



US Army Corps  
of Engineers  
Savannah District

**U.S. Army Engineer District, Savannah  
Corps of Engineers  
Savannah District**

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## **Emergency Employment of Army And Other Resources**

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# **SAVANNAH DISTRICT HURRICANE NOTIFICATION, EVACUATION AND RECALL PROCEDURES**

**CESAS Plan 500-1-13**

**25 May 2004**

## HURRICANE NOTIFICATION, EVACUATION AND RECALL PROCEDURES

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## SAVANNAH DISTRICT

### HURRICANE NOTIFICATION, EVACUATION AND RECALL PROCEDURES

1. Purpose. The purpose of this plan is to educate and provide employees with guidance to enable them to be better prepared in the event a hurricane strikes.
2. Applicability. This plan is applicable to all employees of the U.S. Army Corps of Engineers located in the Savannah, GA, area.
3. References.
  - a. ER 500-1-1, Civil Emergency Management Program, 30 Sep 01.
  - b. EP 500-1-1, Civil Emergency Management Program – Procedures, 30 Sep 01.
  - c. CESAS Plan 500-1-1, CESAS Natural Disaster Procedures, 1 Jun 94.
  - d. CESAS Plan 500-1-9, Savannah District Hurricane Plan, 1 May 02.
4. Notification of Hurricane and to Evacuate.
  - a. Local/NOAA.

(1) Hurricane Information Sources. Local governments and the county Emergency Management Directors or designated alternates are responsible for maintaining the emergency communication and warning systems. The County Commission Chairmen and Mayors work with the Emergency Management Directors to provide uniform public information. The Emergency Management Directors are, however, the chief spokespersons during a hurricane and will oversee the release of all emergency public information. Radio and television stations will provide initial releases of information and notification to allow early evacuation if necessary.

(2) The National Oceanic and Atmospheric Administration (NOAA): Provides continuous broadcasts of the latest weather information directly from National Weather Service offices. Taped weather messages are repeated every 4 to 6 minutes and are routinely revised every 1 to 3 hours or more frequently if needed. Special weather radios operate on NOAA frequencies; additionally, many radios offer the weather band as an added feature. NOAA weather radio operates on the following frequencies in the coastal Georgia/South Carolina area:

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This plan supersedes CESAS Plan 500-1-13, 4 Aug 03.

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Beaufort, SC	162.475 MHz
Savannah, GA	162.400 MHz

Following is a brief list of Emergency Alert Systems (EAS's) in this area. If any of these stations cannot be received, contact the county Emergency Management Office and obtain information regarding the nearest Emergency Alert System (EAS).

WYKZ-FM, Beaufort, SC	98.7 MHz
WQBT-FM, Savannah, GA	94.1 MHz
WXMK-FM, Brunswick, GA	105.9 MHz

b. Savannah District.

(1) Non-Duty Hours. If hazardous weather conditions or other emergency situations which affect the opening of the District office develop during non-working hours, employees in the Savannah area should listen to area radio and television stations for instructions on reporting to work.

(2) Duty Hours. Unless otherwise notified, all employees are expected to report to work as usual. Any required dismissal during normal working hours will be announced through supervisory channels.

c. Status of Savannah District Employees – Dismissal/Admin Leave/Liberal Leave. The Commander will authorize group dismissals or closures only when conditions are severe or where normal agency operations are significantly interrupted. Employees should not assume that excused absences will be granted in all situations, since a liberal annual leave policy may be more appropriate in some instances.

d. Specific Actions. See Appendices C and D.

5. Evacuation. County Emergency Management officials will provide information regarding evacuation. They have established shelters within the local coastal counties for individuals to use when a county does not require total evacuation. When an entire county must be evacuated, host cities have been designated to receive these individuals. Employees should follow the directions of county Emergency Management officials. See Appendix E for specific actions.

6. All Clear and Recall Procedures.

a. Dismissal. If possible, instructions for reporting to work will be placed on a recorded message. You may obtain this recorded message by dialing 912-652-5280 or 1-800-543-6891. These telephone numbers are activated only during an emergency situation.

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b. Recall. All employees located in the Savannah/Ft. Stewart areas only must call the Alternate Emergency Operations Center at **1-866-681-1368** not later than 24 hours following administrative dismissal or office closure due to natural disaster. The purpose of this contact is to provide an accounting for each District employee, to facilitate leave requests if needed based upon the disaster and, to facilitate return to duty instructions, as needed. **FAILURE TO CALL IN WILL RESULT IN THE EMPLOYEE'S ABSENCE BEING CHARGED AS ABSENCE WITHOUT LEAVE (AWOL). THE EXISTENCE OF LEGITIMATE, MANAGEMENT APPROVED EXTENUATING CIRCUMSTANCES MAY RESULT IN AWOL BEING CHANGED TO APPROVED LEAVE AFTER THE FACT.** Employees are responsible for checking media sites and recorded messages set forth in paragraphs above to obtain return to duty information, as well. During the call in, employees should be prepared to provide the following information: name, organization, phone number during closure period, and leave request if appropriate.

