Storm-Tide Elevations Produced by Hurricane Andrew Along the Southern Florida Coasts, August 24, 1992

U.S. GEOLOGICAL SURVEY

Open-File Report 94-116

Prepared in cooperation with the

FEDERAL EMERGENCY MANAGEMENT AGENCY

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By MITCHELL H. MURRAY

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CONVERSION FACTORS, VERTICAL DATUM, AND ACRONYMS

Multiply	By	To obtain
foot (ft)	0.3048	meter
mile (mi	1.609	kilometer
mile per hour (mi/hr)	1.609	kilometer per hour
square mile (mi^2)	2.590	square kilometer

Sea level: In this report, "sea level" refers to the National Geodetic Vertical Datum of 1929--a geodetic datum derived from a general adjustment of the first-order level nets of the United States and Canada, formerly called Sea Level Datum of 1929.

Astronomical tide: The daily rise and fall of water in the sea caused by the gravitational forces of the sun and moon; also called tide.

Storm surge: Abnormal rise of water caused by the wind and pressure forces in a hurricane.

Storm tide: Combined effect of the astronomical tide and storm surge. The highest storm tide value occurs when the maximum storm surge elevation occurs at high tide.

Acronyms

FEMA = Federal Emergency Management Agency
GPS = Global Positioning System

Storm-Tide Elevations Produced by Hurricane Andrew Along the Southern Florida Coasts, August 24, 1992

By Mitchell H. Murray

Abstract

On August 24, 1992, Hurricane Andrew made landfall south of Miami, Florida, and crossed the extreme southern point of peninsular Florida. The combined effects of storm surge from the hurricane and astronomical tide, referred to as storm tide, caused flooding over a large part of extreme southern Florida. In the weeks that followed the storm, the U.S. Geological Survey identified, described, and surveyed many high-water marks along the southeastern coast of Florida (Miami to Key Largo) and in selected areas along the southwestern coast of Florida (Flamingo to Goodland) to document the extent of flooding. A total of 336 high-water marks are described in tabular form in this report and their locations are plotted on nineteen 7.5-minute topographic quadrangle maps, which are included as plates in the pocket at the back of this report. For the southeastern coast, north-south profiles of the high-water marks along the outer and inner barrier islands and along the western shoreline of Biscayne Bay are also presented. Storm-tide elevations (relative to sea level) ranged from 4 to 6 feet in northern Biscayne Bay, increased in a southerly direction to about to 17 feet on the western shoreline near the center of the bay and decreased from that point to about 3 to 6 feet in southern Biscayne Bay and Barnes Sound. Elevations along the southwestern coast ranged from 4 to 5 feet above sea level at Flamingo and 5 to 7 feet above sea level at Goodland in the Ten Thousand Islands area.

INTRODUCTION

At about 5:00 a.m., on Monday, August 24, 1992, Hurricane Andrew made landfall in extreme southern Florida. Hurricane force winds of 74 mi/hr or greater affected about 3,000,000 people in Dade, Broward, Collier, and Monroe Counties (fig. 1). The strongest winds, around the eye, occurred in southern Dade and northern Monroe Counties and in the Florida Keys. The maximum 1-minute sustained wind was estimated at 145 mi/hr with gusts to at least 175 mi/hr (Brian Jarvinen, National Oceanic and Atmospheric Administration, written commun., 1993). On the Saffir/Simpson hurricane scale of 1 to 5, with 5 being the strongest storm, Hurricane Andrew was rated a category 4 storm. Hudak (1992) reported that Hurricane Andrew left a 300-mi^2 area of "intense" destruction, 30 mi wide and 10 mi deep, along the southeastern coast from Kendall southward to Florida City (fig. 2). The storm tide peaked at about 17 ft above sea level in the vicinity of S.W. 180th Terrace and Old Cutler Road, about 13 mi south of Miami. The strongest winds on the northern side of the eye also occurred at this location, and the combined effects of wind and storm tide destroyed or damaged many homes and boats in this area. Hurricane Andrew continued across the Everglades (fig. 2) at about 18 mi/hr and moved into the Gulf of Mexico about 8:00 a.m. on the same day (fig. 1). Storm tide was also generated on the southwestern coast of Florida, but the elevations were smaller than those observed in Biscayne Bay (fig. 2).

The U.S. Geological Survey, in cooperation with the Federal Emergency Management Agency (FEMA), collected data in southern Florida for flood elevations and depths caused by Hurricane Andrew. This report documents storm-surge elevations, ground elevations where surge elevations were surveyed, and

Figure 1. Storm track of Hurricane Andrew across southern Florida, August 24, 1992.

Figure 2. Study area and quadrangles for which storm-tide elevations are delineated. Hatchured area represents 300-square mile area of intense destruction.

type and quality of high-water marks at 336 sites and delineates the extent of inundation based on these high-water marks at selected locations. The data are presented in tables and on a series of nineteen 7.5-minute quadrangle topographic maps (pls. 1-19, in pocket at back of this report).

Thirteen of these maps cover an area from north Miami to about middle Key Largo on the southeastern coast of Florida. Six maps cover parts of the southwestern coast of Florida near Flamingo, near Chokoloskee, and near Goodland in the Ten Thousand Islands area (fig. 2). The landward extent of storm-tide inundation has been delineated on seven of these maps. Surveying of the high-water marks after the storm was most extensive along the 30-mi reach from the Broad Causeway near Miami to Turkey Point near Homestead (pls. 2-5, 7, 8, and 19).

Description of Study Area

The study area covers a wide area and includes parts of Dade, Collier, and Monroe Counties in Florida (fig. 1). Most of the storm-tide data were collected in Dade County, which is bounded by the Atlantic Ocean to the east, Broward County to the north, Collier and Monroe Counties to the west, and the Florida Keys to the south. Geographic areas, water bodies, and place names within this three-county area are shown in figure 2.

Early urbanization was primarily along coastal northeastern Dade County because of good drainage and access to the ocean. Subsequently, the construction of canals and artificial drainage of land farther inland opened up most of eastern Dade County for development, especially agriculture. Urbanization of the area also increased but remained concentrated near the coast. Major urban centers in the area include Miami, Miami Beach, Key Biscayne, Homestead, and Florida City (fig. 2).

Physiographic features such as the Atlantic Coastal Ridge (fig. 3) have significantly controlled the environment, drainage, and ultimately the land use along coastal Dade County. The Atlantic Coastal Ridge, a narrow ridge 2 to 10 mi wide that parallels the coast, forms the highest ground in the county. Elevations along the ridge range from about 8 to 15 ft above sea level between Homestead and north Miami to 20 ft above sea level or greater in some places (Fish and Stewart, 1991). West of Homestead, elevations of the Atlantic Coastal Ridge are from 5 to 8 ft above sea level. The Atlantic Coastal Ridge is a natural barrier to drainage of the interior, except where it is breached by shallow sloughs or rivers. The Everglades, west of the Atlantic Coastal Ridge, is by far the largest physiographic feature in Dade County; land-surface elevations in the Everglades are generally less than 8 ft above sea level. Coastward from the Everglades and the Atlantic Coastal Ridge lie coastal marshes and mangrove swamps at elevations that generally range from 0 to 3 ft above sea level (Fish and Stewart, 1991). Data-collection efforts in the Everglades interior and along the southern and southwestern mangrove fringes were limited for this study by road access and benchmark availability. A detailed description of all the physiographic features for Dade County is presented in a report by Fish and Stewart (1991).

