Chnep 100A.pdf

FLOOD INSURANCE STUDY

City of Sanibel, Florida

Lee County

October 15, 1985

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

FIGURES

TABLES

EXHIBITS

FLOOD INSURANCE STUDY

CITY OF SANIBEL,
LEE COUNTY,
FLORIDA

1.0 INTRODUCTION

1.1 Purpose of Study

The purpose of this Type 19 Flood Insurance Study is to investigate the existence and severity of flood hazards in the City of Sanibel, Lee County, Florida, and to aid the administration of the Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. Initial use of this information will be to revise Flood Insurance Rate Map developed from data presented in the Type 15 Flood Insurance Study. Further use of the information will be made by local and regional planners in their efforts to promote sound land use and flood plain management. Minimum flood plain management requirements for participation in the National Flood Insurance Program are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

In some states or communities, flood plain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the state (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for the Type 15 Flood Insurance Study were performed by Tetra Tech, Inc. (the Study Contractor) for the Federal Emergency Management Agency (FEMA), under Contract No. H-4053. This study was completed in February 1978.

The hydrologic and hydraulic analyses used for this Type 19 Flood Insurance Study were based on the report "Determination of 100-year Coastal Surge Flood Elevations for Lee County, Florida" (Reference 1).

1.3 Coordination

The following organizations or agencies were contacted in an attempt to explore all possible sources of data: Florida Department of Natural Resources, Florida State Department of Community Affairs, Florida State Department of Transportation, Lee County Board of Commissioners, Lee County Division of Transportation, Lee County Flood Insurance Coordinator, and the U.S. Department of Commerce, National Oceanic and Atmospheric Administration.

Also contacted were the Sanibel City Planning Department, Southwest Florida Regional Planning Council, Southwest Florida Water Management District, South Florida Water Management District, U.S. Army Corps of Engineers (COE), Jacksonville District, U.S. Geological Survey (USGS), and, Howard Needles Tammen and Bergendoff, Inc.

The State Coordinator was involved with this survey through the FEMA Regional Office in Atlanta.

On May 10, 1984, the results of this Flood Insurance Study were reviewed and accepted at a final coordination meeting attended by representatives of FEMA and the community.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the City of Sanibel, Lee County, Florida. The area of study is shown on the Vicinity Map (Figure 1).

A detailed coastal flooding analysis was performed on the complete coastline of the City of Sanibel, where the flooding source is the Gulf of Mexico.

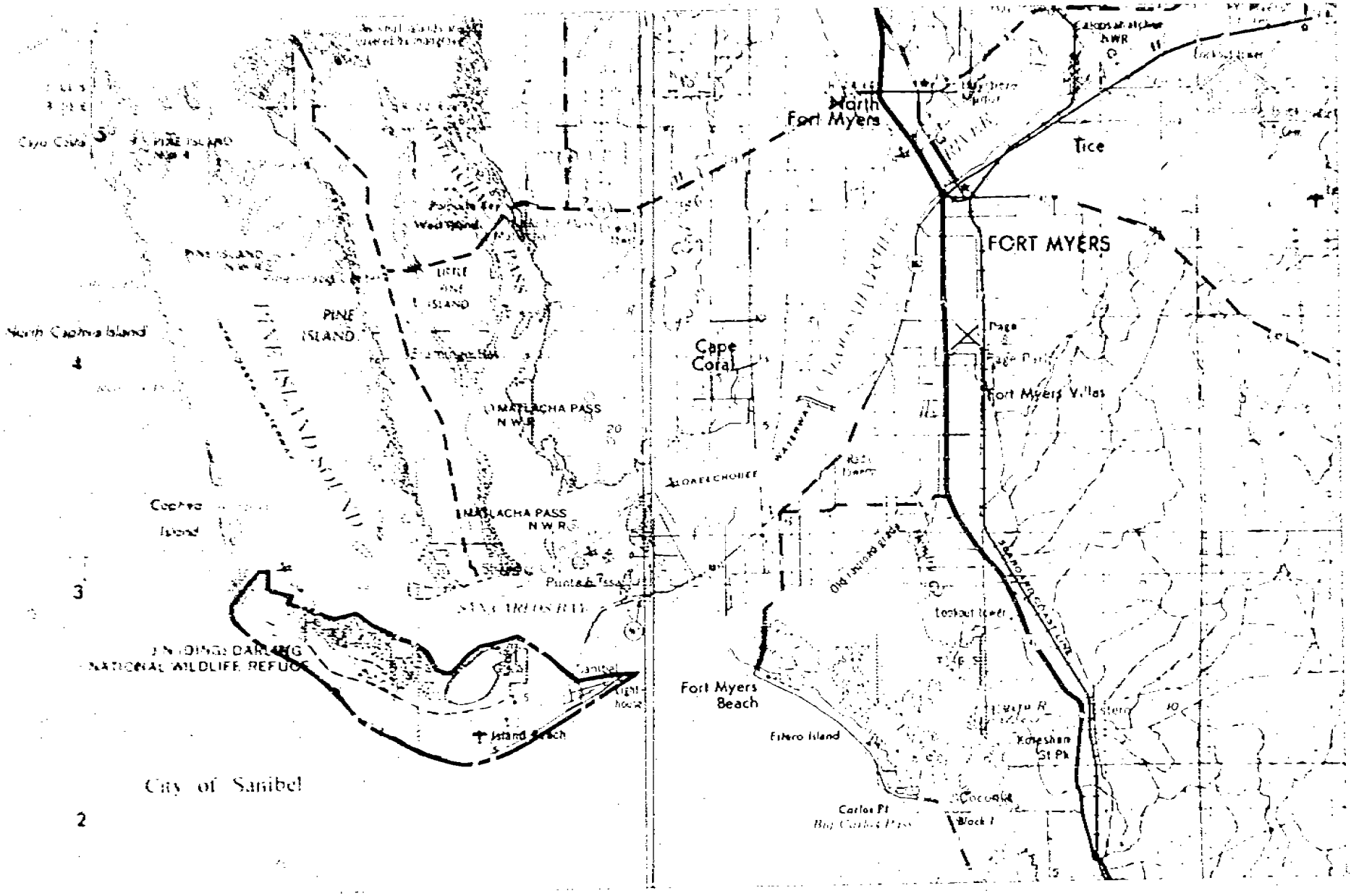
The areas studied by detailed methods were selected based on the extent and validity of available existing hydrologic and hydraulic data.