- 11 Appendices
- App A – Hurricane Characteristics
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ROGER A. GERBER  
COL, EN  
Commanding

DISTRIBUTION: See Appendix K

## APPENDIX A

### Hurricane Characteristics

#### 1. General.

a. Hurricanes are tropical cyclones in which winds reach constant speeds of 74 miles per hour (MPH) or more and blow in a large spiral around a relatively calm center--the eye of the hurricane. Every year, these violent storms bring destruction to coastlines and islands in their erratic path. Stated very simply, hurricanes are giant whirlwinds in which air moves in a large tightening spiral around a center of extreme low pressure, reaching maximum velocity in a circular band extending outward 20 or 30 miles from the eye wall. This circulation is counter-clockwise in the Northern Hemisphere and clockwise in the Southern Hemisphere. Near the center, hurricane winds may gust to more than 200 MPH. The entire storm dominates the ocean surface and lower atmosphere over tens of thousands of square miles.

b. The eye, like the spiral structure of the storm, is unique to hurricanes. In the eye, winds are light and skies are clear or partly cloudy. But this calm is deceptive, bordered as it is by maximum force winds and torrential rains. Many persons have been killed or injured when the calm eye lured them out of shelter, only to be caught in the maximum winds at the far side of the eye, where the wind blows from a direction opposite to that in the leading half of the storm.

c. Hurricane winds do much destruction, but drowning is the greatest cause of hurricane deaths. As the storm approaches and moves across the coastline, it brings huge waves and storm tides which may reach 25 feet or more above normal. The rise may come rapidly, flooding coastal lowlands. Waves and currents erode beaches and barrier islands, undermine waterfront structures, and wash out highways and railroad beds. The torrential rains that can accompany the hurricane produce sudden flooding as the storm moves inland. As its winds diminish, rainfall floods constitute the hurricane's greatest threat.

#### 2. Hurricane Origins.

a. The hurricanes that strike the eastern United States are born in the tropical and subtropical North Atlantic Ocean, the Caribbean Sea, and the Gulf of Mexico. Most occur in August, September, and October, but the 6-month period from 1 June through 30 November is considered the Atlantic hurricane season.

b. The principal regions of tropical cyclone origins vary during the season. Most early (May and June) storms originate in the Gulf of Mexico and western Caribbean. In July and August, the areas of most frequent origin shift eastward and by September are located over the larger area from the Bahamas southeastward to the Lesser Antilles, and then eastward to the south of the

Cape Verde Islands, near the west coast of Africa. After mid-September, the principal areas of origin shift back to the western Caribbean and Gulf of Mexico.

c. Hurricanes begin as relatively small tropical cyclones which drift gradually to the west-northwest (in the Northern Hemisphere), imbedded in the westward-blowing trade winds of the tropics. Under certain conditions these disturbances increase in size, speed, and intensity until they become full-fledged hurricanes. The storms move forward very slowly in the tropics and may remain almost stationary for short periods of time. The initial forward speed is usually about 15 MPH or less. Then, as the hurricane moves farther away from the Equator, its forward speed tends to increase; at middle latitudes it may exceed 50 MPH in extreme cases. The great storms are driven by the heat released by condensing water vapor and by external forces. Once cut off from the warm ocean, the storm usually begins to die, starved for water and heat energy and dragged apart by friction as it moves over land.

### 3. Actions Associated With Hurricanes.

a. The winds of a hurricane are very dangerous. For many structures, wind force is sufficient to cause destruction. Mobile homes are particularly vulnerable to hurricane winds. Some hurricanes spawn tornadoes which contribute to incredible destruction. The greatest threat from a hurricane's winds is their cargo of debris--a deadly barrage of flying missiles such as lawn furniture, signs, roofing, and metal siding.

b. The floods and flash floods brought by the torrential rains of a hurricane are dangerous killers. Even though a hurricane normally weakens rapidly as it moves inland, the remnants of the storm can bring 6 to 12 inches or more of rain to the area it crosses. The resulting floods may cause great damage and loss of life. Hurricane Diane of 1955 caused little damage as it moved into the continent; but long after its winds subsided, it brought floods to Pennsylvania, New York, and New England that killed 200 people and cost an estimated \$700 million in damage. In 1972, Agnes fused with another storm system, flooding creek and river basins in the northeast with more than a foot of rain in less than 12 hours, killing 117 people and causing almost \$3 billion damage. Hurricane Beulah of 1967 brought major floods to southern Texas, killing 10 persons and causing millions of dollars in damage.

c. The storm surge is a great dome of water often 50 miles wide that comes sweeping across the coastline near the area where the eye of the hurricane makes landfall. The surge, aided by the hammering effect of breaking waves, acts like a giant bulldozer sweeping everything in its path. The stronger the hurricane, the higher the storm surge. This is unquestionably the most dangerous part of a hurricane. Nine out of 10 hurricane fatalities are caused by the storm surge. During the infamous Hurricane Camille in 1969, a 25-foot storm surge inundated Pass Christian in Mississippi. Lesser heights are more usual but still extremely dangerous. Many factors are involved in the formation and propagation of a storm surge, such as the strength of the storm,

bottom conditions where the storm comes ashore, and the position of the storm center in relation to the shore.