A complex water-management system of canals and control structures was built in the study area beginning in the early 1900's to provide drainage, regulate freshwater discharge, and maintain desirable groundwater levels. Salinity control structures have been constructed on most of the canals discharging to the ocean to prevent the inland movement of saltwater through the canals.

Methods

In the first phase of the study, immediately after Hurricane Andrew swept through southern Florida, the U.S. Geological Survey sent field personnel to locate and identify high-water marks and the extent of inundation along transects perpendicular to the coastline at about 1-mi intervals. A description of the high-water mark locations and type of marks (inside still-water line, outside line, driftline, and so forth) and an assessment of the quality of the marks were prepared during this phase of the study. The quality of each mark was assigned a category as follows:

- *Excellent*: A level, extremely well-defined line of densely accumulated fine debris (or a distinct stain) considered to represent the high-water surface with an accuracy of ±0.05 ft.
- *Good*: A level, well-defined line of densely accumulated fine debris (or a distinct stain) considered to represent the high-water surface with an accuracy of ±0.10 ft.

Figure 3. Physiographic features of Dade County prior to development (from Fish and Stewart, 1991).

- *Fair:* A level, but less distinct band of fine or coarse debris (or stain) considered to represent the high-water surface with an accuracy of ±0.25 ft.
- *Poor*: A poorly defined band of sparsely accumulated coarse debris that might reflect surface wave action, a discontinuous scatter of coarse debris on a structure, a coarse groundline of heavy vegetative drift, or other evidence of high water such as debris in the branches of a tree, which is considered to represent the high-water surface with an uncertainty of more than about 0.25 ft.

The best high-water marks for indication of maximum still-water storm-tide elevation, termed inside marks, generally were found in small rooms of buildings, such as bathrooms or closets. These locations best minimized the effects of wind and wave action on water-surface elevations. Outside marks were sometimes of poor quality because of wave action, or in the case of debris lines were commonly distorted as a result of high winds. About 46 percent of the 336 high-water marks used for this study were judged to be excellent or good, and about 25 percent were judged to be poor.

In the second phase of the study, the elevation of each high-water mark and the land-surface elevation were determined and referenced to sea level. Most elevations were determined by using conventional direct-leveling techniques and vertical control stations (bench marks) from bench-mark networks maintained by the Florida Department of Natural Resources and the Dade County Survey Department. In certain areas where bench-mark elevations have not been referenced to sea level, such as on remote barrier islands and along the southwestern coastline, a Global Positioning System (GPS) was employed to establish vertical control. The GPS, in brief, is a system utilizing three telemetry units (two located on known bench marks and one located on the unknown point) that use data satellites in a triangulation scheme to determine latitude, longitude, and elevation. A Trimble 4000ST GPS unit was used to obtain 26 high-water marks as indicated in table 1 at the end of this report. (*Note*: Use of brand names in this report is for identification purposes only and does not constitute endorsement by the U.S. Geological Survey.)

The third phase of the study involved a reconnaissance of the landward extent of the storm tide using observed debris lines in the field in conjunction with topographic maps to document the extent of inundation for selected areas (pls. 2-5, 7, 8, and 19). The extent of overbank flow for selected river and canal reaches west of the coastal Biscayne Bay inundation area, including reaches of the Miami River (pl. 2), Coral Gables Canal (pl. 3), Snapper Creek Canal (pl. 3), Cutler Drain Canal comprising C-100, C-100A, and C-100B (pl. 5), and Black Creek Canal (pl. 5), was also determined by debris lines.

The high-water marks, land-surface elevations, and type of marks (inside or outside) are shown on 19 quadrangle maps (in pocket at back of this report). The maps are identified in figure 2 and presented as plates 1 to 19. Descriptions of the high-water marks and their quality are given in table 1 (at the end of this report).

Vertical Datum

In this report, sea level refers to the National Geodetic Vertical Datum of 1929 (NGVD of 1929). NGVD of 1929 is a geodetic datum derived by the U.S. Coast and Geodetic Survey (now known as the National Ocean Service) by averaging hourly water-level readings at 21 U.S. and 5 Canadian locations. This hourly average was defined as mean sea level or zero elevation. Although sea level is used in lieu of NGVD of 1929 in this report, many maps today are referenced to NGVD of 1929. This section is presented for those readers who need to distinguish storm tide and storm surge based on NGVD of 1929 and sea-level changes that have occurred since NGVD of 1929 was originally derived.

Because sea levels have been rising in varying amounts with respect to location and time since 1929, the local mean sea level is now higher than NGVD of 1929. The most recent computation of sea level at various locations was in 1978 using hourly water-level readings for the time period 1960-78. In Miami, sea level in 1978 was 0.43 ft higher than NGVD of 1929. Extrapolating the data to 1992 would give a rise of about 0.55 ft. The relations among NGVD of 1929, local mean sea level, tide elevations, and storm surge as well as the equation used to calculate storm surge are shown in figure 4.

In the area of Biscayne Bay, where the eye of Hurricane Andrew came ashore, peak storm surge occurred just before or near high astronomical tide. The elevation of the astronomical tide above estimated local mean sea level of 1992 for most locations in the area

EXPLANATION

MC=DIFFERENCE BETWEEN NGVD OF 1929 AND LOCAL MEAN SEA LEVEL (1992)

TE= ELEVATION OF TIDE ABOVE LOCAL MEAN SEA LEVEL(1992) AT TIME OF PEAK STORM-TIDE ELEVATION

ST=STORM TIDE, WATER ELEVATION ABOVE NATIONAL GEODETIC VERTICAL DATUM OF 1929 (NGVD OF 1929)

SS=STORM-SURGE ELEVATION

$$SS=ST-(MC+TE)$$

Figure 4. Storm-surge elevation computation.

of Biscayne Bay at the time the storm hit the coast was 1.3 to 1.5 ft. If storm tide (ST) represents the height of the high-water surface above NGVD of 1929, MC represents the estimated difference between NGVD of 1929 and local mean sea level of 1992 (0.55 ft), and TE represents the elevation of the astronomical tide above local mean sea level of 1992 (1.3 to 1.5 ft), the storm-surge elevation (SS) can be determined using the equation in figure 4 as follows:

$$SS = ST - (MC + TE) \quad (1)$$

For Hurricane Andrew:

$$MC + TE \approx 2 \text{ ft} \quad (2)$$

For example, if a high-water elevation of 14.6 ft was observed at one location, the storm surge would be about 12.6 ft (Brian Jarvinen, National Oceanic and Atmospheric Administration, written commun., 1993).

It is important for the reader to understand that a documented storm-tide elevation represents not only the depth of water but also that part of land surface above mean sea level. The depth of water above land surface can be obtained by subtracting the associated land-surface elevation (located on the respective plates) from the water-surface elevation at the high-water mark. For example, high-water mark 23 (S.W. 180th Terrace) on plate 5 had a storm-tide elevation of 16.9 ft above sea level and a land-surface elevation of 6.4 ft above sea level. The difference between these two elevations (10.5 ft) is the maximum depth of water above land surface at that point during the storm.