2.2 Community Description

The City of Sanibel encompasses an area of 10 square miles in southwestern Lee County. This island city, situated approximately 4 miles from the Florida mainland, is located approximately 100 miles south of St. Petersburg and approximately 130 miles northwest of Miami Beach. The water bodies surrounding the study area include the Gulf of Mexico to the south, west, and east, as well as San Carlos Bay and Pine Island South to the north. Although the island's permanent population is 4,120, its peak population during the tourist season swells to 11,000 (Reference 2).

The topography of the island is generally flat, with a maximum elevation of approximately 10 feet National Geodetic Vertical Datum of 1929 (NGVD), and an average elevation of approximately 4 feet NGVD. Rainstorm runoff has increased with the increased land development. This runoff occurs overland to natural ditches and rivers. Some problems exist with culverts under highways in the wetland areas. These culverts do not have sufficient capacity to handle the increased flow rates and, thus, impede the flow of water. In addition, some culverts are above the river's natural bottom, thus ponding the water in the river beds.

Sanibel lies in the subtropical climatic zone. The year in this region is divided into wet and dry seasons. The wet season extends from June through



FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SANIBEL, FL

(LEE CO.)

FIGURE 1

VICINITY MAP

September and coincides with the hurricane season. During this 4-month period, the island receives nearly two-thirds of its annual precipitation. Due to the moderating effects of the Gulf of Mexico, the study area is warmer in winter and cooler in summer than communities in the interior of Lee County.

The island is highly susceptible to storms passing nearby. This situation and the island's relative isolation have caused the City of Sanibel to strive to restrict the total island population to that which can be evacuated safely from the island under emergency weather conditions. Storm surges can easily reach the study area, causing extensive flooding and evacuation difficulties (Reference 3).

Development on the island is generally low-density, single family housing. High-density condominium developments are extensive along the Gulf Coast ridge and in the island's eastern portion.