4. Hurricane Categories. All hurricanes are dangerous, but some are more so than others. The way storm surge, wind, and other factors combine determines the hurricane's destructive power. The National Weather Service categorizes hurricanes by intensity on the Saffir/Simpson Hurricane Scale which indicates the relative strength of a hurricane. Category 1 is a minimum hurricane; category 5 is the worst case. The criteria for each category are shown below. This can be used to give an estimate of the potential property damage and flooding expected along the coast with a hurricane.

<u>Saffir/Simpson Hurricane Scale</u>				
<u>Cat</u>	<u>Central Pressure</u>		<u>Winds (MPH)</u>	<u>Surge (Feet)</u>
	<u>(Millibars)</u>	<u>(Inches of Mercury)</u>		
1	980+	28.94+	74-95	4-5
2	965-979	28.50-28.93	96-110	6-8
3	945-964	27.91-28.49	111-130	9-12
4	920-944	27.17-27.90	131-155	13-18
5	less 920	less 27.17	155+	18+

Category	Definition--Effects
1	<u>Winds 74-95 mph:</u> No real damage to building structures. Damage primarily to unanchored mobile homes, shrubbery, and trees. Some damage to poorly constructed signs. Also, some coastal road flooding and minor pier damage.
2	<u>Winds 96-110 mph:</u> Some roofing material, door, and window damage to buildings. Considerable damage to shrubbery and trees with some trees blown down. Considerable damage to mobile homes, poorly constructed signs and piers. Coastal and low-lying escape routes flood 2-4 hours before arrival of center. Small craft in unprotected anchorages break moorings.
3	<u>Winds 111-130 mph:</u> Some structural damage to small residences and utility buildings with a minor amount of curtainwall (non structural wall) failures.

Damage to shrubbery and trees with foliage blown off trees and large trees blown down. Flooding near the coast destroys smaller structures with larger structures damaged by floating debris. Terrain continuously lower than 5 feet above sea level may be flooded inland 8 miles or more. Low-lying escape routes are cut off by rising water 3-5 hours before arrival of center.

- 4 Winds 131-155 mph: More extensive curtainwall failures with some complete roof structure failure on small residences. Shrubs, trees and all signs are blown down. Complete destruction of mobile homes. Extensive damage to doors and windows. Major erosion of beach areas. Major damage to lower floors of structures near the shore. Terrain continuously lower than 10 feet above sea level may be flooded, requiring massive evacuation of residential areas inland as far as 6 miles.
- 5 Winds greater than 155 mph: Complete roof failure on many residences and industrial buildings. Some complete building failures with small utility buildings blown over or away. All trees, shrubs and signs are blown down. Complete destruction of mobile homes. Severe and extensive window and door damage. Major damage to lower floors of all structures located less than 15 feet above sea level and within 500 yards of the shoreline. Massive evacuation of residential areas on low ground within 5 to 10 miles of the shoreline may be required.

## APPENDIX B

### Preparing for Hurricane Season

#### 1. Must Know.

a. Know safe routes inland and the location of shelters if evacuation is necessary. Listen for EAS announcements from county Emergency Management officials concerning evacuation routes and the location of shelters.

b. Know the meaning of the severe weather and hurricane information released by the National Weather Service.

c. Know the area's storm surge history and elevation.

d. Know safety procedures and evacuation plans and review them often. Plan a family trial run. Review the purpose of preparation with the entire family. Have a clear understanding where the family will gather and know which shelter will be used if evacuation is requested. Know where each family member may be reached if away from home. Leave informative notes if direct communication is not possible.

e. Assemble a Hurricane Survival Kit and store it in a convenient location known to all family members. Hurricane Survival Kits should be adequate for a 4-day stay and contain the following items.

- (1) Food (Nonperishable)
- (2) Water (1 quart per person per day for drinking)
- (3) Eating and Cooking Utensils
- (4) Toilet Articles
- (5) Sanitary Needs
- (6) Medication
- (7) Portable Radio and Batteries
- (8) Flashlight and Batteries

- (9) Bedding
- (10) Clothing
- (11) Special Needs for Young, Elderly, or Handicapped Individuals
- (12) Portable Ice Chest

f. Keep on hand a can of lime to sterilize garbage and refuse in anticipation of reduced collection services.

g. Obtain vicinity and State maps.

(1) State of Georgia maps may be obtained free of charge from the Georgia Department of Transportation, 2 Capitol Square, S.W., ATTN: Map Sales, Atlanta, GA 30334-1002, or by calling the Map Sales Department directly at 404-656-5336. Individual Georgia county maps may also be obtained at a nominal charge from this same location.

(2) State of South Carolina maps may be obtained free of charge from the South Carolina Department of Transportation, Map Sales Section, P.O. Box 191, Columbia, SC 29202, or by calling the Map Sales Section directly at 803-737-4533. Individual South Carolina county maps may also be obtained at a nominal charge from this same location.

(3) Check with your local Chamber of Commerce for availability of city maps for your location.

## 2. Preparing Your Home.

a. Houses and Mobile Homes.