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STORM-TIDE ELEVATIONS

The elevations of each high-water mark were plotted on a series of 7.5-minute quadrangle maps (pls. 1-19). All water-surface elevations presented in this report are based on high-water marks obtained as described in the "Methods" section. Differences between adjacent high-water marks could result from the effects of wave action and/or the effects of lag between the occurrence of outside high water and the filling of rooms in houses where inside marks were obtained. Differences can also occur in rivers and canals as the storm tide moves upstream where hydraulic gradients occur as a result of streambank constrictions. Further evaluation of local differences between adjacent elevations of high-water marks is beyond the scope of this report.

A plot of average storm-tide elevations for selected high-water marks for the mainland coast, inner barrier island coast, and outer barrier island coast of southeastern Florida is shown in figure 5. For this report, these coasts are defined as follows:

- *Mainland coast*: The part of the mainland coast that is in direct contact with Biscayne Bay; that is all points from north Miami southward to Turkey Point near Homestead (fig. 6).
- *Inner barrier island coast*: The part of the barrier islands, including Miami Beach, the Venetian Islands, Fisher Island, Virginia Key, Key Biscayne, Boca Chita, Elliot Key, and Key Largo that is in contact with Biscayne Bay, Blackwater Sound, and Buttonwood Sound. Two examples would be the western coast of Key Biscayne in Biscayne Bay and the western coast of Key Largo in Buttonwood Sound (fig. 6).
- *Outer barrier island coast*: All of the barrier island coastline that is in direct contact with the open ocean. An example would be the eastern coasts of Key Biscayne and Key Largo (fig. 6).

The mileage baseline used to prepare figure 5 is shown in figure 6. The baseline is oriented in a north-south direction so as to be aligned perpendicular to the east-west streets of the urban areas to facilitate interpolations of storm-tide elevations. The water-surface elevation data used to prepare figure 5, where possible, were obtained from inside high-water marks located along the east-west transects. Outside high-water marks were used when inside marks were unavailable.

The alongshore elevation data, plotted on figure 5, are presented in table 2. The distances to open water from the mainland and the inner and outer barrier island high-water marks are also given in table 2. The distance to open water is defined, for the purposes of this report, as the shortest (straight line) distance over which the surge would pass to reach the mainland and

Figure 5. Alongshore storm-tide elevations for the mainland coast and the outer and inner barrier island coasts of southeastern Florida.

Figure 6. Baseline for mileage and selected high-water mark locations along the southeastern coast of Florida.

Table 2. Storm-tide elevations and distance to open water at selected locations along the southeastern Florida coast

[Figure 6 shows location of site numbers used for identification purposes in this report only. Coast location: M, mainland coast; I, inner-barrier island coast; and O, outer-barrier island coast]

Site No.	Site name or location	Storm-tide elevation (feet above sea level)	Coast location	Distance south from Broad Causeway (miles)	Distance to open water (miles)
1	N.E. 123rd Street (Broad Causeway)	5.2	M	0.0	0.0
2	N.E. 71st Street	5.8	M	2.5	.1
3	N.E. 55th Street	4.2	M	3.5	.1
4	N.E. 46th Street (Bay Point)	3.7	M	4.5	.2
5	N.E. 36th Street (Juttle Tuttle Causeway, NW)	3.8	M	4.5	.0
6	N.E. 36th Street (Julia Tuttle Causeway, SW)	4.4	M	4.5	.0
7	N.E. 36th Street (Julia Tuttle Causeway, NE)	3.6	I	4.5	.0
8	N.E. 36th Street (Julia Tuttle Causeway, SE)	5.2	I	4.5	.0
9	N.E. 29th Street	5.2	M	5.0	.1
10	Rivo Alto Island	4.4	I	6.5	.0
11	Palm Island	4.0	I	7.0	.0
12	Star Island	4.7	O	7.0	.0
13	Fisher Island (west Government Cut)	5.4	I	7.5	.0
14	Fisher Island (east Government Cut)	8.6	O	8.0	.0
15	Fisher Island (east Norris Cut)	6.6	O	8.5	.0
16	Virginia Key north (Lamar Lake)	6.5	O	9.0	.2
17	S.E. 14th Street (Point View)	7.8	M	9.0	.0
18	S.W. 27th Street (Mercy Hospital)	9.3	M	9.0	.2
19	Virginia Key south (Fish Hatchery)	7.1	O	9.5	.0
20	Virginia Key south (seaquarium)	7.8	I	10.0	.0
21	S.W. 40th Street (Vista Court)	9.9	M	10.5	.0
22	Key Biscayne (Crandon Marina)	7.4	I	11.0	.0
23	S.W. 48th Street (Dinner Key)	9.6	M	11.0	.2
24	S.W. 51st Street (Peacock Park)	10.9	M	11.5	.0
25	S.W. 58th Street (Poinciana Drive)	9.7	M	11.5	.0
26	Key Biscayne Crandon Park west	7.6	I	12.0	.3
27	Key Biscayne Crandon Park east	7.4	O	12.0	.2
28	S.W. 70th Street (Sunrise Harbor)	9.3	M	12.5	.1
29	Key Biscayne (Harbor Drive)	7.5	I	12.5	.0
30	Key Biscayne (Ocean Drive)	9.6	O	13.0	.0
31	Key Biscayne (West Enid Drive)	7.6	I	13.0	.0
32	S.W. 88th Street (Gables Estates)	9.4	M	13.0	1.0
33	S.W. 100th Street (Matheson Hammock)	9.5	M	14.0	.0
34	S.W. 111th Street	8.2	M	15.0	1.2
35	S.W. 132nd Street (Coral Bay)	11.7	M	16.5	.0
36	S.W. 153rd Street	15.0	M	17.5	.2
37	S.W. 168th Street (Deering Estate south)	16.6	M	18.5	.0
38	S.W. 174th Street	16.2	M	19.5	.1
39	S.W. 180th Terrace (near Burger King Corp.)	16.9	M	21.0	.6
40	S.W. 183rd Terrace	14.7	M	21.5	.6

Table 2. Storm-tide elevations and distance to open water at selected locations along the southeastern Florida coast--Continued

Site No.	Location	Storm-tide elevation (feet above sea level)	Coast location	Distance south from Broad Causeway (miles)	Distance to open water (miles)
41	S.W. 196th Street	10.8	M	22.5	1.0
42	S.W. 198th Street (Saga Bay)	10.1	M	23.0	.9
43	S.W. 248th Street (Black Point Marina)	12.6	M	23.5	.2
44	S.W. 267th Street (Princeton Canal)	8.8	M	25.0	.9
45	Boca Chita	6.9	I	25.0	.0
46	S.W. 299th Street (Military Canal)	8.4	M	27.0	.4
47	S.W. 320th Street (Mowry Canal)	7.5	M	29.0	.4
48	S.W. 328th Street (Homestead Bayfront Park)	6.7	M	30.5	.0
49	Elliot Key (Point Adelle)	9.2	O	30.5	.0
50	Elliot Key (Visitors Center)	7.3	I	30.5	.0
51	S.W. 352nd Street (Turkey Point)	4.8	M	31.5	.0
52	Angelfish Key (northern Key Largo)	4.1	O	39.0	.0
53	South Pumpkin Creek (Key Largo)	4.9	O	39.5	.0
54	Ocean Reef Club (Key Largo)	4.2	O	40.0	.0
55	Little Card Sound (NW of Card Sound Road)	3.9	M	42.0	.0
56	Barnes Sound (SW of Card Sound Road)	4.8	M	42.0	.0
57	Carysfort Harbor	3.0	O	46.0	.0
58	Point Mary South	4.4	O	50.0	.0
59	Jewfish Creek South	3.1	I	50.5	.0
60	Sunset Cove (about U.S. 1 mile marker 99)	5.4	I	57.0	.0
61	Rock Harbor (about U.S. 1 mile marker 99)	2.6	O	57.5	.0

the inner and outer barrier island storm-tide elevation points. Open water is considered to be Biscayne Bay for the mainland and the inner barrier island coastal locations and the Atlantic Ocean for the outer barrier island coastal locations.