2.3 Principal Flood Problems

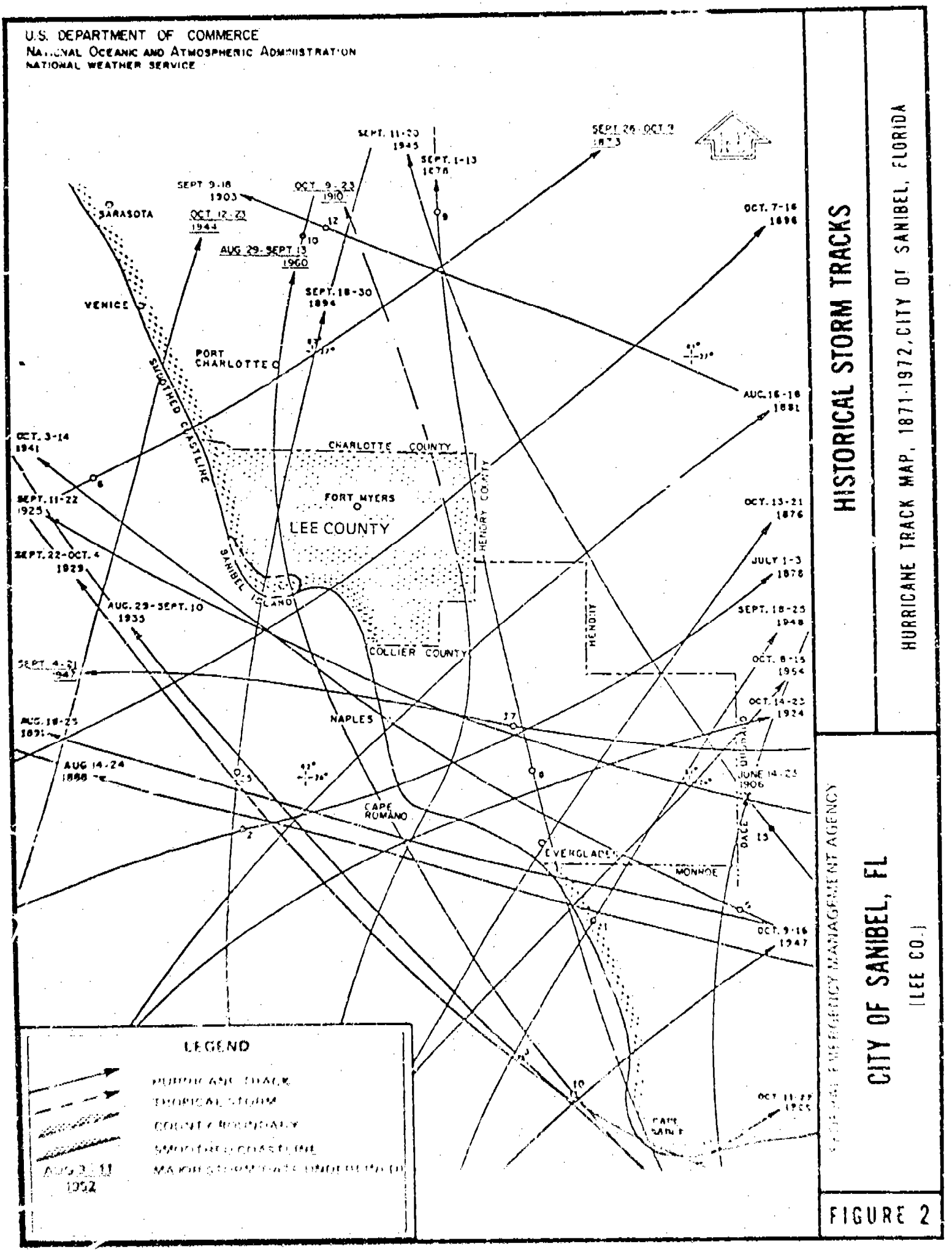
Storms passing Florida in the vicinity of the City of Sanibel can produce high storm surges and inundate the entire island. The wave action that accompanies wind-generated storms can also cause structural damage. A brief description of several significant hurricanes provides historic information to which the projected flood depths can be compared.

The hurricane of September 11-22, 1926 was one of the most destructive events of the century in Florida. Damage from this storm was estimated at $100 million statewide. High tides up to 12 feet above normal were reported at Fort Myers and Punta Rassa. The offshore islands of Sanibel and Captiva were inundated with many homes being swept off their foundations. Flooding damage in the Fort Myers, Sarasota, and Bradenton areas was estimated at $3 million.

The hurricane of September 4-21, 1947 entered the Florida coastline at Fort Lauderdale on September 17. As it moved across the peninsula, it maintained its full intensity and caused extensive flooding. Winds of 90 knots were recorded at Fort Myers, where storm damage totaled nearly $1 million.

In September 1960, the southern portion of Lee County was particularly affected by Hurricane Donna. Highwater marks of 10 to 11 feet mean sea level were recorded on Estero Island. The effects of the hurricane were augmented by antecedent rains which, in the previous three weeks, totaled almost 10 inches over the affected areas. This resulted in higher-than-normal water tables.

Additional historical flood information can be found in the Flood Insurance Study for Lee County, Unincorporated Areas, Florida (Reference 4) and in the COE reports (References 5 and 6). A graphic representation of historical storms can be found in Figure 2, Historical Storm Tracks.



2.4 Flood Protection Measures

No extensive community flood protection projects exist along the coast. Flood proofing of structures is done on an individual basis and includes such measures as elevation of dwellings, conservation of mangroves and dunes, and construction of seawalls.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude that are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for flood plain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long-term, average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood that equals or exceeds the 100-year flood (1 percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Analyses were carried out to establish the peak elevation-frequency relationships for each flooding source studied in detail.

Inundation from the Gulf of Mexico caused by passage of storms (storm surge) was determined by the joint probability method (Reference 7). The storm populations were described by probability distributions of 5 parameters that influence surge heights. These were central pressure depression (which measures the intensity of the storm), radius to maximum winds, forward speed of the storm, shoreline crossing point, and crossing angle. These characteristics were described statistically based on an analysis of observed storms in the vicinity of the City of Sanibel. Primary sources of data for this were "Tropical Cyclone Deck 993" (Reference 8), "Tropical Cyclones of the North Atlantic Ocean, 1871-1963" (Reference 9), "Some Climatological Characteristics of Hurricanes and Tropical Storms, Gulf and East Coasts of the United States" (Reference 10), "Survey of Meteorological Factors Pertinent to Reduction of Loss of Life and Property in Hurricane Situations" (Reference 11), and "Monthly Weather Review" (Reference 12). Digitized storm information for all storms from 1886 to 1977 was used to correlate statistics (Reference 13). A summary of the parameters used for the area is presented in Table 1, Parameter Values for Surge Elevations.

