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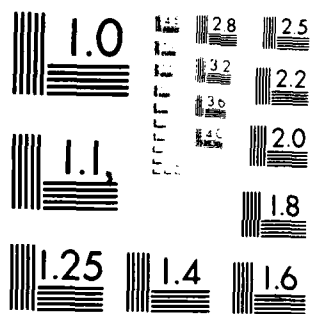
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POSTSTORM RECONNAISSANCE OF TROPICAL STORM CHRIS

by

Thomas H. Flor

Hydraulics Laboratory

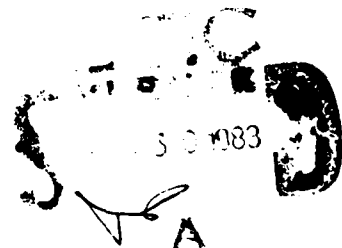
U. S. Army Engineer Waterways Experiment Station
P. O. Box 631, Vicksburg, Miss. 39180



July 1983

Final Report

Approved For Public Release. Distribution Unlimited



Prepared for Office, Chief of Engineers, U. S. Army
Washington, D. C. 20314

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This report presents the results of a poststorm reconnaissance to determine the extent of flooding caused by Tropical Storm Chris along the Texas-Louisiana coastline in September 1982. This survey covered the coastal area from Sabine Pass, Texas, to Cameron, Louisiana. Tropical Storm Chris made landfall 7 miles east of Sabine Pass at 0600 CDT 11 September 1982. The highest storm-generated surge, in the range of 8.5 to 9 ft, occurred at Peveto Beach, 8 miles east of the point of landfall. Storm-induced (Continued)		

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20. ABSTRACT (Continued).

flooding west and east of the point of landfall is estimated to have reached 2.8 ft above predicted tide level 17 miles to the west and 2.5 ft above predicted tide 19 miles to the east. The meteorological history of Tropical Storm Chris is included as an appendix to this report.

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Preface

The poststorm reconnaissance reported herein was conducted as part of the Hurricane Surge Data Collection Work Unit under the sponsorship of the Office, Chief of Engineers, U. S. Army. The Hurricane Surge Data Collection Work Unit (part of the Coastal Engineering R&D Program, Mr. J. H. Lockhart, Technical Monitor) is a multiyear project of the Hydraulics Laboratory, U. S. Army Engineer Waterways Experiment Station (WES), under the general supervision of Mr. H. B. Simmons, Chief of the Hydraulics Laboratory, and Mr. C. E. Chatham, Acting Chief of the Wave Dynamics Division.

Mr. A. W. Garcia is the Project Manager of the Hurricane Surge Data Collection Work Unit. Mr. T. H. Flor performed the field investigation and prepared this report.

Commander and Director of WES during the conduct of this study and the preparation and publication of this report was COL Tilford C. Creel, CE. Technical Director was Mr. F. R. Brown.

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Conversion Factors, U. S. Customary to Metric (SI)
Units of Measurement

U. S. customary units of measurement used in this report can be converted to metric (SI) units as follows:

<u>Multiply</u>	<u>By</u>	<u>To Obtain</u>
feet	0.3048	metres
inches	25.4	millimetres
knots (international)	0.51444444	metres per second
miles (U. S. statute)	1.609344	kilometres
millibars	100.	pascals

Poststorm Reconnaissance of Tropical Storm Chris

1. Tropical Storm Chris began as a low-pressure system in the western portion of the Gulf of Mexico and reached tropical storm status 110 miles* south-southeast of Galveston, Texas, at 0800 CDT on 10 September 1982. Less than 24 hours later, at 0600 CDT 11 September 1982, the storm made landfall in Louisiana, 7 miles east of Sabine Pass. The path of the storm is shown in Figure 1.

2. A poststorm reconnaissance was made from Sabine Pass, Texas, to Cameron, Louisiana, on 20 September 1982. The maximum water level reported west of the point of landfall was an estimated +3.5 ft NGVD** between 0500 and 0600 CDT 11 September 1982 at Sea Rim State Park, 10 miles west of Sabine Pass. Figure 2 is a hydrograph taken at the park between 0400 and 0700 on the date of landfall. The predicted tide for 0600 CDT at Sabine Pass jetty, the nearest tide station, was +0.7 ft NGVD. Figures 3 and 4 are a preliminary poststorm report and a barogram from Sabine Pass, respectively, obtained from the National Weather Service in Port Arthur, Texas. Due to a loss of power to the weather service telephone link with the National Ocean Survey (NOS) tide gage at Sabine Pass, no water-level data were available for this area during the preliminary survey. This information has been supplied by NOS and appears in Figure 5.

3. The actual point of landfall was in a remote wetland area east of Sabine Pass. No evidence of flooding was found along Louisiana Highway 82 in this area. The highway is approximately 1 mile inland from the point of landfall and 6 to 7 ft above NGVD.