- (1) Trim dead wood from trees.
- (2) Secure loose rain gutters.
- (3) If shutters do not protect windows, stock plywood or pressboard, nails and masking tape which can be used to protect windows.
- (4) Inventory and photograph or videotape personal property for insurance purposes and

store the records in a waterproof place such as a safe deposit box.

- (5) Review insurance policies and ensure they cover both wind and water damage.
- (6) Keep the family car in good repair and the gas tank full.
- (7) Secure all awnings over doors and windows.
- (8) Ensure mobile home's tiedown system meets or exceeds local and/or State codes.

b. High-Rise Apartments.

(1) Be familiar with the location of all exit stairways. Count the number of steps from apartment door to exit door in the event lights are off in the corridors and halls. Do not use the elevator unless absolutely necessary to evacuate elderly or disabled individuals.

(2) Predetermine a location outside the building for family members to meet if asked to evacuate.

(3) Rehearse the evacuation plan. It could save lives.

## APPENDIX C

### Actions Hurricane Watch

A hurricane watch indicates there is a probability of a hurricane in the area. When a hurricane watch is issued, a specific area and period of time for danger is included. Check often for official bulletins on the EBS weather radio, local radio, and/or area television. Immediately take the following actions.

- a. Inventory and restock the Hurricane Survival Kit. Refer to Appendix B.
- b. Lock and secure all windows, glass doors, etc., with storm shutters or other protection materials, such as plywood or pressboard, or tape in an X fashioned with cloth-backed tape. Glass that is coated with a plastic sunscreen is already somewhat protected. Wedge sliding glass doors with a bar.
- c. Survey area limbs and branches and trim those which may brush against the house.
- d. Collect and place all loose articles indoors.
- e. Keep a full tank of fuel in automobile or boat and check battery.
- f. Make plans to secure the house if evacuation is intended.
- g. Moor, anchor, or store boat in a safe place, keeping in mind high winds and the possibility of a storm surge.
- h. Check portable radio and obtain extra batteries. An automobile radio can also be used to stay informed.
- i. Limit telephone calls.
- j. Obtain adequate supplies of special or prescription medicines, baby needs, and sanitary items.
- k. Become familiar with the main cutoff devices for electricity, water, and gas.
- l. Package valuables such as titles, deeds, insurance papers, licenses, stocks, bonds, jewelry, etc., for safekeeping in waterproof containers. Consider relocating these items to a safe deposit box.

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- m. If a Red Cross Shelter is to be used, contact a veterinarian or the local Humane Society to arrange for safeguarding pets and animals.
- n. Remove all pictures, bric-a-brac, etc., from walls. Draw all drapes and blinds to limit flying glass.
- o. Lower, remove, and store television antenna in a safe place.
- p. Turn off electricity to pool and add extra chlorine to the water. Aluminum furniture can be placed in the pool for safekeeping.
- q. Arrange for transportation should evacuation be necessary. This is especially important for the elderly and handicapped.

## APPENDIX D

### Actions Hurricane Warning

A hurricane warning is issued when winds of at least 74 miles per hour, high water, and a storm surge are expected in a specific area within 24 hours. The warning will identify coastal areas where these conditions are expected to occur. Depending on the strength, location, and direction of the hurricane's movement, coastal areas can require as long as 36 hours to evacuate. For this reason, be prepared to evacuate even if the weather does not appear threatening at the time. Pay close attention to official announcements by county Emergency Management officials. Disregard rumors.

- a. Turn refrigerator and freezer to their coldest settings. Store plastic bottles of water and newspapers in vacant areas of refrigerator and freezer. In case of power failure, cover freezer with blankets. Open only when necessary.
- b. Fill containers, bathtub, and washing machine with water.
- c. Relocate Hurricane Survival Kit to central area. Refer to Appendix B.
- d. Review evacuation routes and shelter sites.
- e. Use the telephone only for emergencies.

## APPENDIX E

### Evacuation

When a hurricane threatens to strike, county Emergency Management officials will provide information regarding evacuation. Local radio and television stations will announce areas to be evacuated and information on which Red Cross Shelters are open and staffed. EVACUATE IF ADVISED TO DO SO. The following guidance applies.

- a. Act immediately, in daylight if possible. Do not take the chance of becoming marooned.
- b. Store perishables, taking reasonable amounts of nonperishable foodstuffs. Prepare a meal and snack for family because it may be some time before food or beverages are available.
- c. Turn off all utilities upon departure.
- d. Lock home securely.
- e. Leave early, travel with care, and follow recommended routes. Stay away from low lying areas. Avoid obstructions, wires, and trees. Keep radio on and listen for additional instructions and bulletins.
- f. If evacuating to a shelter:
  - (1) Take the following items:
    - (a) Toilet Articles
    - (b) Sanitary Needs
    - (c) Medication
    - (d) Portable Radio and Batteries
    - (e) Flashlight and Batteries
    - (f) Clothing

- (g) Pillows
- (h) Blanket
- (i) Sleeping Bags
- (j) Folding Chairs
- (k) Snacks
- (l) Juice/Drinks
- (m) Entertainment (books, cards, quiet toys for children)
- (n) Special Needs for Young, Elderly, or Handicapped

Individuals

(2) Do not attempt to take pets, firearms, or intoxicating beverages into the shelter. The only animals allowed in shelters are seeing-eye dogs.