Both the inner and outer coast elevations are shown on the alongshore profile in figure 5 to illustrate the effect of the marshes (fig. 3) and barrier islands on the storm tide. Storm-tide elevations from the Broad Causeway to S.W. 111 Street and from Princeton Canal to Barnes Sound were relatively low (generally less than 8 ft above sea level), and the highest storm-tide elevations (17 ft above sea level) were in the vicinity of S.W. 180th Terrace (fig. 6, site 39), east of Old Cutler Road (Burger King Corporation) in Perrine. The area of highest storm-tide elevations was in an area of the coastal mainland that is unprotected by barrier islands and was at the outer northern eyewall edge of the hurricane where sustained winds reached 145 mi/hr. Maximum storm tides occur at different times and locations due to complex interaction of wind and wave dynamics. Because of this complexity, an analysis of the timing and elevation of peak storm tides throughout the study area is beyond the scope of this report.

STORM-TIDE INUNDATED AREAS

As mentioned in the "Methods" section, the third phase of data collection involved mapping the debris lines longitudinally between documented and surveyed east-west latitudinal transects for selected areas. The southeastern coast reconnaissance began in the vicinity of Haulover Inlet near Sunny Isles, covering both sides of the barrier islands and the Florida Keys, to about mile marker 99 on south Key Largo (fig. 6). Because of the lack of available air and boat transportation and generally smaller storm tides, no attempt was made to map areas of inundation along the mainland fringes of Florida Bay (fig. 1); along the remote southwestern coastal areas from north Cape Sable to the Monroe-Collier County boundary, just south of Chokoloskee, or in the Ten Thousand Islands area south of Goodland (fig. 2). The northernmost extent of reconnaissance for the southwestern coast was the Gulf of Mexico side of Marco Island Beach (fig. 2).

Where possible, the inland extent of storm-tide inundation shown on the quadrangles (pls. 2-5, 7, 8, and 19) was mapped using debris lines observed in the field. Mapping the line of farthest landward inundation along the entire coast, however, was not possible in swampy undeveloped areas and was beyond the scope of this study. An attempt was made to define the areas inundated by the storm tide using aerial photography but this proved unsuccessful. Localized high or low ground surfaces in urbanized areas were also difficult to map because these areas were often difficult to identify in the field or on topographic maps. The boundary line defining the extent of inundation was estimated in places because of limited control. In areas where more exact information is required than can be provided by the boundaries shown on the plates, surveys can be performed using the nearest measured high-water mark elevation as the probable maximum water-surface elevation for that area. Areas in which land-surface elevations are lower than the elevation of the nearest measured high-water mark were probably inundated by the storm tides. Extrapolation of high-water elevations and boundaries of inundated areas should be based on consideration of local flow dynamics and directional orientation of the winds, canals, and topographic features.

Inundation in the form of slight overtopping of the seawalls occurred in the coastal area beginning on the mainland coast near Little River and extending south to the Miami River (pl. 2). The Miami River experienced slight overtopping as far inland as N.W. 24th Street beginning most noticeably on the coast from Brickell Point south to Point View. Some minor overtopping of seawalls was also noted in parts of Biscayne, Watson, Palm, Rivo Alto, and Fisher Islands (pl. 2). Continuing south of Rickenbacker Causeway, inundation was mainly limited to those areas east of South Bayshore Drive (pl. 4) having land-surface elevations of less than about 15 ft above sea level, which includes much of the area east of Old Cutler Road (pl. 3). Key Biscayne was completely inundated (pl. 4), and Virginia Key experienced partial inundation (pls. 2 and 4). Overtopping was most apparent in the area south of the Deering Estate where the coastal ridge was inundated and where the highest storm-tide elevations occurred (pl. 5, high-water mark no. 24). Overtopping of the Cutler Drain Canal was observed as far west as U.S. Highway 1 (pl. 5). Levee L-31E (S.W. 87th Avenue) south of Franjo was not overtopped, except in the area south of S.W. 224nd Street. This levee was overtopped as far inland as the intersection of Old Cutler Road and the Black Creek Canal. Levee L-31E near Princeton Canal (C-102) continued to be overtopped as far west

as S.W. 107th Avenue (pl. 5). Many areas south of Princeton Canal were also inundated, but control in these areas was limited because of inaccessibility of the areas (pl. 7). Elliot and Adams Keys were completely inundated (pl. 8). Goodland in the northern part of the Ten Thousand Islands area was partly inundated, but storm tides were not noticeably above normal high tide at Marco Island Beach, in the area west of David Key and north of Caxambas Bay, or at the Isle of Capri (pl. 19).

SUMMARY

Hurricane Andrew made landfall south of Miami in southern Florida at about 5:00 a.m., on Monday, August 24, 1992, just before high tide. The hurricane with a maximum 1-minute sustained windspeed of 145 mi/hr and gusts to at least 175 mi/hr moved westward at 18 mi/hr, creating an area of "intense" destruction 30 mi wide and 10 mi deep from Kendall southward to Florida City. The storm tide peaked at an elevation of about 17 ft above sea level in the vicinity of S.W. 180th Terrace in Perrine, about 13 mi south of Miami.

High-water marks produced by the storm tide from Hurricane Andrew were identified, described, and surveyed by personnel of the U.S. Geological Survey along the coast of southeastern Florida from Miami southward to Key Largo and at selected areas along the southwestern coast from Flamingo northward to Goodland shortly after the storm. A total of 336 high-water marks were surveyed. These high-water marks are described in this report, and their locations and elevations are plotted on 19 topographic quadrangle maps. The landward extent of storm-tide inundation is delineated on seven of these maps. Profiles of storm-tide elevations along the mainland coast and the inner and outer barrier island coasts south of Miami are also presented in this report.

The highest storm-tide elevations associated with Hurricane Andrew occurred at locations where sustained winds reached their maximum (145 mi/hr) and were blowing toward the shore in areas unprotected by barrier islands. Average storm-tide elevations (relative to sea level) in Biscayne Bay ranged from 4 to 6 ft in the northern part of the bay, increased in a southerly direction to a maximum of 17 ft on the western shoreline near the center of the bay and decreased south of that area to about 3 to 6 ft in the southern part of the bay and in Barnes Sound. Storm-tide elevations along the southwestern coast ranged from 4 to 5 ft at Flamingo and 5 to 7 ft at Goodland in the Ten Thousand Islands area.