4. The town of Peveto Beach, 8 miles east of the point of landfall, experienced the highest rise in water level. Visual comparison of high-water marks on several homes with a survey mark at +9.5 ft NGVD showed evidence of a high-water level between +9.0 and +10.0 ft NGVD. The nearest tide stations for which predicted astronomic tide data are available for 0600 CDT 11 September 1982 are Sabine Pass jetty and Calcasieu Pass. Peveto Beach lies roughly

* A table of factors for converting U. S. customary units of measurement to metric (SI) units is presented on page 3.

** The National Geodetic Vertical Datum (NGVD) of 1929 established the elevation of local mean sea level (msl) for all areas of North America relative to Galveston, Texas. Therefore, msl for Galveston, Texas, and all localities discussed in this report is at an elevation of 0.00 ft NGVD.

midway between these two tide stations. The predicted tide for Sabine Pass jetty was +0.7 ft NGVD, for Calcasieu Pass +0.4 ft NGVD. The resultant storm-generated surge at Peveto Beach was therefore in the range of 8.5 to 9 ft.

5. Figure 6 shows wave-induced damage to Highway 82 at a point approximately 2 miles east of Peveto Beach. The highway is at an elevation of +7.0 ft NGVD in this area. Drift lines of floating debris against sections of the fence to the north of the highway indicated that the total rise in water level, including wave setup, was high enough to allow wave action to exceed the height of the highway.

6. In the town of Holly Beach, 5 miles east of Peveto Beach, several homes within 100 ft of the normal shoreline were severely damaged (Figure 7). It was not possible to determine a maximum water level in this area; however, the highway at the north edge of town is at an elevation of +5.0 to +6.0 ft NGVD and no floating debris was noted to the north of the highway. The storm-generated surge in this area was probably somewhat less than 5 ft. At a point approximately 4 miles east of Holly Beach, debris caught about 3 ft above ground level in a fence around a brine pipeline substation indicated a maximum storm-generated surge of approximately 4.5 ft.

7. In the town of Cameron, 19 miles east of the point of landfall, no flooding was reported except in several very low areas. Figure 8 is a hydrograph from a U. S. Army Engineer District, New Orleans, CE, tide gage at Calcasieu Pass, just south of Cameron. This figure shows a maximum tide level of 4.35 ft above mlg (+3.55 ft NGVD) at 0300 CDT 11 September 1982 and a lower peak of 4.0 ft above mlg (+3.2 ft NGVD) at 0900 CDT. The respective predicted tides for these times were +1.2 ft NGVD and +0.4 ft NGVD. The storm-generated surge was therefore less than 2.5 ft at Calcasieu Pass. Figure 9 shows a line of floating debris deposited along the highway just west of the Calcasieu Pass gage.

8. The meteorological characteristics of Tropical Storm Chris, including wind speeds, barometric pressures, and reported positions, have been obtained from the National Hurricane Center and are included in Appendix A.

