos River at Richmond

Latest observed value: 53.13 ft at 5:15 AM CDT 30-Aug-2017. Flood Stage is 45 ft

Major: 50.0'
Moderate: 48.0'
Minor: 45.0'

Graph Created (6:50AM Aug 30, 2017)  -  Observed -  Forecast (issued 2:30AM Aug 30)
RMOT2(plotting HGIRG) "Gage 0" Datum: 27.94'
Observations courtesy of US Geological Survey
Hydrograph Basics

**FORECAST:**
Forecast River Stages

**CREST:**
Peak Stage

Latest observed value: 53.13 ft at 5:15 AM CDT 30-Aug-2017. Flood Stage is 45 ft.
STAGE VS FLOW:
Hydrologists, models, reservoirs work in flow. Emergency managers, media, general public work in stage.

What is flow or a cubic foot per second?
Hydrograph Basics

A basketball is roughly a cubic foot, so 20,000 cfs is 20,000 basketballs of water passing the gage every second.
Understanding River Criteria Levels

**BELOW CRITERIA**
Impact: Water is within the banks of the river with no impacts to the surrounding area. Flow speeds may still be high during rainfall or releases which could impact recreational activities.

**ACTION**
Impact: Water is over the banks and into the flood plain, but not a threat to structures or roadways. Some action may be required such as moving farm equipment or increasing awareness.

**MINOR**
Impact: Typically water is impacting areas inside of floodplain which can vary by location. Some low water crossings covered by water, agricultural flooding, water approaching public areas (parks, sidewalks etc.). Areas frequently flooded can expect to be impacted.

**MODERATE**
Impact: Water now reaching areas only impacted by significant rain events. Structures can be inundated, several roads covered with water, water may cut off certain areas, widespread agricultural flooding.

**MAJOR**
Impact: Water is near the highest it’s ever been representing rare flooding and significant widespread impacts. Most roads will be covered by water in the area cutting off if not completely flooding subdivisions, rivers can be several miles wide in areas. Homes and structures underwater, bridges inundated and in danger of being hit by debris. Impacts may be greater than ever experienced.
Advanced Hydrologic Prediction System

USGS Water Alerts

- Set alerts when a gauge reaches certain water surface elevations.
- Identify the gauge nearest you
- Click on the gauge

USGS Water Alerts: https://maps.waterdata.usgs.gov/mapper/wateralert/
USGS Water Alerts

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- Identify the gauge nearest you
- Click on the gauge and select “Subscribe to WaterAlert"

USGS Water Alerts: https://maps.waterdata.usgs.gov/mapper/wateralert/
USGS Water Alerts

- Set alerts when a gauge reaches certain water surface elevations.
- Identify the gauge nearest you
- Click on the gauge and select “Subscribe to WaterAlert"
- Define how you want to receive the information:
  - Email or phone
  - Frequency
  - Stage or Discharge
  - Stream Elevation(s)
- Note: Use Internet Explorer

USGS Water Alerts:
https://maps.waterdata.usgs.gov/mapper/wateralert/
Partners
Harris County Flood Control District

- HCFCD’s mission is to provide flood damage reduction projects that work, with appropriate regard for community and natural values.
  - Devise flood damage reduction plans
  - Implement the plans
  - Maintain the infrastructure
- Flood Warning System
- Public Website: www.harriscountyfws.org
Flood Warning System

Stream Elevation
A100_120 Clear Creek @ FM 528

Stream Elevation (Feet)