For areas subject to flooding directly from the Gulf of Mexico, the FEMA standard storm surge model was used to simulate the coastal surge generated by any chosen storm (that is, any combination of the 5 storm

CENTRAL PRESSURE DEPRESSION (MILLIBARS)	97.5	87.5	77.5	67.5	57.5	47.5	37.5	27.5	17.5
AVERAGE ASSIGNED PROBABILITIES*	0.020	0.023	0.035	0.055	0.070	0.105	0.142	0.230	0.320
STORM RADIUS TO MAXIMUM WINDS (NAUTICAL MILES)		15				30			
PROBABILITY		0.61				0.39			
FORWARD SPEED (KNOTS)		8		14		20			
PROBABILITIES:									
ENTERING		0.46		0.35		0.19			
ALONGSHORE		0.46		0.35		0.19			
EXITING		0.50		0.43		0.07			
DIRECTION OF STORM PATH (DEGREES FROM TRUE NORTH)	ENTERING			ALONGSHORE			EXITING		
	63	18		333			288	243	
PROBABILITY	0.29	0.27		0.21			0.19	0.04	
FREQUENCY OF STORM OCCURRENCE (STORMS/NAUTICAL MILE/YEAR)				0.00299					

*AVERAGE OF ENTERING, ALONGSHORE, AND EXITING PROBABILITIES

TABLE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SANIBEL, FL

(LEE CO.)

PARAMETER VALUES FOR SURGE ELEVATIONS

parameters defined previously). By performing such simulations for a large number of storms, each of known total probability, the frequency distribution of surge height can be established as a function of coastal location. These distributions incorporate the large-scale surge behavior, but do not include an analysis of the added effects associated with much finer scale wave phenomena, such as wave height or runup. As the final step in the calculations, the astronomic tide for the region is then statistically combined with the computed storm surge to yield recurrence intervals of total water level (Reference 14).

The storm-surge elevations for the 10-, 50-, 100-, and 500-year floods have been determined for the Gulf of Mexico and are shown in Table 2, Summary of Stillwater Elevations. The analyses reported herein reflect the stillwater elevations due to tidal and wind setup effects and include the contributions from wave action effects.

3.2 Hydraulic Analyses

Hydraulic analyses, considering storm characteristics and the shoreline and bathymetric characteristics of the flooding sources studied, were carried out to provide estimates of the elevations of floods of the selected recurrence intervals along each of the shorelines.

The FEMA storm surge model was utilized to simulate the hydrodynamic behavior of the surge generated by the various synthetic storms. This model utilizes a grid pattern approximating the geographical features of the study area and the adjoining areas. Surges were computed utilizing grids of 5 nautical miles, 1 nautical mile, and 2,000 feet, depending on the resolution required.

Underwater depths and land heights for the model grid systems were obtained from photogrammetric maps and USGS topographic maps (References 15 and 16).

The methodology for analyzing the effects of wave heights associated with coastal storm surge flooding is described in a report prepared by the National Academy of Sciences (Reference 17). This method is based on the following major concepts. First, depth-limited waves in shallow water reach a maximum breaking height that is equal to 0.78 times the stillwater depth. The wave crest is 70 percent of the total wave height above the stillwater level. The second major concept is that wave height may be diminished by dissipation of energy due to the presence of obstructions, such as sand dunes, dikes and seawalls, buildings, and vegetation. The amount of energy dissipation is a function of the physical characteristics of the obstruction and is determined by procedures prescribed in Reference 17. The third major concept is that wave height can be regenerated in open fetch areas due to the transfer of wind energy to the water. This added energy is related to fetch length and depth.

Wave heights were computed along transects (cross-section lines) that were located along the coastal areas, as illustrated in Figure 3, Transect Location Map, in accordance with the "Users Manual for Wave Height Analysis" (Reference 18). The transects were located with consideration given to the

FLOODING SOURCE AND LOCATION	TRANSECT	STILLWATER ELEVATION (FEET NGVD)			
		10% (10-YEAR)	2% (50-YEAR)	1% (100-YEAR)	0.2% (500-YEAR)
GULF OF MEXICO					
Shoreline between Blind Pass and Bowman's Beach Road	1	5.3	N/A	10.3	N/A
From the intersection of Gulf of Mexico and Westgate Roads to the intersection of Sea Breeze and Bowman's Beach Roads	1	4.3	N/A	8.1	N/A
Shoreline between Bowman's Beach Road and the east end of Run Bayou	2	5.3	N/A	9.5	N/A
From point 1,420 feet southeast of the intersection of State Road 867 and Bowman's Beach Road to the intersection of Gulf Pines Drive and Gulf Beach Way	2-3	3.6	N/A	7.8	N/A
Shoreline between east end of Run Bayou and Rabbit Road	3	5.3	N/A	9.1	N/A
Shoreline between Rabbit Road and Tarpon Bay Road	4	5.3	N/A	10.9	N/A
From the intersection of Sanibel Captiva and Periwinkle Roads to the intersection of Sanibel Captiva Road and Dixie Beach Boulevard	4	4.1	N/A	7.9	N/A