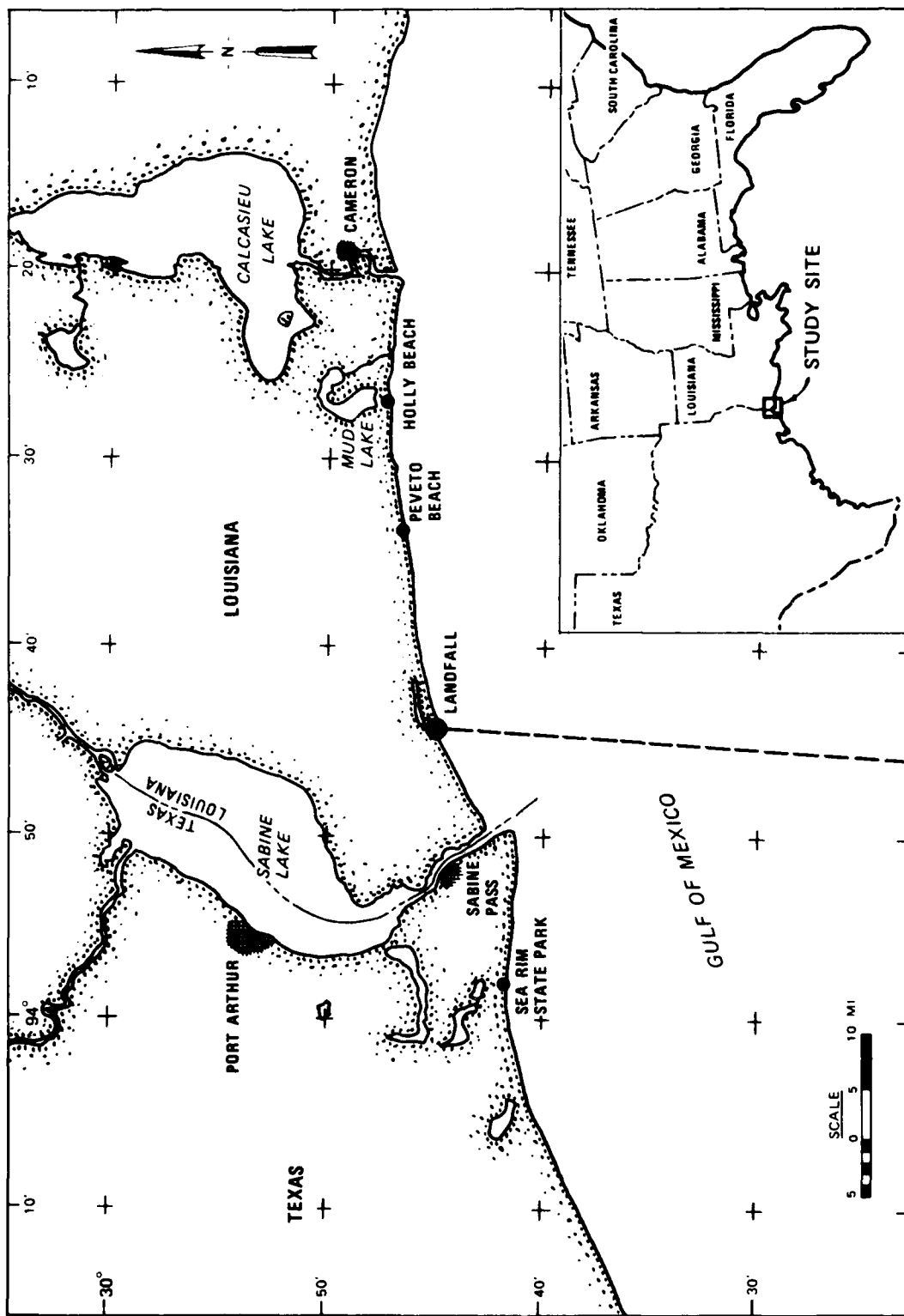


Figure 1. Tropical Storm "Chris" 11 September 1982

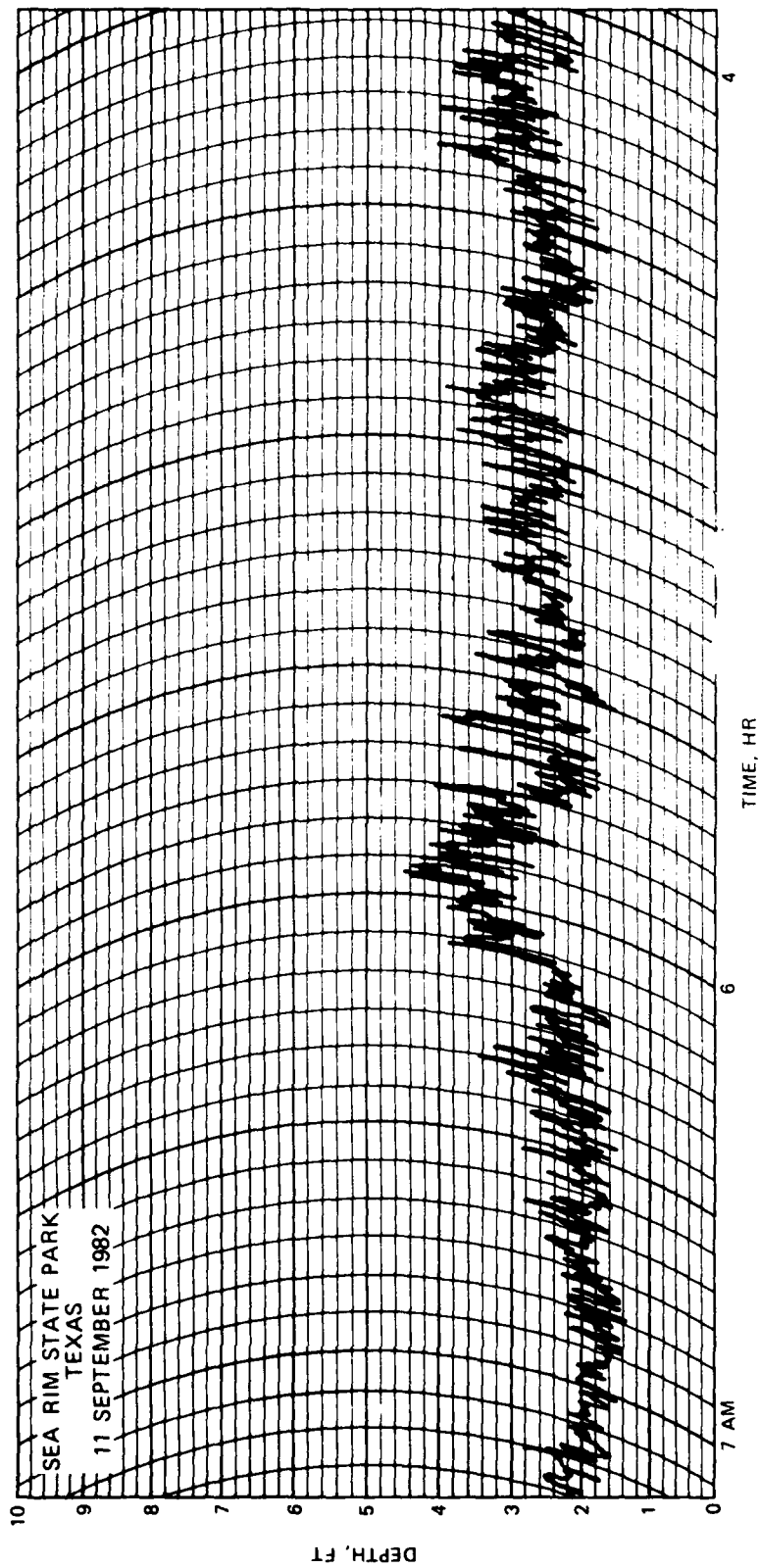


Figure 2. Hydrograph at Sea Rim State Park

11A
ZCZC SATPSHBT
WWUSC RWRB 112000
TSATPSHBT

POST STORM REPORT...PRELIMINARY TS CHRIS
NATIONAL WEATHER SERVICE PORT ARTHUR TX
302PM CDT SAT SEP 11 1962

A. HIGHEST SUBSTAINED WIND AT BPT 31 KTS AT 11/2617 CDT
PEAK GUST 39 KTS AT 11/2615 CDT

PEAK GUST AT SEA RIM STATE PARK 45 KTS AT 11/2557 CDT

B. LOWEST PRESSURE 29.55 INCHES AT 11/2615 CDT

C. MAX 1 HOUR RAIN .35
MAX. 5 HOUR RAIN .40
MAX. 12 HOUR RAIN .41
MAX. 24 HOUR RAIN .41

D. SABINE PASS TIDE GAGE POWER DISCONNECTED BY HOUSEHOLDER
WHEN SHE DEPARTED 10/1600 CDT. NO TIDES AVAILABLE DURING
THE STORM. HOUSEHOLDER INSISTS ON DISCONNECTING POWER AND
MOVING TO HIGHER GROUND WITH EVERY STORM. UNABLE TO POWER
GAGE WITH BATTERY POWER. RECOMMEND GAGE BE MOVED TO MORE
SUITABLE LOCATION.

SEA RIM STATE PARK PERSONNEL ESTIMATE 3.5 FEET NGVD MAX.
TIDE BETWEEN 11/2520 AND 0600 CDT.

E. NO BEACH EROSION.

F. NEGATIVE FLOODING.

G. UNCONFIRMED FUNNEL CLOUD AT 11/0725 CDT 8 ST. MILES EAST
OF BPT.

H. A 65 FOOT UTILITY BOAT...THE TRINITY SHOAL...SUNK APPROXIMATELY
11/2400 CDT ABOUT 9 MILES SOUTHEAST OF SABINE PASS TEXAS.
CONDITIONS OF 3 SOB UNKN.

SABINE OFFSHORE CREWBOAT WASHED UP ON TO DOCKS.

SCATTERED POWER FAILURES IN NEDERLAND...BRIDGE CITY AND
GROVES.