<table>
<thead>
<tr>
<th>Flood Frequency</th>
<th>Elevation</th>
</tr>
</thead>
<tbody>
<tr>
<td>10% (10-year)</td>
<td>17.50'</td>
</tr>
<tr>
<td>2% (50-year)</td>
<td>20.10'</td>
</tr>
<tr>
<td>1% (100-year)</td>
<td>21.00'</td>
</tr>
<tr>
<td>.2% (500-year)</td>
<td>23.10'</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
<th>Elevation</th>
</tr>
</thead>
<tbody>
<tr>
<td>6/20/1973</td>
<td></td>
<td>16.88'</td>
</tr>
<tr>
<td>9/20/1979</td>
<td></td>
<td>18.48'</td>
</tr>
<tr>
<td>5/3/1981</td>
<td></td>
<td>13.78'</td>
</tr>
<tr>
<td>8/18/1983</td>
<td>Alicia</td>
<td>14.38'</td>
</tr>
<tr>
<td>8/1/1989</td>
<td>Chantal</td>
<td>18.78'</td>
</tr>
<tr>
<td>10/18/1994</td>
<td></td>
<td>15.98'</td>
</tr>
<tr>
<td>6/9/2001</td>
<td>Allison</td>
<td>18.28'</td>
</tr>
<tr>
<td>10/16/2006</td>
<td></td>
<td>15.40'</td>
</tr>
<tr>
<td>8/16/2007</td>
<td>Erin</td>
<td>7.20'</td>
</tr>
<tr>
<td>4/18/2009</td>
<td></td>
<td>14.80'</td>
</tr>
<tr>
<td>8/27/2017</td>
<td>Harvey</td>
<td>24.20'</td>
</tr>
</tbody>
</table>

High water mark elevations are approximate.
Flood Safety

What to do before, during, and after a flood?
Safety Before a Flood

- Prepare a family disaster plan.
- Check if your insurance covers flood damages. If not, get flood insurance.
- Keep insurance and other important documents, such as copies of driver's licenses and credit cards, and other valuable items, in a safe deposit box.
- Assemble a disaster supplies kit. Be sure to include prescription medications, food, and water.
- Find out where you can go if ordered to evacuate.
- Arrange to keep in contact with relatives and friends.
- Know your resources.

Knowing what to do when a flood occurs will increase your family’s safety and possibly its survival.
Safety During a Flash Flood

• Turn around, don’t drown when encountering flooded roads.
• Be especially cautious at night when it is harder to recognize the dangers of flooding.
• Stay away or be swept away. River banks and culverts can become unstable and unsafe.
• You should monitor the latest forecasts and be prepared to take action should additional Flash Flood Warnings be issued.
• Have multiple ways to receive weather information (cell phone, NOAA weather radio, television, etc.)
Turn Around, Don’t Drown!

- Most flood deaths occur in vehicles.
- It only takes six inches of water for a vehicle to lose contact with the road surface.
- Most vehicles can be swept away in just 18 to 24 inches of water!
- Don’t Rely on Your Big Vehicles
- Flooded roads may have hidden dangers, such as washed out road beds or underwater obstructions.
- If your vehicle is caught in rising water, leave it immediately and seek higher ground.

Minnesota road damaged by flood waters, courtesy of FEMA.
Safety During a Flood

- Do not sightsee!
- Evacuations are ongoing and first responders are working hard to get people to safety. Do not get in their way!
- Flood waters from creeks, bayous and rivers will be swiftly moving. *Do not go near the flood waters!* They will sweep you away if you go in the water.
- Stay out of the flood waters!
- Roads may still be closed as they could be damaged or still under water. *Barricades are for your protection; do not drive around them!*
Safety After a Flood

• Don’t put yourself in danger.
• Return home only when authorities indicate it is safe.
• Use extreme caution when entering buildings
• Cut power to flooded areas of your home
• Only use generators in well-ventilated areas – **Not** in a closed garage!
• Do not use power tools while standing in water
• If you smell or hear gas, call the Fire Department.
Report Flooding
What to Report

Flash Flooding

- Underpasses filling with water
- Impassible roadways
- Any fast-moving water greater than 6 inches in depth

Any River or Bayou Flooding

Flooding, Washington County (2016)
Formatting Reports

Reports should include the following information:

- **WHO** is calling
- **WHERE** the flooding is located
- **WHAT** type of flooding is occurring (flash, river, or bayou)
- **WHEN** the flooding occurred (is it ongoing?)
- **HOW** deep is the water (if you can *safely* evaluate this)
The Good

“I’m a storm spotter located in Sealy at the intersection of Meyer and FM 2187. Water is flowing over curbs; it’s at least 6-8 inches deep in some locations on the road.”