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Table 1. Descriptions and elevations of high-water marks surveyed along the southern Florida coasts following Hurricane Andrew, August 1992

[See figure 1 for location of plate number. Quality: E, excellent; G, good; F, fair; P, poor (DL indicates debris line). Type: I, inside; O, outside. **e**, estimated value]

Plate No.	Quadrangle	Mark No.	Nearest city/town	Latitude	Longitude	Quality of mark	Type of mark	Water-surface elevation (feet above sea level)	Land-surface elevation (feet above sea level)
1	North Miami	1	North Miami	255314	800844	P	O	5.2	5.2
2	Miami	1	Miami	255027	801035	F	O	5.7	4.6
		2	do.	255025	801037	G	I	5.7	4.6
		3	do.	255026	801037	G	O	5.7	4.6
		4	do.	255024	801039	G	O	4.7	3.7
		5	do.	255024	801047	P, DL	O	5.6	5.6
		6	do.	255024	801041	F	O	5.8	4.7
		7	do.	254936	801052	F, DL	O	4.2	4.2
		8	do.	254936	801052	E	O	4.2	3.8e
		9	do.	254935	801052	P, DL	O	3.8	3.8
		10	do.	254934	801052	P, DL	O	3.9	3.9
		11	do.	254906	801103	G, DL	O	3.7	3.7
		12	do.	254838	801023	F, DL	O	4.0	4.0
		13	do.	254838	801022	G, DL	O	3.8	3.8
		14	do.	254839	801021	G, DL	O	3.7	3.7
		15	do.	254836	801023	G, DL	O	4.2	4.2
		16	do.	254836	801022	G, DL	O	4.4	4.4
		17	do.	254836	801021	G, DL	O	4.6	4.6
		18	Miami Beach	254835	800910	P, DL	O	4.1	4.1
		19	do.	254835	800905	F, DL	O	4.0	4.0
		20	do.	254835	800903	F, DL	O	4.0	4.0
		21	do.	254835	800848	P, DL	O	5.2	5.2
		22	do.	254835	800847	P, DL	O	5.2	5.2
		23	do.	254844	800838	F, DL	O	3.6	3.6
		24	do.	254846	800837	F, DL	O	3.6	3.6
		25	Miami	254815	801113	F	O	5.2	4.5

Table 1. Descriptions and elevations of high-water marks surveyed along the southern Florida coasts following Hurricane Andrew, August 1992--Continued

Plate No.	Quadrangle	Mark No.	Nearest city/town	Latitude	Longitude	Quality of mark	Type of mark	Water-surface elevation (feet above sea level)	Land-surface elevation (feet above sea level)
2	Miami	26	Miami	254814	801113	F	O	5.2	3.8
		27	do.	254814	801111	F	O	5.3	4.9
		28	do.	254814	801111	F	O	5.0	4.9
		29	Miami Beach	254656	801002	G, DL	O	2.7	1.5
		30	do.	254656	801002	G, DL	O	4.0	3.2
		31	do.	254656	801002	E, DL	I	2.6	2.3e
		32	do.	254721	800923	F, DL	O	4.4	4.4
		33	do.	254721	800923	P, DL	O	4.2	4.2
		34	do.	254721	800923	P, DL	O	4.6	4.6
		35	do.	254641	800858	G	O	4.7	4.4
		36	Miami	254638	801105	F	O	5.3	3.8
		37	do.	254638	801105	F	O	5.3	3.7
		38	Fisher Island	254549	800818	F, DL	O	5.4[1]	5.4[1]
		39	do.	254544	800807	F, DL	O	4.7	4.7
		40	do.	254541	800807	G	I	8.6[1]	7.9[1]
		41	do.	254521	800823	G	I	6.6	5.2
		42	do.	254521	800825	G	O	6.6	5.9
		43	Miami	254538	801135	F	O	7.6	7.3
		44	do.	254539	801134	G	O	7.7	6.5
		45	do.	254539	801134	G	I	7.6	6.5
		46	do.	254537	801129	F	O	7.5	5.5
		47	do.	254537	801126	E	O	7.5	3.1
		48	do.	254535	801129	F	O	7.6	4.6
		49	do.	254534	801125	F	O	8.0	4.5
		50	do.	254533	801124	E	I	7.5[1]	3.8[1]
		51	do.	254532	801122	G	I	7.3	7.2
		52	do.	254531	801122	G	I	7.4	7.3
		53	do.	254525	801123	E	I	7.8	5.5
		54	do.	254524	801124	E	I	7.3	4.8

Table 1. Descriptions and elevations of high-water marks surveyed along the southern Florida coasts following Hurricane Andrew, August 1992--Continued

Plate No.	Quadrangle	Mark No.	Nearest city/town	Latitude	Longitude	Quality of mark	Type of mark	Water-surface elevation (feet above sea level)	Land-surface elevation (feet above sea level)
2	Miami	55	Miami	254741	801442	P, DL	O	5.4	5.4
		56	do.	254740	801439	P	O	5.1	4.3
		57	do.	254725	801404	P, DL	O	5.4	5.4
		58	do.	254725	801403	P, DL	O	5.1	5.1
		59	do.	254725	801402	F, DL	O	5.2	5.2
		60	do.	254724	801400	F, DL	O	5.1	5.1
		61	do.	254718	801402	P, DL	O	5.3	5.3
		62	do.	254719	801401	P, DL	O	5.0	5.0
		63	do.	254711	801329	P, DL	O	5.3	5.3
		64	do.	254705	801327	P, DL	O	5.3	5.3
3	South Miami	1	South Miami	254417	801715	P, DL	O	6.0	6.0
		2	do.	254416	801714	P, DL	O	6.0	6.0
		3	do.	254401	801630	P, DL	O	6.1	6.1
		4	do.	254401	801629	P, DL	O	6.1	6.1
		5	do.	254220	801542	P, DL	O	8.5	8.5
		6	do.	254220	801539	P, DL	O	8.8	8.8
		7	do.	254232	801501	G	O	9.3	6.2
		8	do.	254232	801501	E	I	9.1	6.8
		9	do.	254231	801506	E	I	9.3	7.3
		10	do.	254228	801515	G	O	9.3	8.1
		11	do.	254228	801515	E	I	9.3	8.1
		12	do.	254228	801517	E	I	9.2	6.5
		13	do.	254228	801521	G	O	9.1	6.7
		14	do.	254228	801521	E	I	9.3	7.8
		15	do.	254121	801519	F	O	9.2	6.6
		16	do.	254122	801543	F	O	9.5	9.2
		17	do.	254121	801607	E	I	9.3	7.5
		18	do.	254121	801607	G	O	9.4	7.5

Table 1. Descriptions and elevations of high-water marks surveyed along the southern Florida coasts following Hurricane Andrew, August 1992--Continued