KAVA

Figure 3. NWS storm report

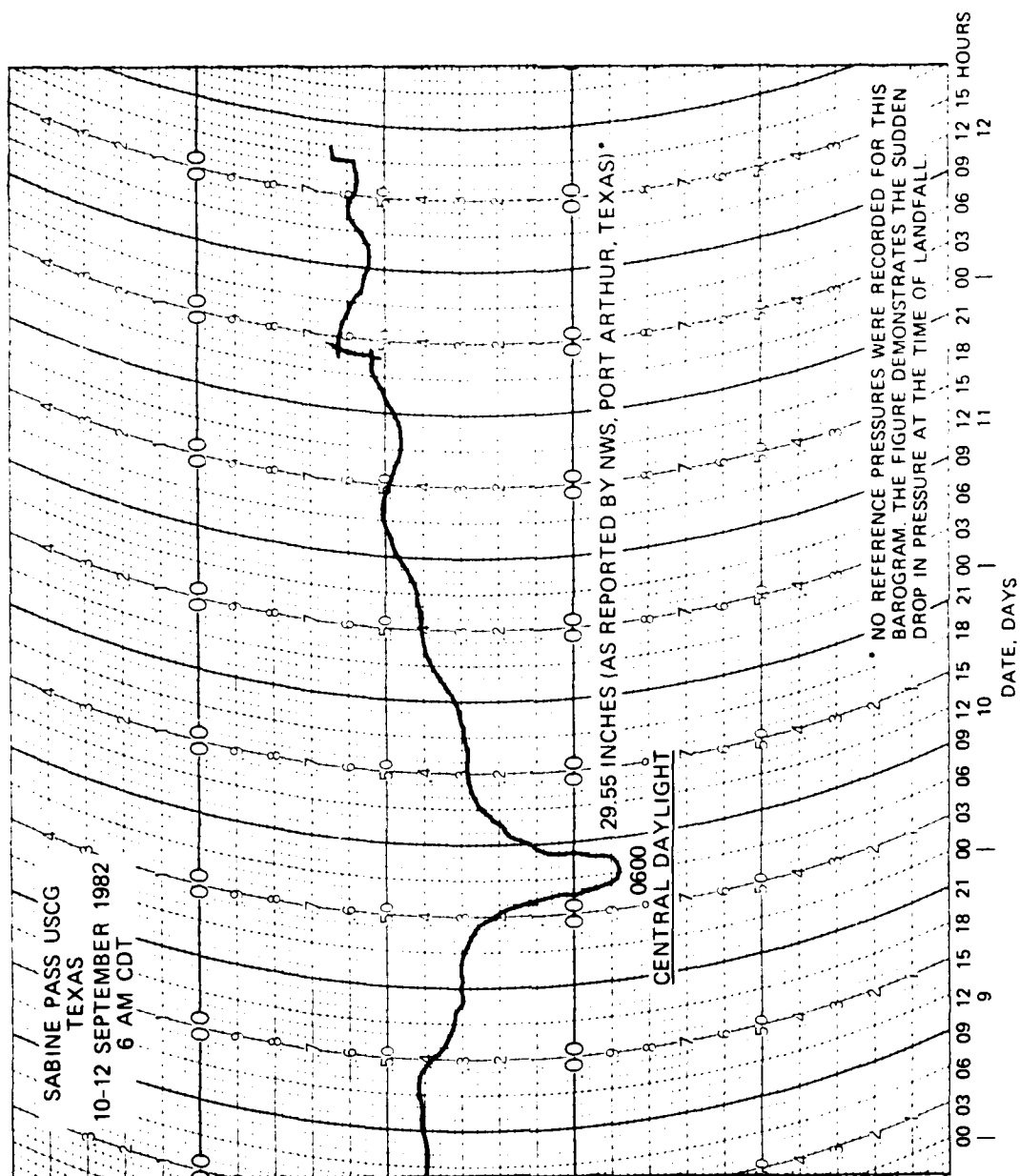


Figure 4. Barogram at Sabine Pass.