The Bad

“Hey, we got some flooding here a few minutes ago!”

The Ugly

“My sister-in-law said the bayou got really closer to her house, did you have a warning out for that?”
How to Report

Call us!
Spotter line: 1-800-846-1828

Report via amateur radio
Call sign WX5HGX

Email
sr-hgx.nws@noaa.gov

Social Media
Twitter: @NWSHouston
Facebook: NWSHouston

Spotter Tip
Set up SKYWARN as a contact in your smartphone
Flood Risk
Flood Risk?

Any situation involving exposure to a Flood danger, harm or loss.

“While levees can help reduce flood risk...they do not eliminate the risk.”
Everyone is at risk for flooding

- Brief definition of flooding is any forms of rising water in which 2 properties are affected—one being yours
- **Structure Coverage**
  - Max coverage $250,000
- **Contents coverage**
  - Contents is an optional addition, except for Preferred Risk Policy.
  - Max coverage $100,000 coverage for Actual Cash Value
- **Wait Period**
  - Typically - 30-days from purchase until effective.
- **Average NFIP pay out for Harvey was $112K (March 2018)**

- **Group Flood Insurance**
  - Available during a Presidential Declared event
  - If qualified for a IA grant a GFIP will be purchased in the amount of $600
  - Policy is good for 3 years
  - Must maintain insurance on the property forever
  - Max amount on the policy is 33,500 this includes structure and dwelling
  - Average pay out for Harvey for IA was $6000
Insurance Misconception

- **Misconception:**
  “I’m already covered—my homeowners policy covers flooding.”

- **Fact:**
  Most insurance policies do not cover flooding; only flood insurance covers flood damage.

Renters and Business owners should also consider flood insurance for contents.

- **Misconception:**
  “I don’t live in a flood zone.”

- **Facts:**
  - Floods are the #1 natural disaster in the United States.
  - If it can rain, it can flood.
  - FIRMs do not show localized flooding from drainage ditches/sewers/road ponding.
  - To some degree overland flooding...but not property to property drainage problems.
What is a FIRM?

Flood Insurance **Rate** Map
- Identifies the flood zones
- SFHA (high risk)
  - A, AE, AO, AH, VE, V etc. (**Aqua**)
    - 1% annual chance flood
- Non-SFHA (low to moderate risk)
  - B, C and X (Shaded – **orange** or gray color & non-Shaded)
    - Orange/Gray area – outlines areas protected by Levees
    - Even the non-shaded is a flood zone – a minimal risk.
- Used for rating flood insurance policies
- Are subdivided by panels to cover jurisdictional boundary.
- Shows what the BFE within the zones
- FIRM’s show Costal and Riverine flood risk

Find your zone at https://msc.fema.gov/portal/home
# Cost of Flood Damage?

2,500 sqft, one-story home with possessions worth $50,000

<table>
<thead>
<tr>
<th>Interior Water Depth (Inches)</th>
<th>Cost to Home</th>
<th>Cost to Personal Property</th>
<th>Combined Loss Potential</th>
</tr>
</thead>
<tbody>
<tr>
<td>1&quot;</td>
<td>$23,635</td>
<td>$3,172</td>
<td>$26,807</td>
</tr>
<tr>
<td>2&quot;</td>
<td>$23,720</td>
<td>$3,172</td>
<td>$26,892</td>
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<td>3&quot;</td>
<td>$24,370</td>
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<td>$46,633</td>
<td>$94,538</td>
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<tr>
<td>48&quot;</td>
<td>$53,355</td>
<td>$50,000</td>
<td>$103,355</td>
</tr>
</tbody>
</table>
Structure Elevation Impact Insurance Rates

The elevation is just one factor, others include: when was the structure, has it flooded in the past, etc.

High Risk = $$$
Medium Risk = $
Lower Risk = $

The elevation is just one factor, others include: when was the structure, has it flooded in the past, etc.