Plate No.	Quadrangle	Mark No.	Nearest city/town	Latitude	Longitude	Quality of mark	Type of mark	Water-surface elevation (feet above sea level)	Land-surface elevation (feet above sea level)
3	South Miami	19	South Miami	254119	801603	E	I	9.4	5.3
		20	do.	254030	801618	P	O	9.2	8.8
		21	do.	254044	801525	F	I	9.0	4.9
		22	do.	254044	801526	P	I	8.5	3.3
		23	do.	254045	801529	G	I	9.5	7.7
		24	do.	254045	801528	P	I	10.0	4.0
		25	do.	254051	801554	E	I	9.3	2.9
		26	do.	254013	801705	F, DL	O	7.1	7.1
		27	do.	254004	801700	F, DL	O	8.2	8.2
		28	do.	253914	801657	G	O	8.7	7.2
		29	do.	253914	801655	G	I	8.4	7.3
		30	do.	253914	801654	G	I	8.6	7.6
		31	do.	253913	801649	G	I	8.8	3.7
		32	do.	253907	801625	G	I	8.7	7.1
		33	do.	253857	801634	G	I	9.8	7.5
		34	do.	253855	801616	G	I	11.7	10.5
		35	do.	253854	801620	G	I	9.2	8.0
		36	do.	253857	801634	G	O	9.8	8.0
		37	do.	253857	801634	F	O	10.1	8.0
		38	do.	253853	801616	F	O	10.4	6.0
		39	do.	253812	801913	P, DL	O	6.1	6.1
		40	do.	253811	801913	P, DL	O	6.9	6.9
		41	do.	253746	801906	P, DL	O	7.2	7.2
		42	do.	253744	801906	P, DL	O	7.9	7.9
		43	do.	253750	801758	G	I	14.6	10.5
		44	do.	253746	801802	F, DL	O	14.5	14.5
		45	do.	253741	801803	F	I	14.8	14.3
		46	do.	253748	801802	G	I	15.2	8.9
		47	do.	253903	801643	G	I	10.2	9.7e

Table 1. Descriptions and elevations of high-water marks surveyed along the southern Florida coasts following Hurricane Andrew, August 1992--Continued

Plate No.	Quadrangle	Mark No.	Nearest city/town	Latitude	Longitude	Quality of mark	Type of mark	Water-surface elevation (feet above sea level)	Land-surface elevation (feet above sea level)
4	Key Biscayne	1	Miami	254432	801258	F	O	9.2	8.6
		2	do.	254430	801255	G	I	9.3	6.1
		3	do.	254427	801252	F	O	9.1	8.2
		4	do.	254427	801252	F	O	9.1	8.2
		5	do.	254426	801251	G	O	9.5	9.1
		6	do.	254421	801303	G	O	9.1	7.4
		7	do.	254421	801303	G	I	8.2	7.1
		8	do.	254416	801331	P, DL	O	9.0	9.0
		9	do.	254416	801331	P, DL	O	9.3	9.3
		10	do.	254416	801331	F	O	9.0	5.6
		11	do.	254414	801330	G	O	9.4	6.0
		12	do.	254413	801330	E	I	9.1	6.2
		13	do.	254413	801330	E	O	9.5	5.7
		14	do.	254410	801326	G	I	9.9	6.8
		15	do.	254410	801326	G	I	9.9	6.9
		16	do.	254411	801329	G	I	9.7	6.8
		17	do.	254411	801329	G	I	8.5	7.7
		18	Coconut Grove	254341	801403	P, DL	O	12.0	12.0
		19	do.	254338	801406	P, DL	O	11.1	11.1
		20	do.	254339	801412	E	I	9.3	8.1
		21	do.	254339	801412	E	I	9.2	7.5
		22	do.	254342	801417	E	I	9.6	3.5
		23	do.	254342	801417	G	I	9.7	3.5
		24	do.	254337	801413	P, DL	O	10.6	10.6
		25	do.	254333	801422	G	I	9.8	5.5
		26	do.	254330	801426	F	O	10.8	5.9
		27	do.	254330	801426	F	O	10.9	5.0
		28	do.	254330	801428	F	O	9.9	8.0
		29	do.	254330	801428	P, DL	O	10.0	10.0

Table 1. Descriptions and elevations of high-water marks surveyed along the southern Florida coasts following Hurricane Andrew, August 1992--Continued

Plate No.	Quadrangle	Mark No.	Nearest city/town	Latitude	Longitude	Quality of mark	Type of mark	Water-surface elevation (feet above sea level)	Land-surface elevation (feet above sea level)
4	Key Biscayne	30	Coconut Grove	254303	801446	G	O	9.7	7.2
		31	do.	254303	801445	F	O	7.2	5.8
		32	do.	254303	801449	G	O	9.7	9.0
		33	do.	254303	801448	G	O	9.7	7.5
		34	do.	254232	801457	E	I	9.3	5.2
		35	Key Biscayne	254448	800846	G	I	6.5	5.0e
		36	do.	254444	800850	P, DL	O	6.0	6.0
		37	do.	254352	800957	F	O	7.1	5.1
		38	do.	254357	800939	G	I	6.0	4.0
		39	do.	254355	800941	G	I	7.2	5.6
		40	do.	254354	800948	G	I	7.2	5.1
		41	do.	254352	800944	F	I	7.8[1]	5.9[1]
		42	do.	254335	800920	G	I	7.4	3.6
		43	do.	254326	800910	G	I	7.4	3.9
		44	do.	254255	800922	G	I	7.6	5.3
		45	do.	254251	800925	G	I	7.3	5.5
		46	do.	254251	800925	G	I	7.6[1]	5.5[1]
		47	do.	254215	800925	G	I	7.4	5.4
		48	do.	254155	800953	G	O	7.1	5.4
		49	do.	254147	800932	G	O	7.4	5.9
		50	do.	254147	801011	G	O	8.2	4.8
		51	do.	254147	801011	G	I	7.5	4.8
		52	do.	254142	801019	G	O	7.7	5.9
		53	do.	254142	801019	G	I	7.1[1]	5.9[1]
		54	do.	254123	801025	G	I	7.6	6.1
		55	do.	254123	801025	G	O	7.8	5.5
		56	do.	254123	801025	G	I	7.6	5.6
		57	do.	254123	801011	F	O	6.9	4.9
		58	do.	254121	801012	F	O	7.0	5.4

Table 1. Descriptions and elevations of high-water marks surveyed along the southern Florida coasts following Hurricane Andrew, August 1992--Continued

Plate No.	Quadrangle	Mark No.	Nearest city/town	Latitude	Longitude	Quality of mark	Type of mark	Water-surface elevation (feet above sea level)	Land-surface elevation (feet above sea level)
4	Key Biscayne	59	Key Biscayne	254127	801003	G	O	6.8	4.0
		60	do.	254127	800953	G	I	6.4	4.9
		61	do.	254126	800938	G	O	6.8	5.0
		62	do.	254126	800934	G	I	6.5	5.0
		63	do.	254126	800934	G	O	6.6	5.0
		64	do.	254132	800925	G	I	9.6	7.0
		65	do.	254132	800925	G	O	9.3	7.1
		66	do.	254132	800925	G	I	9.5	7.1
		67	do.	254132	800925	G	O	9.9	7.0
		68	do.	254053	800947	G	I	5.8	4.1
		69	do.	254053	800947	F	O	7.5	5.6
		70	do.	254054	800937	G	I	6.6	6.0
		71	do.	254054	800937	F	O	6.2	2.7
		72	do.	254004	800925	G	I	8.7	8.3
5	Perrine	1	Perrine	253725	802038	F, DL	O	7.2	7.2
		2	do.	253725	802040	F, DL	O	7.2	7.2
		3	do.	253724	802035	F, DL	O	8.5	8.5
		4	do.	253723	802037	F, DL	O	8.3	8.3
		5	do.	253723	802035	G, DL	O	8.6	8.6
		6	do.	253723	802033	F, DL	O	8.2	8.2
		7	do.	253652	801944	F, DL	O	7.6	7.6
		8	do.	253650	801943	F, DL	O	8.6	8.6
		9	do.	253653	801828	G	I	16.5	11.9e
		10	do.	253655	801825	E	I	16.6	11.9e
		11	do.	253653	801828	E	I	15.6	14.8
		12	do.	253242	802032	G	I	15.5	15.0
		13	do.	253636	801835	E	I	16.2	12.1
		14	do.	253636	801835	E	I	16.2	12.1