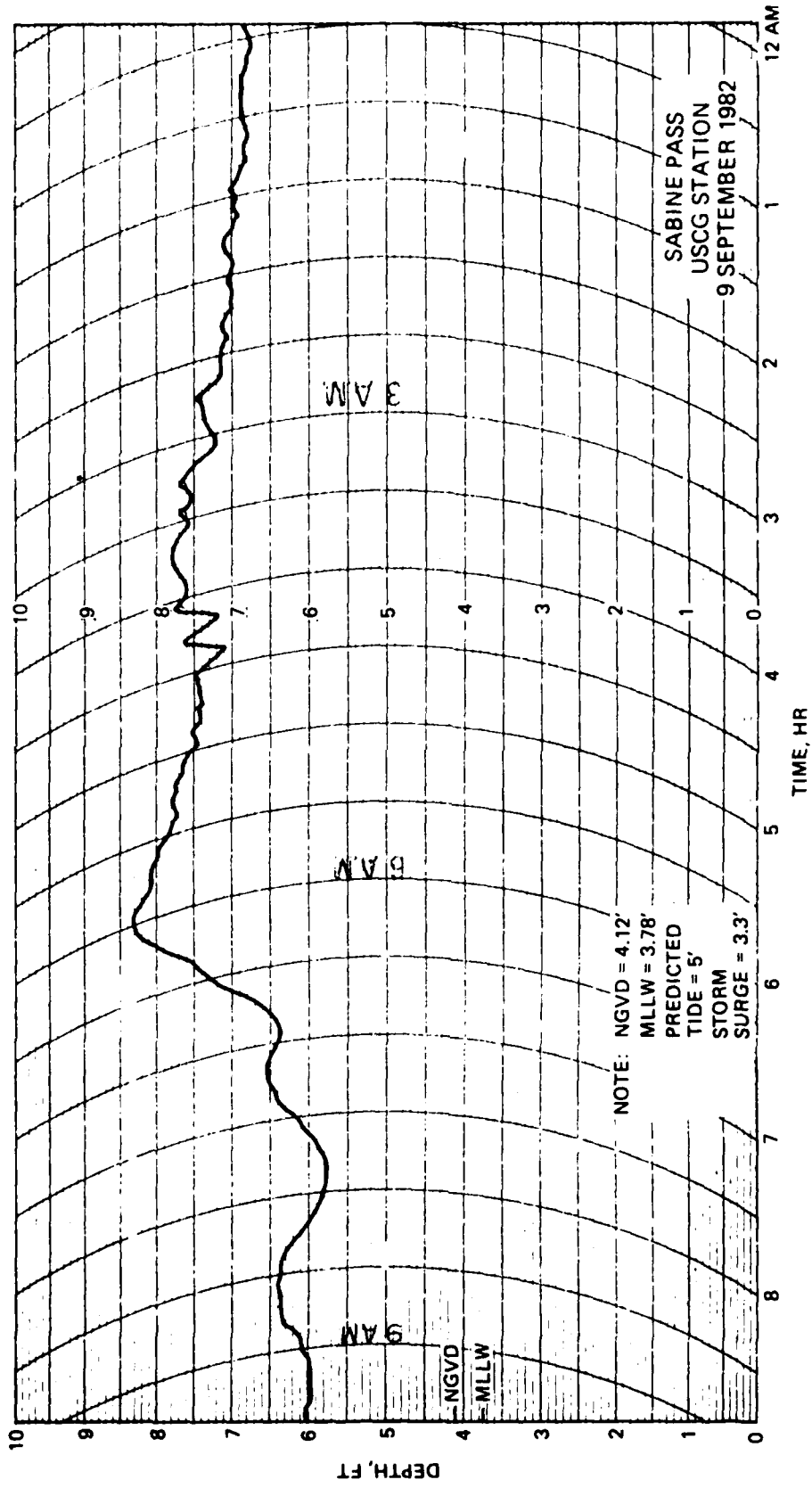


Figure 5. Hydrograph at Sabine Pass



Figure 6. Looking west along Louisiana Highway 82,