TABLE

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SANIBEL, FL

SUMMARY OF STILLWATER ELEVATIONS

FLOODING SOURCE AND LOCATION	TRANSECT	STILLWATER ELEVATION (FEET NGVD)			
		10% (10-YEAR)	2% (50-YEAR)	1% (100-YEAR)	0.2% (500-YEAR)
GULF OF MEXICO					
Shoreline between Tarpon Bay Road and Camino Del Mar	5	5.6	N/A	12.3	N/A
From the intersection of Tarpon Bay and Palm Ridge Roads to the intersection of Cotton Court and Bunting Lane	5-6	3.4	N/A	8.7	N/A
Shoreline between Camino Del Mar to about 2800 feet west of east end of Middle Gulf Drive	6	5.7	N/A	12.4	N/A
Shoreline from about 2800 feet west of east end of Middle Gulf Drive to Lindgren Boulevard	7	5.9	N/A	12.5	N/A
From the intersection of Periwinkle Way and Ybel Road to the intersection of Periwinkle Way to Elinor Way	7	3.2	N/A	9.0	N/A
Shoreline between Lindgren Boulevard and Point Ybel	8	6.1	N/A	12.9	N/A
From the intersection of Periwinkle Way and Bailey Road to the intersection of Periwinkle Way and Seagrape Lane	8	3.0	N/A	9 3	N/A

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SANIBEL, FL

(LEE CO.)

SUMMARY OF STILLWATER ELEVATIONS

GULF OF MEXICO

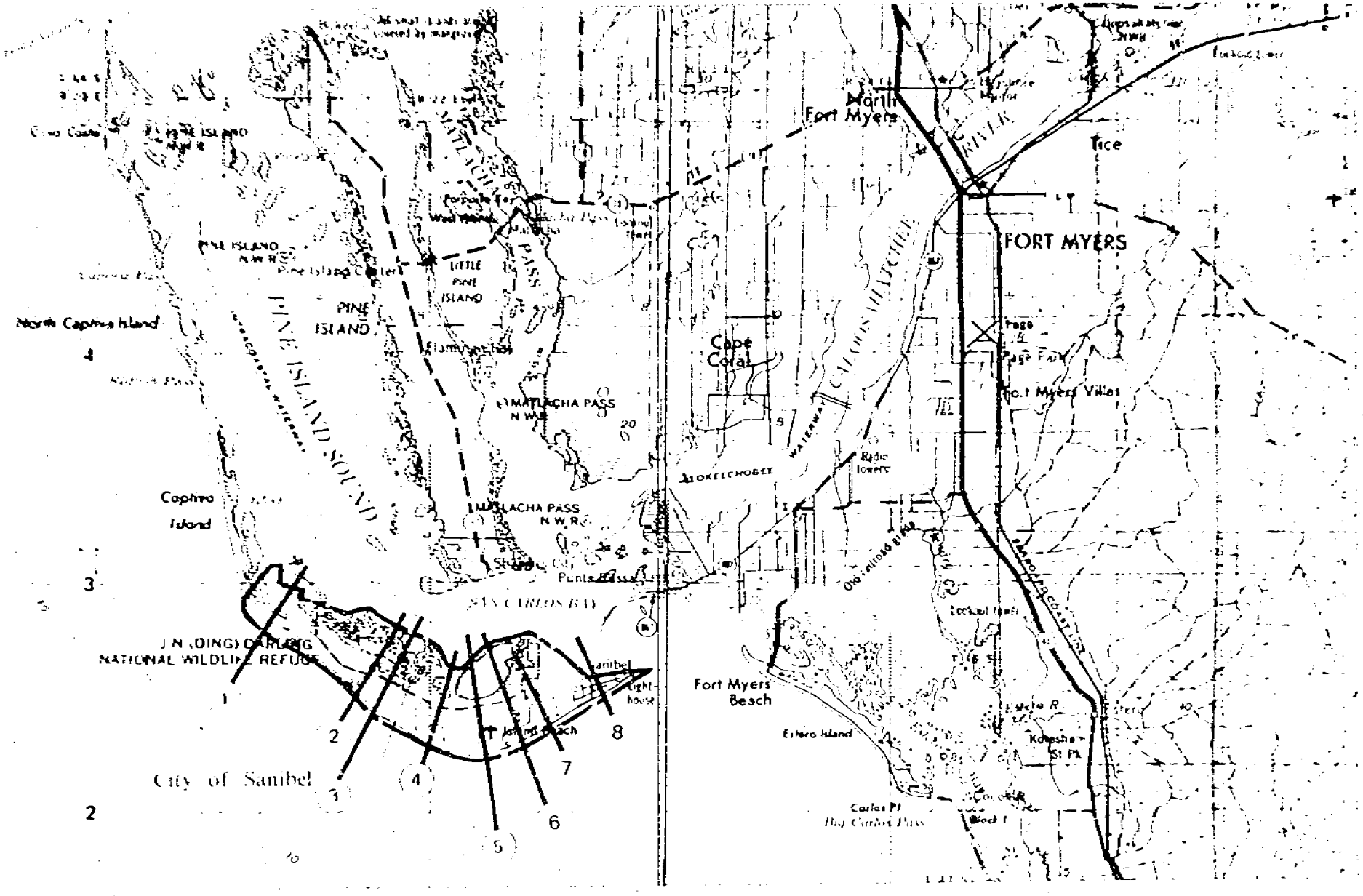


FIGURE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SANIBEL, FL

(LEE CO.)