EVERY Structure has a risk…
generally the higher the structure the less the risk.
Harvey Numbers

Insurance claims
- Harris Co (includes cities such as Houston) – all claims 55,570**
- Matagorda County (unincorporated only) 16 (Losses over 125K)
- Bay City (unincorporated only) 1 Loss over 125K

New GFIP’s Due to Harvey
- Galveston County – 107

Harris County Numbers**
- 154,170 Homes 48,850 in 1% Risk Area (100-yr)
- 34,970 in 0.2% (500-yr) floodplain
- 68% OUTSIDE of the 1% Risk Area.

Living in Texas means we have a flood risk even with heavy rain.
- Tax Day 2016 and Memorial Day 2015 – not with a tropical system

Flood Risk is from multiple sources.

Flood insurance allows individual property owners to manage their risk.
- Buy policies that cover the structure AND contents.
Contact Information

Angela Harrison, Insurance
Cell 470-557-2794 | Angela.Harrison@fema.dhs.gov

Yho-Meka Conway, Insurance
Cell 470-572-0803 | Yho-Meka.Conway@fema.dhs.gov

Lauren Schmied, PE, Floodplain Management
Cell 202-812-6164 | Lauren.Schmied@fema.dhs.gov

Larry Fordham ANFI, CFM, ACA
Acting Senior Regional Insurance Specialist, FEMA Region 6
Phone: 940-383-7253 | Cell: 202-394-4483
Larry.Fordham@fema.dhs.gov

NFIP Hotline
1-800-427-4661
www.fema.gov/nfip
Here to Help You

What Can We Do For Your Community?
Texas Floodplain Management Association

What Can We Do For Your Community?
State History of Devastating Rainfall

Photo courtesy of Lynn Post, Bandera Texas
TFMA Purpose

- Promote public awareness of proper floodplain management
- Promote professional status of floodplain management
- Enhance cooperation and exchange information among individuals, private organizations and public agencies
- Promote floodplain management education
- Inform members of floodplain management legislation
TFMA Regional Training (professional)

- Contact the TFMA office if your Region needs training opportunities
- TFMA will provide speakers
- TFMA will publish training on the TFMA website
- TFMA will provide trainers
- Luncheons
27% (331) of 1240 NFIP Communities responded

85% (282) require a +1’ or more freeboard for new development

44% (145) require a +1’ or more freeboard based on fully developed conditions

48% (159) require detention, require mitigation of downstream impacts or that development to be setback from Floodway Boundary (NAI)

83% require a study to establish the BFE and/or floodway in Zone A

38% (127) require a Zone X Freeboard (1’ to 3’ above nearest street)

78% require Elevation Certificates

73% (243) have community floodplain administrators that are CFM
Public Outreach

- Exhibit Booths
- Physical Flood Model
- Teachers
  - DVD with PowerPoint on “Natural Hazards in Texas”
- School Children
  - Coloring Books
- Calendars
- TADD Bumper Stickers
- Weather Advisories
- Radio Ads (TADD)
Mitigation Resources:

- Collaboration and partnerships
- Sharing success and troubleshooting stories
- Relocation of repetitive loss properties
- Buyout/Acquisition
- Multi-jurisdictional hazard mitigation plans
- Ordinances and codes
  - Compare regionally
- Wetland and other riparian area protection
- Drainage Canal
- Pump Improvements
- Elevation of repetitive loss properties
Community Resilience Collaborative

Collaborative Partners

Texas Sea Grant
- Connects extension team to coastal stakeholders to identify critical issues needing study, funds targeted research, then communicates research results to help solve real-world problems
- Deploys planners to provide technical assistance, outreach, and education to local governments and other community stakeholders

Department of Landscape Architecture & Urban Planning
- Researches planning for resilience
- Trains the next generation of urban planning professionals
- Collaborates with technical experts and professional networks

Institute for Sustainable Communities
- Supports interdisciplinary research of resiliency best practices
- Conducts applied, locally-driven, and co-produced research in vulnerable communities