2 miles east of Peveto Beach

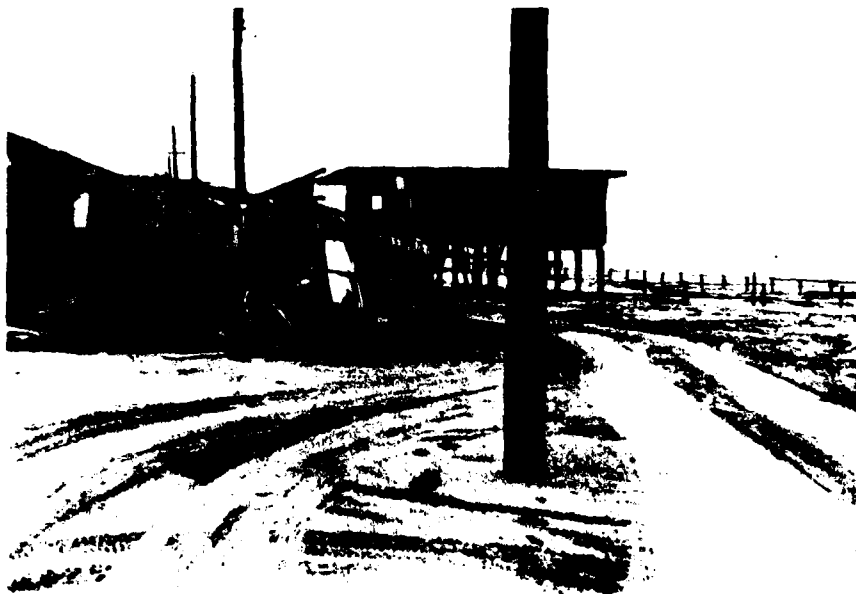
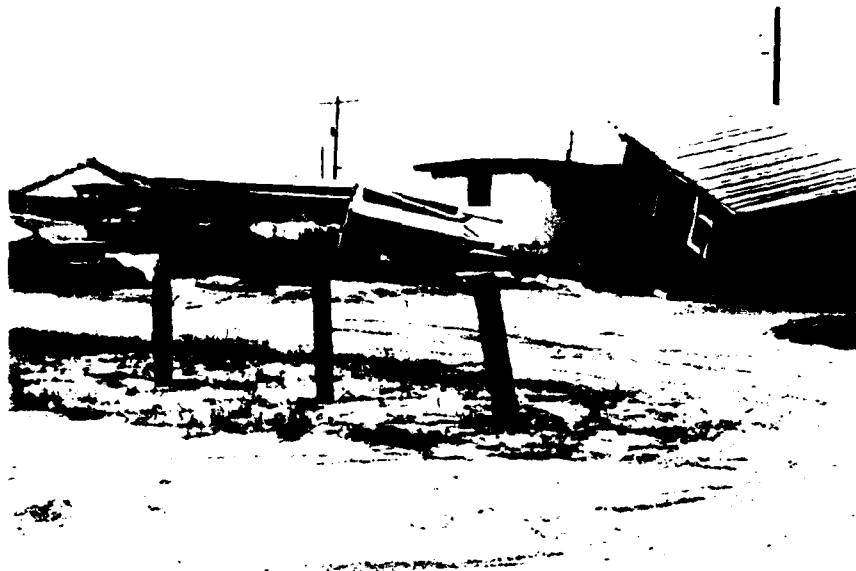
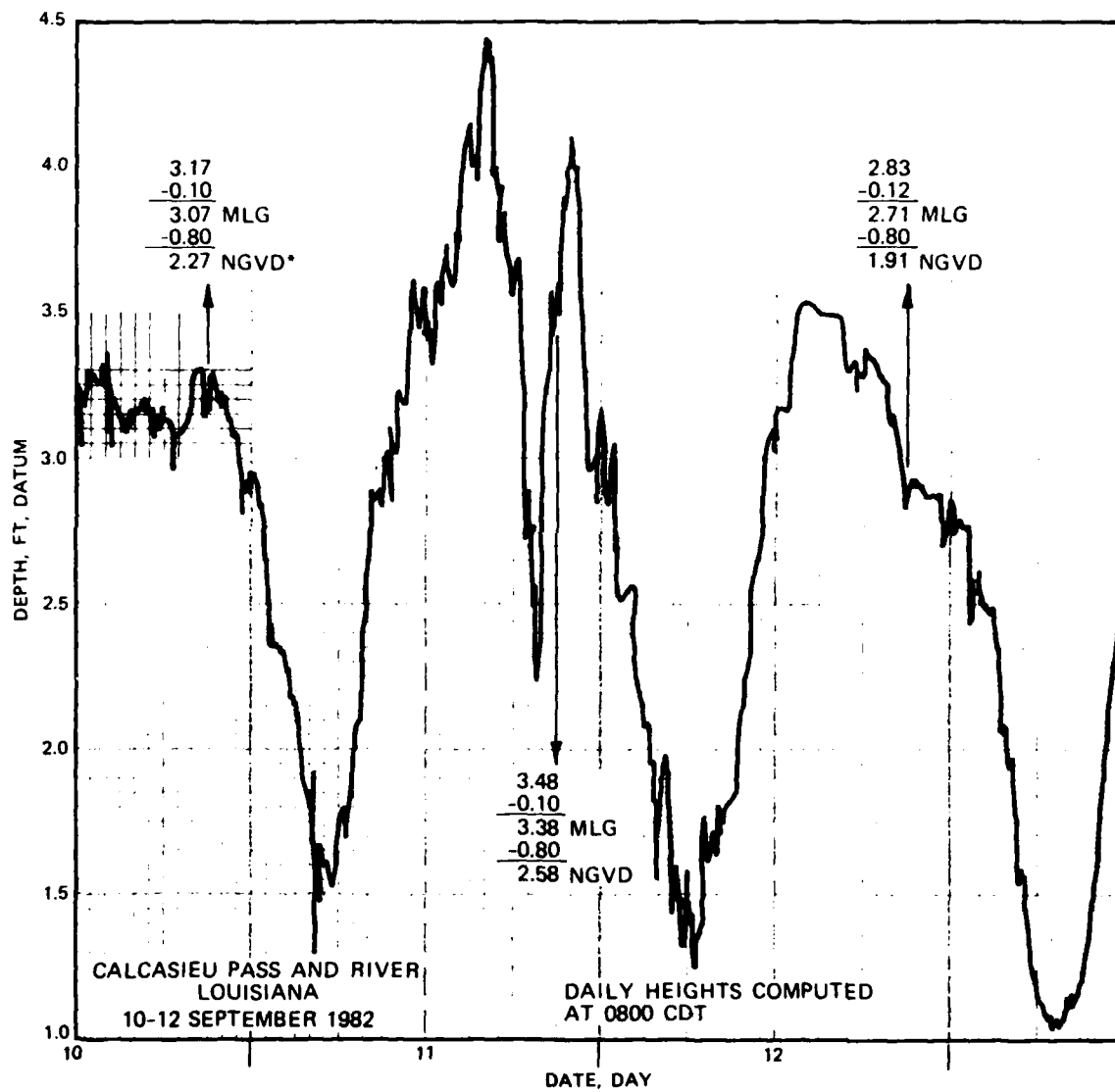