(3) Mass transportation pickup points and schedules will be broadcast on television and radio. A minimum number of buses will be available. If transportation is to be provided by friends or neighbors, contact those individuals.

(4) Remember that the Red Cross Shelter will not have all the comforts of home. Be prepared to make the best of the situation.

g. If evacuating to a location other than a shelter, take with you the Hurricane Survival Kit (see Appendix B) and appropriate maps.

h. Upon arrival at the Red Cross Shelter, all individuals will be registered and briefed on the shelter's rules and procedures. While using the shelter, each person has an obligation to help keep the building clean and sanitary. If possible, volunteer to assist the shelter workers in any way. Communications with shelters will be maintained via law enforcement officials patrolling the area or assigned to shelter sites as well as updated news media as long as the stations maintain power. Stay calm and anticipate behavioral changes especially in children.

i. Remain indoors during the hurricane. If the calm center passes directly overhead, there will be a lull in the wind lasting from a few minutes to an hour or more. Do not go outside unless emergency repairs are absolutely necessary. Remember, at the other side of the eye the winds rise rapidly to hurricane force and come from the opposite direction of the leading edge. Electricity, water, gas, and telephone services may be interrupted. Stay calm and listen to the radio for the all clear.

## APPENDIX F

### All Clear Procedures

Continue to monitor radio and television bulletins for updated information. The county Emergency Management officials and local law enforcement agencies will control access into affected areas. To avoid post-hurricane problems, you should adhere to the following instructions.

- a. If driving is necessary, avoid disaster areas unless they encompass home or work. Drive with extreme caution and be alert for road obstructions, downed electrical wires, and flooded low spots. Do not sightsee. If public transportation was provided to the shelter, return transportation will also be provided.
- b. Evaluate home with extreme care and survey surroundings for downed wires, escaping gas, downed trees, structural damage, etc. (Do not use an open flame in checking for gas leaks.) Check all utility systems to be sure they are safe. Take photographs of major damage before beginning any repairs. Report broken or damaged water, sewer, and electrical lines to appropriate representatives.
- c. Check for the possibility of food spoilage. Properly dispose of spoiled items in accordance with local ordinances.
- d. Do not drink water from the faucet until local officials advise that it is safe from contamination. Use emergency supply or boil tap water before drinking.
- e. Advise friends and family members that you are safe. They may not be able to contact you.
- f. Snakes, animals, and insects instinctively travel inland to higher ground to escape approaching flood waters. Take precautions.
- g. Use streets and roads as little as possible to allow recovery operations to proceed.

APPENDIX G

Hurricane Names

<b>2004 Atlantic Hurricane Names</b>	
Alex	Karl
Bonnie	Lisa
Charley	Matthew
Danielle	Nicole
Earl	Otto
Frances	Paula
Gaston	Richard
Hermine	Shary
Ivan	Tomas
Jeanne	Virgine
Walter	

APPENDIX H  
Hurricane Statistics

DEADLIEST HURRICANES, UNITED STATES 1900-2000  
 (THE TOP 30 ARE LISTED)

RANKING	HURRICANE	YEAR	CATEGORY	DEATHS
1.	TX (Galveston)	1900	4	8000+
2.	FL (Lake Okeechobee)	1928	4	1836
3.	FL (Keys)/S. TX	1919	4	600#
4.	NEW ENGLAND	1938	3*	600
5.	FL (Keys)	1935	5	408
6.	AUDREY (SW LA/N TX)	1957	4	390
7.	NE U.S.	1944	3*	390@
8.	LA (Grand Isle)	1909	4	350
9.	LA (New Orleans)	1915	4	275
10.	TX (Galveston)	1915	4	275
11.	CAMILLE (MS/LA)	1969	5	256
12.	FL (Miami)/MS/AL/Pensacola	1926	4	243
13.	DIANE (NE U.S.)	1955	1	184
14.	SE FL	1906	2	164
15.	MS/AL/Pensacola	1906	3	134
16.	AGNES (NE U.S.)	1972	1	122
17.	Hazel (SC/NC)	1954	4*	95
18.	BESTY (SE FL/SE LA)	1965	3	75
19.	CAROL (NE U.S.)	1954	3*	60
20.	FLOYD (Mid Atlantic & NE U.S.)	1999	2	56
21.	SE FL/LA/MS	1947	4	51
22.	DONNA (FL/Eastern U.S.)	1960	4	50
23.	GA/SC/NC	1940	2	50
24.	CARLA (TX)	1961	4	46
25.	TX (Velasco)	1909	3	41
26.	TX (Freeport)	1932	4	40
27.	S TX	1933	3	40
28.	HILDA (LA)	1964	3	38
29.	SW LA	1918	3	34
30.	SW FL	1910	3	30
31.	ALBERTO (NW FL/GA/AL)	1994	TS&	30
<b>ADDENDUM (Pre-1900 or not Atlantic/Gulf Coast):</b>				
2.	LA	1893	Unk	2000
2-3.	SC/GA	1893	Unk	1000-2000
3.	GA/SC	1881	2	700
9.	San Felipe (Puerto Rico)	1928	4	312
13.	U.S. Virgin Islands, Puerto Rico	1932	2	225
17.	DONNA (St. Thomas, VI)	1960	4	107
25.	Southern California	1939	TS&	45
25.	ELOISE (Puerto Rico)	1975	TS&	44