APPROXIMATE SCALE

4 0 4 8

TRANSECT LOCATION MAP

physical and cultural characteristics of the land so that they would closely represent conditions in their locality. Transects were spaced close together in areas of complex topography and dense development. In close together in areas of complex topography and dense development. In areas having more uniform characteristics, they were spaced at large intervals. It was also necessary to locate transects in areas where unique flooding existed and in areas where computed wave heights varied significantly between adjacent transects.

Each transect was taken perpendicular to the shoreline and extended inland to a point where wave action ceased. Along each transect, wave heights and elevations were computed considering the combined effects of changes in ground elevation, vegetation, and physical features. The stillwater elevations for the 100-year flood were used as the starting elevations for these computations. Wave heights were calculated to the nearest 0.1 foot, and wave elevations were determined at whole-foot increments along the transects. The location of the 3-foot breaking wave for determining the terminus of the V zone (area with velocity wave action) was also computed at each transect. Table 3 provides a listing of the transect locations and stillwater starting elevations, as well as initial wave crest elevations.

Figure 4 represents a sample transect that illustrates the relationship between the stillwater elevation, the wave crest elevation, the ground elevation profile, and the location of the A/V zone boundary.

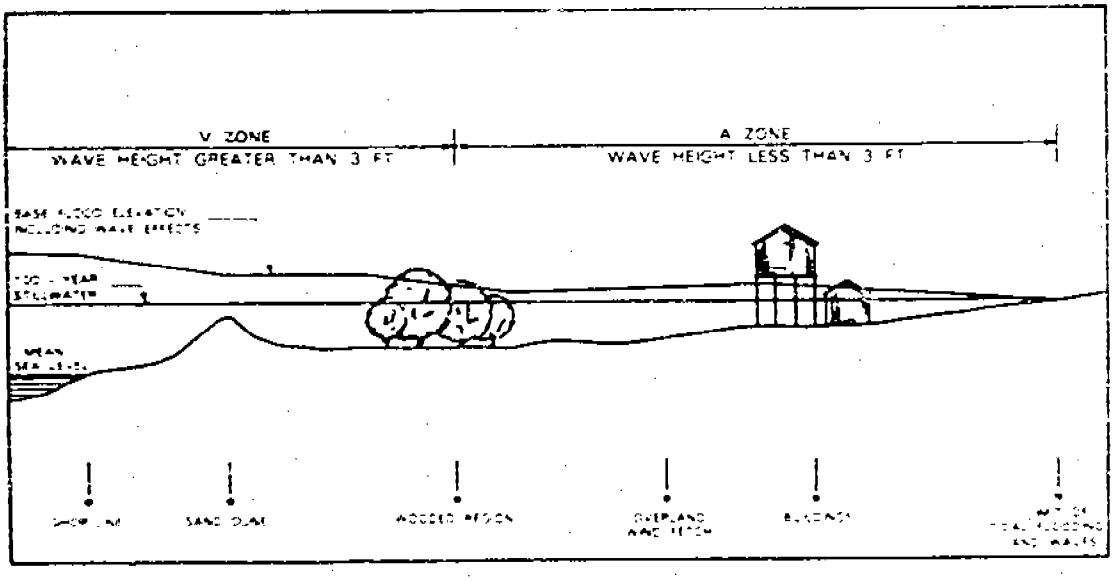


FIGURE 4 - TRANSECT SCHEMATIC

After analyzing wave heights along each transect, wave elevations were interpolated between transects. Various source data were used in the interpolation, including photogrammetric maps (Reference 15), topographic maps (Reference 16), aerial photographs (References 19 and 20), and engineering judgment. Controlling features affecting the elevations were identified and considered in relation to their positions at a particular transect and their variation between transects.

TABLE 3 - TRANSECT LOCATIONS, STILLWATER STARTING ELEVATIONS, AND INITIAL WAVE CREST ELEVATIONS

Transect	Location	Elevation (Feet) Stillwater	Wave Crest
	GULF OF MEXICO		
1	About 1.1 miles southeast of Blind Pass.	10.3	15.9
2	About 600 feet west of intersection of Rue Bayou and Blue Heron Way.	9.5	14.7
3	About 200 feet from west end of West Gulf Drive.	9.4	14.5
4	About 700 feet southwest of intersection of West Gulf Drive and Lake Murex Boulevard.	10.9	16.8
5	About 1,400 feet southwest of intersection of West Gulf Drive and Camino Del Mar.	12.3	19.0
6	About 900 feet southwest of intersection of Casa Ybel Road and Old Cemetery Road.	12.4	19.2
7	About 2.3 miles southwest of Sanibel Lighthouse at Point Ybel.	12.5	19.3
8	About 1.0 mile southwest of Sanibel Lighthouse at Point Ybel.	12.9	19.9

The shoreline is constantly changing on Sanibel Island. Therefore, the most up-to-date aerial photographs of the area have been used to depict the shoreline (Reference 20). The area of Blind Pass, located at the northwest corner of the city, is an inlet that opens and closes due to the passage of storms. For the purposes of this study the inlet of Blind Pass is shown on the maps as an open inlet.