Table 1. Descriptions and elevations of high-water marks surveyed along the southern Florida coasts following Hurricane Andrew, August 1992--Continued

Plate No.	Quadrangle	Mark No.	Nearest city/town	Latitude	Longitude	Quality of mark	Type of mark	Water-surface elevation (feet above sea level)	Land-surface elevation (feet above sea level)
5	Perrine	15	Perrine	253634	801847	G, DL	O	13.5	13.5
		16	do.	253632	801840	F	O	16.2	15.4
		17	do.	253633	801847	G	I	13.2	12.5
		18	do.	253632	801846	G, DL	O	14.1	14.1
		19	do.	253631	801846	F, DL	O	13.9	13.9
		20	do.	253627	801900	F	I	11.7	9.7
		21	do.	253628	801845	G	I	16.5	14.7
		22	do.	253624	801850	F, DL	O	13.6	13.6
		23	do.	253610	801841	F	I	16.9	6.4
		24	do.	253610	801841	F	O	17.2	6.4
		25	do.	253601	801906	E	I	14.7	12.8
		26	do.	263601	801906	F	O	14.7	12.8
		27	do.	253554	801915	P, DL	O	13.9[1]	13.9[1]
		28	do.	253539	802054	P, DL	O	6.4	6.4
		29	do.	253539	802056	P, DL	O	7.0	7.0
		30	do.	253538	802052	F, DL	O	6.9	6.9
		31	do.	253538	802051	F, DL	O	7.0	7.0
		32	do.	253516	801926	F, DL	O	10.8	10.8
		33	do.	253655	801825	F, DL	O	9.3	9.3
		34	do.	253504	801938	E	I	10.1	8.7
		35	do.	253501	801921	E	I	10.1	7.2
		36	do.	253443	801910	P	O	11.5	10.9
		37	do.	253434	802138	P, DL	O	6.3	6.3
		38	do.	253433	802137	P, DL	O	7.3	7.3
		39	do.	253233	801952	F, DL	O	6.6[1]	6.6[1]
		40	do.	253247	802030	F, DL	O	7.5[1]	7.5[1]
		41	do.	253215	802051	E	I	10.3	9.0
		42	do.	253215	802051	P	O	11.0	8.2
		43	do.	253233	801953	F	I	11.8	7.9

Table 1. Dscriptions and elevations of high-water marks surveyed along the southern Florida coasts following Hurricane Andrew, August 1992--Continued

Plate No.	Quadrangle	Mark No.	Nearest city/town	Latitude	Longitude	Quality of mark	Type of mark	Water-surface elevation (feet above sea level)	Land-surface elevation (feet above sea level)
5	Perrine	44	Perrine	253219	801943	F	O	12.0	5.6
		45	do.	253219	801943	G	I	12.5	11.3
		46	do.	253215	801939	E	I	12.6	6.5
		47	do.	253513	801940	P, DL	O	7.4	7.4
		48	do.	253214	802102	F	O	6.7	4.8
		49	do.	253218	802052	P	O	7.0	3.5
		50	do.	253212	802023	F, DL	O	5.2	5.2
		51	do.	253109	802047	E	I	8.8	6.9
		52	do.	253108	802047	P	O	8.4	6.9
6	Soldier Key	1	Key Largo	253128	801034	G	I	6.9[2]	3.0[2]e
		2	do.	253126	801033	G	I	5.1[2]	2.6[2]e
		3	do.	253129	801032	G	I	4.7[2]	0.9[2]e
7	Arsenicker Keys	1	Homestead	252921	802050	F	O	9.7	7.0
		2	do.	252920	802050	E	I	8.5	7.8
		3	do.	252813	802048	P	O	8.8	6.5
		4	do.	252812	802048	P	O	7.5	6.8
		5	do.	252745	802015	E	I	6.7	4.4
		6	do.	252744	802013	E	I	6.9	4.3
		7	do.	252741	802020	G	I	6.7	5.7e
		8	do.	252742	802038	F	O	6.2	4.2
		9	do.	252622	801946	F, DL	O	4.9	4.9
		10	do.	252621	801946	F, DL	O	4.9	4.9
8	Elliot Key	1	Key Largo	252706	801147	E	I	7.3[2]	6.7[2]e
		2	do.	252706	801147	P	O	7.0[2]	6.7[2]e
		3	do.	252706	801147	P	O	6.8[2]	6.7[2]e
		4	do.	252708	801147	P	O	6.1[2]	5.7[2]e

Table 1. Descriptions and elevations of high-water marks surveyed along the southern Florida coasts following Hurricane Andrew, August 1992--Continued

Plate No.	Quadrangle	Mark No.	Nearest city/town	Latitude	Longitude	Quality of mark	Type of mark	Water-surface elevation (feet above sea level)	Land-surface elevation (feet above sea level)
8	Elliot Key	5	Key Largo	252712	801147	P	O	5.6[2]	5.1[2]e
		6	do.	252712	801137	P	O	3.8[2]	2.6[2]e
		7	do.	252712	801130	P	O	4.3[2]	1.2[2]e
		8	do.	252710	801128	P	O	5.8[2]	1.6[2]e
		9	do.	252710	801128	P	O	6.5[2]	1.6[2]e
		10	do.	252710	801128	P	O	7.6[2]	1.6[2]e
		11	do.	252708	801127	P	O	7.7[2]	2.0[2]e
		12	do.	252709	801126	P	O	9.2[2]	1.7[2]e
9	Glades	1	do.	251728	802242	P, DL	O	3.9	3.9
		2	do.	251726	802242	P, DL	O	4.8[3]	4.8[3]
10	Card Sound	1	do.	252001	801537	F, DL	O	3.8[4]	3.8[4]
		2	do.	251957	801525	P, DL	O	3.8	3.8
		3	do.	251957	801525	P, DL	O	4.6	4.6
		4	do.	251956	801525	F, DL	O	4.1[4]	4.1[4]
		5	do.	251913	801613	F, DL	O	4.9[1]	4.9[1]
		6	do.	251837	801636	F, DL	O	4.2[3]	4.2[3]
		7	do.	251502	801843	G, DL	O	3.0[2,4]	3.0[2,4]
		8	do.	251502	801843	G, DL	O	2.8[2]	2.8[2]
		9	do.	251721	802225	P, DL	O	4.0	4.0
		10	do.	251721	802225	P, DL	O	3.9	3.9
		11	do.	251719	802226	P, DL	O	3.6	3.6
		12	do.	251719	802226	P, DL	O	3.5	3.5
11	Blackwater Sound	1	do.	251409	802603	F, DL	O	2.6	2.6
		2	do.	251240	802529	F, DL	O	4.4	4.4
		3	do.	251058	802325	G, DL	O	3.1	2.8

Table 1. Descriptions and elevations of high-water marks surveyed along the southern Florida coasts following Hurricane Andrew, August 1992--Continued