Figure 7. Damage from Tropical Storm Chris
in Holly Beach, Louisiana



* MEAN LOW GULF (MLG) IS AT AND ELEVATION OF -0.8 FT NGVD.

Figure 8. Hydrograph at Calcasieu Pass

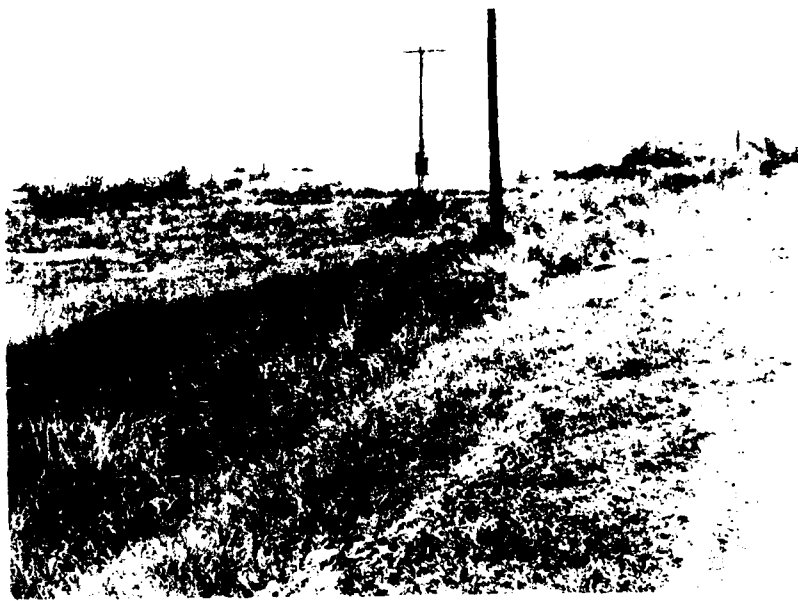


Figure 9. Debris line along south end of county road 1141,
Monkey Island, Cameron, Louisiana

APPENDIX A: PRELIMINARY REPORT BY GILBERT CLARK
HURRICANE SPECIALIST, NATIONAL HURRICANE CENTER

Tropical Storm Chris, 9-12 September 1982

An upper low pressure system began developing over the northeast Gulf of Mexico on 6 September with the circulation gradually working downward as it drifted westward. Reports from ships and NOAA buoys indicated a surface low had developed over the north central Gulf of Mexico by the evening of 8 September. The low continued to drift westward and on 9 September began to take on tropical characteristics as widespread convection north and east of the low warmed the atmosphere. On the morning of 10 September increasing winds on offshore oil rigs, banding on radar, and an Air Force reconnaissance aircraft report of pressure near 1000 mbs. indicated tropical storm Chris had formed.