+ - May actually been as high as 10,000 to 12,000.  
 # - Over 500 of these lost on ships at sea; 600-900 estimated deaths.  
 \* - Moving more than 30 miles an hour.  
 @ - Some 344 of these lost on ships at sea.  
 & - Only of Tropical Storm intensity.  
 Unk - Intensity not sufficiently known to establish category.

COSTLIEST HURRICANES, UNITED STATES 1900-2000  
 (TOP 30 ARE LISTED WHEN ADJUSTED\*\* TO 2000 DOLLARS)

RANKING	HURRICANE	YEAR	CATEGORY	DAMAGE (U.S.) **
1.	ANDREW (SE FL/SE LA)	1992	4	\$34,954,825,000
2.	HUGO (SC)	1989	4	\$9,739,820,675
3.	AGNES (NE U.S.)	1972	1	\$8,602,500,000
4.	BETSY (FL/LA)	1965	3	\$8,516,866,023
5.	CAMILLE (MS/AL)	1969	5	\$6,992,441,549
6.	DIANE (NE U.S.)	1955	1	\$5,540,676,187
7.	FREDERIC (AL/MS)	1979	3	\$4,965,327,332
8.	FLOYD (Mid Atlantic & NE U.S)	1999	2	\$4,666,817,360
9.	NEW ENGLAND	1938	3*	\$4,748,580,000
10.	FRAN (NC)	1996	3	\$3,200,000,000
11.	OPAL (NW FL/AL)	1995	3*	\$3,520,596,085
12.	ALICIA (N TX)	1983	3	\$3,421,660,182
13.	CAROL (NE U.S.)	1954	3*	\$3,134,443,557
14.	CARLA (TX)	1961	4	\$2,550,580,095
15.	GEORGES (FL Keys, MS, AL)	1998	2	\$2,494,800,000
16.	JUAN (LA)	1985	1	\$2,418,795,844
17.	DONNA (FL/Eastern U.S.)	1960	4	\$2,407,888,443
18.	CELIA (S TX)	1970	3	\$2,015,663,203
19.	ELENA (MS/AL/NW FL)	1985	3	\$2,015,663,203
20.	BOB (NC and NE U.S.)	1991	2	\$2,004,635,258
21.	HAZEL (SC/NC)	1954	4*	\$1,910,582,732
22.	FL (Miami)	1926	4	\$1,738,042,353
23.	N TX (Galveston)	1915	4	\$1,544,253,659
24.	DORA (NE FL)	1964	2	\$1,540,946,262
25.	ELOSIE (NW FL)	1975	3	\$1,489,250,000
26.	GLORIA (Eastern U.S.)	1985	3*	\$1,451,277,506
27.	NE U.S.	1944	3+	\$1,221,342,593
28.	BEULAH (S TX)	1967	3	\$1,113,122,363
29.	SE FL/LA/MS	1947	4	\$930,099,359
30.	N TX (Galveston)	1900	4	\$928,160,7935
<b>ADDENDUM (non-mainland U.S. systems):</b>				
16.	INIKI (Kauai, HI)	1992	Unk	\$2,070,000,000
20.	MARILYN (U.S. Virgin Island/E Puerto Rico)	1995	2	\$1,534,697,509
25.	HUGO ( U.S. Virgin Islands/Puerto Rico)	1989	4	\$1,213,080,169
25.	SAN FELIPE (Puerto Rico)	1929	4	\$1,150,000,000

\*\* - Adjusted to 1996 dollars on basis of U.S. of Commerce Implicit Price Deflator for Construction.

\* - Moving more than 30 mile an hour.

+ - Probably higher.

5 = Using 1915 cost adjustment base – none available prior to 1915.

Unk – Intensity not sufficiently known to establish category.

MOST INTENSE HURRICANES, UNITED STATES 1900-2000  
 (AT TIME OF LANDFALL)