Hazard Reduction and Recovery Center
- Conducts research on hazard impacts, mitigation, preparedness, response and recovery, and disseminates results to practitioners
- Provides assistance and consultation to agencies charged with responsibility for hazard analysis, emergency preparedness and response, disaster recovery, and hazard mitigation
Goals of the program:

1. Communities adopt high-quality plans to achieve locally defined visions of sustainable development.

2. Communities increase resilience to natural and technological hazards.

3. Habitat, ecosystems and the services they provide are monitored, enhanced and/or restored.

4. Local and scientific knowledge is leveraged in planning and other decision-making processes.
Current Projects and Partners

- Aransas County Long Term Recovery Plan
  - Began: December 2017
  - Status: currently posted for public comment

- Texas Homeowners Handbook for Coastal Natural Hazards
  - Partner: GLO
  - Status: currently revising first edition, reprinting Spring 2019

- Hitchcock, Texas
  - City Comprehensive Plan - Began June 2018

- Rockport, Texas
  - City Comprehensive Plan - Began June 2018

- Climate Science and Resilience Curriculum
  - Houston Independent School District
  - Jones Futures Academy & E.L. Furr High School

- Strengthening Coastal Counties Resilience Challenge
  - Organized by the National Association of Counties (NACo)
  - Assisting Willacy+Cameron County partnership
  - Status: Beginning October 2018
Texas Coastal Community Planning Atlas

- Allows users to visualize and identify critical issues related to numerous dimensions of development.
- Planners/Elected Officials can seek info about:
  - Environmental Degradation
  - Significant changes in land use patterns
  - Natural hazard risks
  - http://www.texascoastalatlas.com/
Buyers Be-Where

- Access to Critical info about a property’s risk and potential long-term value
- Selected property evaluated along multiple natural and human induced hazards.
  - Color-coded risk score
  - Risk Data
  - Scoring Scale

http://www.texascoastalatlas.com/
A Handbook for Reducing Vulnerability to Disasters
## Planning for Community Resilience: A Handbook for Reducing Vulnerability to Disasters

### Strategy

| Development regulations and land use management | Restrict occupancy in hazardous zones. Regulate density Discourage development in environmentally sensitive areas. | Res Subdivision Ordinances Planned Unit Dev. Special Overlay district Ag or Open Space zoning Hazard setback ordinances SW retention requirements |
| Building Standard | Design regulations that reduce loss and damage | Building codes Wind hazard resistance standards Flood hazard resistance for new homes Retrofit for existing buildings Special utility codes |
| Natural resource protection | Preserve ecologically sensitive areas | Wetland Protection Habitat Protection and restoration |
Questions or Comments?
Questions

National Weather Service
FEMA
TFMA
Links

- NWS Houston/Galveston: [https://www.weather.gov/hgx/](https://www.weather.gov/hgx/)
- West Gulf River Forecast Center: [https://www.weather.gov/wgrfc/](https://www.weather.gov/wgrfc/)
- National Hurricane Center: [https://www.nhc.noaa.gov/](https://www.nhc.noaa.gov/)
- NOAA Tides Predictions: [https://tidesandcurrents.noaa.gov/tide_predictions.html?gid=1413#listing](https://tidesandcurrents.noaa.gov/tide_predictions.html?gid=1413#listing)
- Extratropical Surge Guidance: [https://slosh.nws.noaa.gov/etsurge/](https://slosh.nws.noaa.gov/etsurge/)
- Harris County Flood Control District Flood Warning System: [https://www.harriscountyfws.org/](https://www.harriscountyfws.org/)
- FEMA Flood Map Service Center: [https://msc.fema.gov/portal/home](https://msc.fema.gov/portal/home)
- USGS Water Alerts: [https://maps.waterdata.usgs.gov/mapper/wateralert/](https://maps.waterdata.usgs.gov/mapper/wateralert/)
- NWS Flood Safety: [https://www.weather.gov/safety/flood](https://www.weather.gov/safety/flood)