All elevations are referenced to NGVD. Elevation reference marks used in this study are shown on the maps.

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages state and local governments to adopt sound flood plain management programs. Therefore, each Flood Insurance Study produces maps designed to assist communities in developing flood plain management measures.

4.1 Flood Boundaries

To provide a national standard without regional discrimination, the 1 percent annual chance (100-year) flood has been adopted by FEMA as the base flood for flood plain management purposes. The 0.2 percent annual chance (500-year) flood is employed to indicate additional areas of flood risk in the community. For each flooding source studied in detail, the 100- and 500-year flood boundaries have been delineated using the flood elevations determined at each transect. Between transects, the boundaries were interpolated using photogrammetric maps and USGS topographic maps and aerial photography (References 15, 16, and 20).

Flood plain boundaries are indicated on the Flood Insurance Rate Map. On this map, the 100-year flood plain boundary corresponds to the boundary of the areas of special flood hazards (numbered A zones and numbered V zones) and the 500-year flood plain boundary corresponds to the boundary of areas of moderate flood hazards (Zone B). In cases where the 100- and 500-year flood plain boundaries are close together, only the 100-year flood plain boundary has been shown. Small areas within the flood plain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

5.0 INSURANCE APPLICATION

To establish actuarial insurance rates, data from the engineering study must be transformed into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors, the flood insurance zone designations for each flooding source studied in detail affecting the City of Sanibel.

5.1 Reach Determinations

In coastal areas, reaches are limited to the distance for which the 100-year flood elevation does not vary more than 1.0 foot. The locations of these reaches are shown on the Flood Insurance Rate Map.

5.2 Flood Hazard Factors

The Flood Hazard Factor (FHF) is used to establish relationships between depth and frequency of flooding in any reach. This relationship is then used with depth-damage relationships for various classes of structures to establish actuarial insurance rate tables.

The FHF for areas subject only to storm surge flooding is the difference between the 10- and 100-year stillwater elevations rounded to the nearest 0.5 foot, multiplied by 10, and shown as a 3-digit code. For areas with wave heights less than 3 feet, the FHF is the weighted average difference between the 100-year wave crest elevation and the 10-year stillwater elevation. For areas with wave heights greater than 3 feet, the FHF is determined using the difference between the 10- and 100-year stillwater elevations multiplied by 1.55, then rounded to the nearest 0.5 foot, multiplied by 10, and shown as a 3-digit code.

For example, if the difference between elevations is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference is greater than 10.0 feet, it is rounded to the nearest whole foot.

5.3 Flood Insurance Zones

Flood insurance zones and zone numbers are assigned based on the type of flood hazard and the FHF, respectively. A unique zone number is associated with each possible FHF, and varies from 1 for a FHF of 005 to a maximum of 30 for a FHF of 200 or greater.

Zones A9-A13:	Special Flood Hazard Areas inundated by the 100-year flood; with base flood elevations shown, and zones subdivided according to FHFs.
Zones V13, V16-V17, V19-V21:	Special Flood Hazard Areas along coasts inundated by the 100-year flood that have additional velocity hazards associated with waves of 3-foot amplitude or greater; with base flood elevations shown, and zones subdivided according to FHFs.
Zone B:	Areas between Special Flood Hazard Areas and the limits of the 500-year flood; areas that are protected from the 100- and 500-year floods by dike, levee, or other water control structure; areas subject to certain types of 100-year shallow flooding where depths are less

than 1.0 foot; and, areas subject to 100-year flooding from sources with drainage areas of less than 1 square mile. Zone B is not subdivided.

Zone C: Areas of minimal flooding; not subdivided.

Flood elevation differences, FHFs, flood insurance zones, and base flood elevations for the flooding sources studied in detail in the community are shown in Table 4, Coastal Flood Insurance Zone Data.

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for the City of Sanibel is, for insurance purposes, the principal product of the Flood Insurance Study. This map contains the official delineation of flood insurance zones and base flood elevations. For each flooding source, the expected water-surface elevations of the base (100-year) flood are shown as a weighted average within zones. Each whole-foot elevation is delineated except where cartographic considerations require the combination of two or more elevation zones. The base flood elevations and zone numbers are used by insurance agents, in conjunction with structure elevations and characteristics, to assign actuarial insurance rates to structures and contents insured under the National Flood Insurance Program.

6.0 OTHER STUDIES

A Flood Insurance Study was published for Lee County, Unincorporated Areas, Florida (Reference 4). This study is in complete agreement with the Lee County report.

This study supersedes the previously published Type 15 Flood Insurance Study for the City of Sanibel (Reference 21).