RANKING	HURRICANE	YEAR	CATEGORY	PRESSURE (MILLIBARS)	PRESSURE (INCHES OF MERCURY)
1.	FL (Keys)	1935	5	892	26.35
2.	CAMILLE (MS/SE LA/VA)	1969	5	909	26.84
3.	ANDREW (SE FL/SE LA)	1992	4	922	27.23
4.	FL (Keys) /S TX	1919	4	927	27.37
5.	FL (Lake Okeechobee)	1928	4	929	27.43
6.	DONNA (FL/Eastern U.S.)	1960	4	930	27.46
7.	TX (Galveston)	1900	4	931	27.49
8.	LA (Grand Isle)	1909	4	931	27.49
9.	LA (New Orleans)	1915	4	931	27.49
10.	CARLA (N & Cent. TX)	1961	4	931	27.49
11.	HUGO (SC)	1989	4	934	27.58
12.	FL (Miami)MS /AL/Pensacola	1926	4	935	27.61
13.	HAZEL (SC/NC)	1954	4*	938	27.70
14.	SE FL/SE LA/MS	1947	4	940	27.76
15.	N TX	1932	4	941	27.79
16.	GLORIA (Eastern U.S.)	1985	3*&	942	27.82
17.	OPAL (NW FL/AL)	1995	3*&	942	27.82
18.	AUDREY (SW LA/N TX)	1957	4#	945	27.91
19.	TX (Galveston)	1915	4#	945	27.91
20.	CELIA (S TX)	1970	3	945	27.91
21.	ALLEN (S TX)	1980	3	945	27.91
22.	NEW ENGLAND	1938	3*	946	27.94
23.	FREDERIC (AL/MS)	1979	3	946	27.94
24.	NE U.S.	1944	3*	947	27.97
25.	SC/NC	1906	3	947	27.97
26.	BESTY (SE FL/SE LA)	1965	3	948	27.99
27.	SE FL/NW FL	1929	3	948	27.99
28.	SE FL	1933	3	948	27.99
29.	S TX	1916	3	948	27.99
30.	MS/AL	1916	3	948	27.99
31.	DIANE (NC)	1955	3+	949	28.02
32.	S TX	1933	3	949	28.02
33.	BEULAH (S TX)	1967	3	950	28.05
34.	HILDA (Central LA)	1964	3	950	28.05
35.	GRACIE (SC)	1959	3	950	28.05
36.	TX (Central)	1942	3	950	28.05

RANKING	HURRICANE	YEAR	CATEGORY	PRESSURE (MILLIBARS)	PRESSURE (INCHES OF MERCURY)
37.	SE FL	1945	3	951	28.08
38.	FL (Tampa Bay)	1921	3	952	28.11
39.	CARMEN (Central LA)	1974	3	952	28.11
40.	EDNA (New England)	1954	3*	954	28.17
41.	SE FL	1949	3	954	28.17
42.	FRAN (N C)	1996	3	954	28.17
43.	ELOISE (NW FL)	1975	3	955	28.20
44.	KING (SE FL)	1950	3	955	28.20
45.	CENTRAL LA	1926	3	955	28.20
46.	SW LA	1918	3	955	28.20
47.	SW FL	1910	3	955	28.20
48.	NC	1933	3	957	28.26
49.	FL (Keys)	1909	3	957	28.26
50.	EASY (NW FL)	1950	3	958	28.29
51.	N TX	1941	3	958	28.29
52.	NW FL	1917	3	958	28.29
53.	N TX	1909	3	958	28.29
54.	MS/AL	1906	3	958	28.29
55.	ELENA(MS/AL/NW FL)	1985	3	959	28.32
56.	CAROL (NE U.S.)	1954	3*	960	28.35
57.	IONE (NC)	1955	3	960	28.35
58.	EMILY (NC)	1993	3	960	28.35
59.	ALICIA (N TX)	1983	3	962	28.41
60.	CONNIE (NC/VA)	1955	3	962	28.41
61.	SW FL/NE FL	1944	3	962	28.41
62.	CENTRAL LA	1934	3	962	28.41
63.	SW FL/NE FL	1948	3	963	28.44
64.	NW FL	1936	3	964	28.47

\* - Moving more than 30 mile an hour.  
 & - Highest category justified by winds  
 # - Classified Cat. 4 because of estimated winds.  
 † - Cape Fear, North Carolina, area only, was a Cat. 2 at final landfall.