Tropical storm Chris began moving northward almost immediately under the influence of a large low pressure trough moving eastward from the Southwestern United States. The center moved inland between Port Arthur, Texas and Lake Charles, Louisiana near Sabine Lake during the early morning hours of 11 September. Chris weakened rapidly while moving north northeast through western Louisiana and into eastern Arkansas on 12 September, where the low pressure center associated with Chris lost all identity. However, moisture from the storm contributed to heavy rains in Tennessee and Kentucky with local rainfall totals up to 16 inches reported.

The storm reached maximum strength near the coast with satellite classification indicating highest sustained winds to be 55 knots. Offshore oil rigs reported gusts up to 70 knots. Lowest pressure was estimated to be 994 mbs. It is quite likely Chris would have become a hurricane in a few hours if the circulation had not moved inland.

Highest tides were between 5 and 6 feet just east of the center. Rainfall amounts of 5 to 10 inches were observed in Louisiana with a few local amounts in excess of 10 inches.

There were no casualties reported. Preliminary damage estimates in Louisiana were less than one million dollars. In Texas a restaurant on Pleasure Island near Port Arthur had an estimated \$200,000 wind damage. There was the usual damage to trees and power lines. Several large boats in the Gulf of Mexico sustained heavy damage. Casualty and damage figures from flooding in Kentucky and Tennessee are not known at this time.

There were as many as 6500 residents evacuated from the immediate Louisiana coast and many oil workers were taken off the Gulf of Mexico oil rigs.

Gale warnings were issued on the Louisiana coast prior to naming the storm because of the strong pressure gradient between a large high pressure system over the United States and the developing low. A summary of all the warnings is attached.

GBC 9/27/82

TROPICAL STORM CHRIS
SUMMARY OF WARNINGS

DATE	TIME (GMT)	ACTION TAKEN
9/9/82	0100	Gale Warnings issued for the Louisiana coast east of Port Arthur, Texas to the mouth of the Mississippi.
9/9/82	1600	Gale Warnings issued for the Texas coast from Port Arthur to Port Oconnor.
9/10/82	1000	Gale Warnings extended south of Port Oconnor to Brownsville.
9/10/82	1000	Gale Warnings discontinued from Morgan City, Louisiana eastward to the mouth of the Mississippi.
9/10/82	2200	A Hurricane Watch issued from Port Oconnor, Texas to Morgan City, Louisiana.
9/10/82	2200	Gale Warnings extended eastward from Morgan City, Louisiana to the mouth of the Mississippi.
9/10/82	2200	Gale Warnings discontinued from Port Oconnor to Brownsville, Texas.
9/11/82	0200	Gale Warnings and the Hurricane Watch are discontinued south of Freeport, Texas.
9/11/82	1000	The Hurricane Watch is discontinued from Freeport, Texas to Morgan City, Louisiana.
9/11/82	1300	Gale Warnings are discontinued from west of Port Arthur to Freeport, Texas.
9/11/82	1600	Gale Warnings are discontinued from east of Morgan City, Louisiana to the mouth of the Mississippi.
9/11/82	2200	Gale Warnings are discontinued from Port Arthur, Texas to Morgan City, Louisiana.

TROPICAL STORM CHRIS - PRELIMINARY BEST TRACK

9-12 SEPTEMBER 1982

DATE	TIME (GMT)	Position		PRESSURE (MB)	WIND (KT)	STAGE
		LATITUDE (°N)	LONGITUDE (°W)			
9/9	0000	26.2	91.0	1010	25	Subtropical Depression
"	0600	26.3	91.7	1010	25	" "
"	1200	26.4	92.3	1009	25	" "
"	1800	26.6	93.0	1009	30	" "
9/10	0000	26.8	93.7	1008	30	Tropical Depression
"	0600	26.9	94.0	1007	30	" "
"	1200	27.3	94.2	1005	35	Tropical Storm
"	1800	27.9	94.1	1001	45	" "
9/11	0000	28.4	94.1	1000	50	" "
"	0600	29.0	94.0	997	50	" "
"	1200	29.8	93.8	994	55	" "
"	1800	30.8	93.4	999	40	" "
9/12	0000	31.8	93.2	1004	30	Tropical Depression
"	0600	32.8	92.8	1006	30	" "
"	1200	33.8	92.4	1008	30	" "
"	1800	34.8	91.8	1010	25	" "
9/13	0000	Dissipated				