7.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting the Natural and Technological Hazards Division, Federal Emergency Management Agency, 1371 Peachtree Street, N.E., Suite 736, Atlanta, Georgia 30309.

FLOODING SOURCE	TRANSECT	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1% (100 YEAR) FLOOD AND 10% (10 YEAR)	FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION[3,4] (FEET NGVD)
GULF OF MEXICO	1	0001,0002,0005	-7.8 -4.7	080 045	V16 A9	12-16 8-12
	2	0002,0005	-6.5 -5.0	065 050	V13 A10	12-15 8-12
	3	0002,0003,0005 0006	6.4 5.0	065 050	V13 A10	12-15 8-10
	4	0003,0005,0006	8.7 5.4	085 055	V17 A11	14-17 8-13
	5	0003,0006	10.4 6.0	100 060	V20 A12	15-19 9-14
	6	0003,0006,0007	-10.4 -6.0	100 060	V20 A12	15-19 9-14
	7	0003,0004,0006 0007	-10.2 -6.4	100 065	V20 A13	15-19 9-14

[1] FLOOD INSURANCE RATE MAP PANEL
[2] WEIGHTED AVERAGE IN FEET
[3] ROUNDED TO NEAREST FOOT
[4] DUE TO MAP SCALE LIMITATIONS, BASE FLOOD ELEVATIONS SHOWN ON MAP MAY REPRESENT AVERAGE ELEVATIONS FOR THE ZONES DEPICTED
[5] INCLUDES EFFECTS OF WAVE ACTION

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SANIBEL, FL
(LEE CO.)

COASTAL FLOOD INSURANCE ZONE DATA

GULF OF MEXICO

FLOODING SOURCE	TRANSECT	PANEL[1]	ELEVATION DIFFERENCE BETWEEN 100-YEAR FLOOD AND 500-YEAR FLOOD	FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATIONS[2] (FEET NGVD)
GULF OF MEXICO	8	0004,0007	-10.5 - 9.5 - 8.2 - 6.5	110 095 080 065	V21 V19 V16 A13	17 - 20 16 14 15 9 14

[1] FLOOD INSURANCE RATE MAP PANEL
[2] WEIGHTED AVERAGE IN FEET
ROUNDED TO NEAREST FOOT
NOTE: DO MAP SCALE LIMITATIONS. BASE FLOOD ELEVATIONS SHOWN ON MAP MAY REPRESENT AVERAGE ELEVATIONS FOR THE ZONES DEPICTED
INCLUDES EFFECTS OF WAVE ACTION

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SANIBEL, FL
(LEE CO.)

COASTAL FLOOD INSURANCE ZONE DATA

GULF OF MEXICO

8.0 REFERENCES AND BIBLIOGRAPHY

1. South Florida Water Management District, Determination of 100-year Coastal Surge Flood Elevations for Lee County, Florida, with Appendices. January 1983.

2. Bureau of Economic and Business Research, Open File Report, University of Florida, Gainesville, Florida. April 1984.

3. Rogers, Golden and Harpern, Hurricane Evacuation and Hazard Mitigation Study, Final Report, November 1981.

4. Federal Emergency Management Agency, Flood Insurance Study, Lee County, Unincorporated Areas, Florida, November 1984.

5. U.S. Army Corps of Engineers, Jacksonville District, Flood Plain Information, Charlotte and North Lee Counties, May 1968.

6. ————, Special Flood Hazard Information Report on South Lee County Coastal Areas, July 1970.

7. U.S. Department of Commerce, Environmental Sciences Services Administration, Technical Memorandum WBTM, Hydro 11, Joint Probability Method of Tide Frequency Analysis Applied to Atlantic City and Long Beach Island, New Jersey, V.A. Myers, April 1970.

8. ————, National Weather Service, Tropical Cyclone Deck 993, 1975.

9. ————, Weather Bureau, Technical Paper No. 55, Tropical Cyclones of the North Atlantic Ocean 1871-1963, G.W. Cry, 1965.

10. ————, National Weather Service, Technical Report NWS 15, Some Climatological Characteristics of Hurricanes and Tropical Storms, Gulf and East Coasts of the United States, F.P. Ho, R.W. Schwerdt, and H.V. Goodyear, May 1975.

11. ————, National Hurricane Research Project, Report No. 5, Survey of Meteorological Factors Pertinent to Reduction of Loss of Life and Property in Hurricane Situations, March 1957.

12. ————, National Weather Service, Monthly Weather Review, abstracts of previous year hurricane season, 1964 to 1977.

13. ————, National Weather Service, Tape of Digitized Storm Information from 1886 Through 1977, Asheville, North Carolina.

14. Tetra Tech, Inc., Coastal Flooding Storm Surge Model, Parts 1 and 2, prepared for the Federal Emergency Management Agency, 1981.

15. Howard Needles Tammen and Bergendoff, Photogrammetric Maps, prepared for the City of Sanibel. Scale 1:24000, Contour Interval 1 foot. Bosworth Aerial Surveys, Inc., Lake Worth, Florida. June 1976.