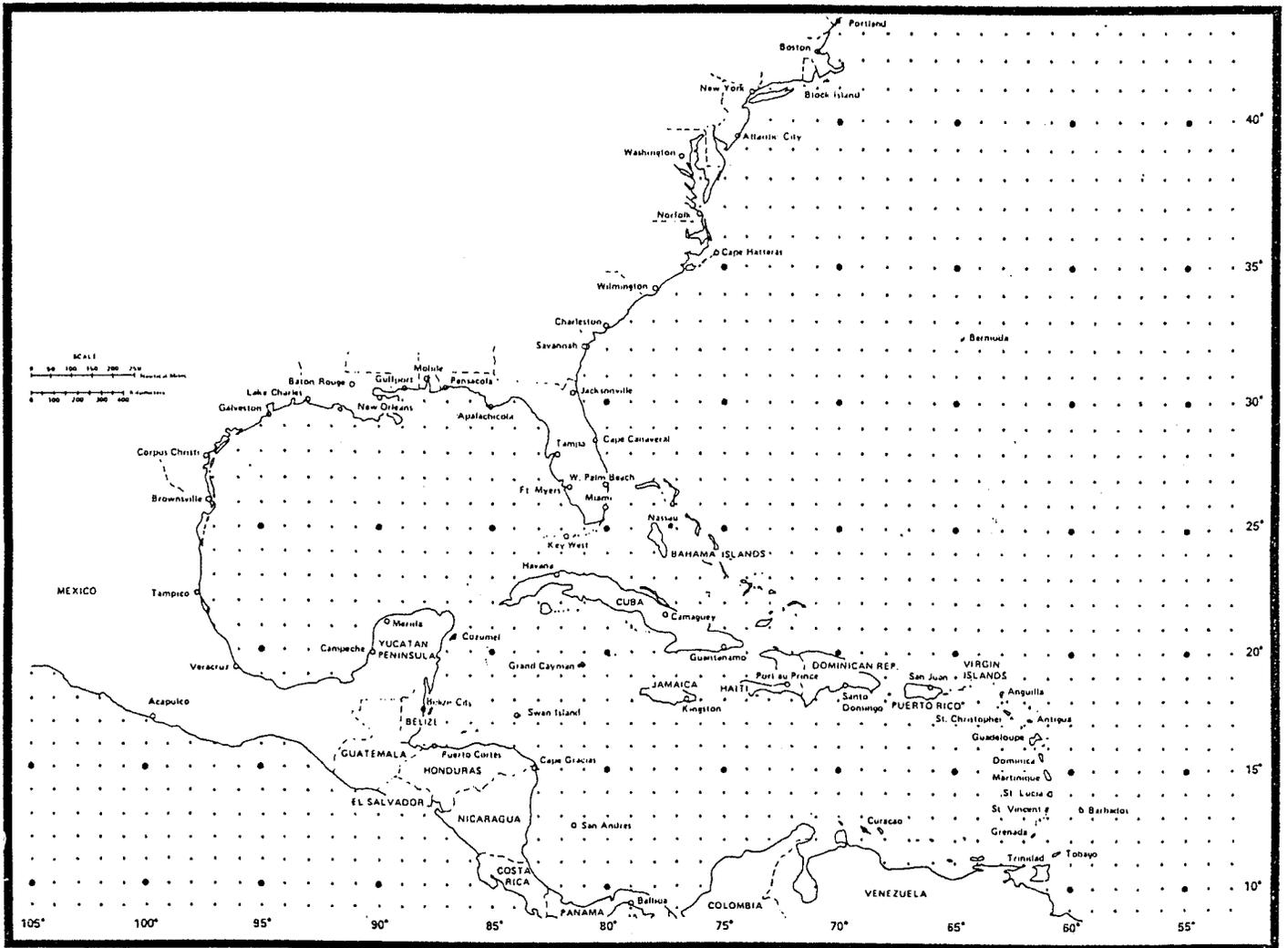
## APPENDIX I

### How To Track A Tropical Disturbance

A hurricane tracking map and map log have been included in this Appendix for plotting. The following are brief instructions on plotting a tropical disturbance.

- a. Advisories are numbered consecutively for each storm. Present location and intensity are described and expected movement is given. Hurricane advisories are issued at 6-hour intervals, at 0500, 1100, 1700, and 2300. Each message gives the name, center of the eye's position, intensity, and forecast movement of the hurricane.
- b. Hurricane center positions are given by latitude (for example 13.5 degrees North) and longitude (for example, 55.0 degrees West). When the storm moves within range of radars, center positions may also be given as statute miles and compass directions from a specified point.
- c. Note the advisory number, center position, intensity, and forecast direction of movement. Then mark the center position on the tracking map. Because hurricanes change direction very quickly, listen more carefully to where the storm will go than where it has been.

Hurricane Tracking Map





## APPENDIX J

### Explanation of Terms

The National Oceanic and Atmospheric Administration (NOAA) transmits early storm communiques called weather bulletins. The National Hurricane Center (NHC) located in Corral Gables, FL, along with National Weather Service (NWS) Branch Offices, gathers all Atlantic tropical weather disturbance data. Terms to know:

Advisory. A method for disseminating storm and hurricane data to the public every 6 hours.

Intermediate Advisory. A method of updating regular advisory information every 2 to 3 hours as necessary.

Special Advisory. Warning given any time there is a significant change in weather conditions or change in warnings.

Small Craft Advisory. Sustained (exceeding 2 hours) weather and/or sea conditions either present or forecast that are potentially hazardous to small boats. Hazardous conditions may include winds of 20 to 38 MPH (18 to 33 knots) and/or dangerous wave conditions.

Tropical Disturbance. A moving area of thunderstorms in the tropics.

Tropical Depression. An area of low pressure with a counterclockwise circulation of clouds and winds up to 38 MPH.

Tropical Storm. Counterclockwise circulation of clouds and winds from 39 to 73 MPH.

Hurricane. Counterclockwise circulation of clouds and winds 74 MPH or greater.

Hurricane Watch. There is a probability of a hurricane striking the area.

Hurricane Warning. A hurricane is expected to strike the area within 24 hours.

Storm Surge. An abnormal rise of the sea along a shore as the result, primarily of the winds of a storm.

Tornado Watch. Tornadoes and severe thunderstorms are possible in the area.

Tornado Warning. Tornado detected in the area. TAKE SHELTER IMMEDIATELY.

APPENDIX K

Distribution

<u>Activity</u>	<u>Number of Copies</u>
CDR, USAED South Atlantic, ATTN: CESAD-CM-OE	4
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