Plate No.	Quadrangle	Mark No.	Nearest city/town	Latitude	Longitude	Quality of mark	Type of mark	Water-surface elevation (feet above sea level)	Land-surface elevation (feet above sea level)
12	Garden Cove	1	Key Largo	251130	802057	P, DL	O	3.3[2]	3.3[2]
		2	do.	251130	802058	P, DL	O	4.4[2]	4.4[2]
13	Rock Harbor	1	Florida City	250520	802655	P, DL	O	5.4	5.4
		2	do.	250520	802655	P, DL	O	5.5	5.5
		3	do.	250547	802654	P, DL	O	2.6	2.6
14	Lake Ingraham West	1	do.	250918	810734	G, DL	O	9.5[2]	9.5[2]
		2	do.	250918	810734	G, DL	O	9.5[2]	9.5[2]
		3	do.	250918	810734	G, DL	O	9.6[2]	9.6[2]
15	Lake Ingraham East	1	do.	250802	810601	F, DL	O	8.0[2]	8.0[2]
		2	do.	250802	810601	F, DL	O	8.1[2]	8.1[2]
		3	do.	250802	810601	F, DL	O	7.8[2]	7.8[2]
		4	do.	250802	810601	F, DL	O	6.6[2]	6.6[2]
16	Flamingo	1	do.	250828	805453	P, DL	O	4.7	4.7
		2	do.	250828	805453	P, DL	O	4.8	4.8
		3	do.	250828	805453	P, DL	O	4.8	4.8
		4	do.	250826	805522	P, DL	O	5.3	5.3
		5	do.	250826	805523	P, DL	O	6.3	6.3
		6	do.	250826	805525	P, DL	O	7.0	7.0
		7	do.	250826	805526	P, DL	O	7.9	7.9
		8	do.	250820	805536	P, DL	O	5.0	5.0
		9	do.	250820	805537	P, DL	O	5.1	5.1
		10	do.	250819	805538	P, DL	O	5.2	5.2
		11	do.	250814	805555	P, DL	O	5.0	5.0
		12	do.	250814	805556	P, DL	O	5.2	5.2
		13	do.	250814	805558	P, DL	O	5.0	5.0

Table 1. Descriptions and elevations of high-water marks surveyed along the southern Florida coasts following Hurricane Andrew, August 1992--Continued

Plate No.	Quadrangle	Mark No.	Nearest city/town	Latitude	Longitude	Quality of mark	Type of mark	Water-surface elevation (feet above sea level)	Land-surface elevation (feet above sea level)
17	Everglades City	1	Everglades City	255021	812256	G, DL	O	4.4	4.4
		2	do.	255021	812256	G, DL	O	4.4	4.4
		3	do.	255020	812255	G, DL	O	4.4	4.4
18	Chokoloskee	1	do.	254837	812146	F, DL	O	4.5	4.5
		2	do.	254837	812146	F, DL	O	4.5	4.5
		3	do.	254837	812146	G, DL	O	4.7	4.0e
		4	do.	254837	812146	F, DL	O	4.2	4.2
		5	do.	254834	812134	G	O	4.8	4.0
		6	do.	254834	812134	F, DL	O	4.8	4.8
		7	do.	254834	812134	F, DL	O	4.3	4.3
		8	do.	254834	812134	F, DL	O	4.3	4.3
19	Marco Island	1	Marco Island	255557	813900	E, DL	O	5.6	5.6
		2	do.	255557	813900	G, DL	O	5.1	5.1
		3	do.	255557	813900	G, DL	O	4.9	4.9
		4	do.	255556	813920	E	O	5.2	4.2
		5	do.	255531	813854	E	O	5.4	3.9
		6	do.	255531	813853	E	O	5.8	4.3
		7	do.	255527	813901	E	O	7.1	6.2
		8	do.	255525	813860	E	O	6.8	6.0
		9	do.	255524	813859	E	O	6.9	6.2
		10	do.	255519	813854	E	O	6.1	4.9
		11	do.	255519	813852	E	O	6.2	4.5
		12	do.	255523	813844	E	O	5.9	5.1
		13	do.	255524	813841	F, DL	O	5.7	5.7
		14	do.	255522	813838	E	O	5.6	4.9
		15	do.	255523	813837	F	I	6.2	4.9
		16	do.	255523	813836	E	O	5.8	4.9

Table 1. Descriptions and elevations of high-water marks surveyed along the southern Florida coasts following Hurricane Andrew, August 1992--Continued

Plate No.	Quadrangle	Mark No.	Nearest city/town	Latitude	Longitude	Quality of mark	Type of mark	Water-surface elevation (feet above sea level)	Land-surface elevation (feet above sea level)
19	Marco Island	17	Marco Island	255526	813835	E	O	5.6	4.8
		18	do.	255527	813835	E	O	5.5	4.6
		19	do.	255528	813835	E	O	5.3	4.6
		20	do.	255529	813838	G, DL	O	5.3	5.3
		21	do.	255528	813840	G, DL	O	5.4	5.4
		22	do.	255528	813842	G, DL	O	5.2	5.2

[1]Average of two high-water mark elevations.

[2]GPS, Global Positioning System

[3]Average of three high-water mark elevations.

[4]Average of four high-water mark elevations.

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

PREPARED IN COOPERATION WITH THE
FEDERAL EMERGENCY MANAGEMENT AGENCY

OPEN FILE REPORT 94-116
North Miami quadrangle- PLATE 1
Murray, M. H., 1994, Storm-tide elevations produced by Hurricane Andrew along the southern Florida coasts, August 24, 1992

PLATE 1.-- MAP SHOWING WATER-SURFACE ELEVATIONS AND HIGH-WATER MARK LOCATION IN AREA AFFECTED BY HURRICANE ANDREW, NORTH MIAMI, FLORIDA, QUADRANGLE.

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

PREPARED IN COOPERATION WITH THE
FEDERAL EMERGENCY MANAGEMENT AGENCY

OPEN FILE REPORT 94-116
Miami quadrangle-PLATE 2
Murray, M. H., 1994, Storm-tide elevations produced by Hurricane Andrew along the southern Florida coasts, August 24, 1992

PLATE 2.--MAP SHOWING WATER-SURFACE ELEVATIONS, HIGH-WATER MARK LOCATIONS, AND LANDWARD EXTENT OF STORM-TIDE INUNDATION IN AREAS AFFECTED BY HURRICANE ANDREW, MIAMI, FLORIDA, QUADRANGLE.

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U.S. GEOLOGICAL SURVEY

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FEDERAL EMERGENCY MANAGEMENT AGENCY

OPEN-FILE REPORT 94-116
South Miami quadrangle-PLATE 3
Murray, M. H., 1994, Storm-tide elevations produced by Hurricane Andrew along the southern Florida coasts, August 24, 1992

EXPLANATION
AREA INUNDATED BY STORM TIME
LANDWARD EXTENT OF STORM-TIDE INUNDATION--
47 10.2/9.7e (I) HIGH-WATER MARK, NUMBER, AND ELEVATIONS--
Number in large type is mark number referenced in table 1.
Numbers in small type are elevations in feet above sea level.*
Upper value is elevation of high water, and lower value is elevation of land surface. High-water elevations at a site are designated as inside (I) or outside (o) marks.
Estimated values are designated with an "e".
* Sea level refers to the National Geodetic Vertical Datum of 1929-- a geodetic vertical datum derived from a general adjustment of the first-order level nets of the United States and Canada, formerly called Sea Level Datum of 1929.
Coral Way Village
Westchester
West Miami
South Miami
CORAL GABLES
Olympia Heights
Glenvar Heights
SOUTH MIAMI
Sunset Corners
Kendall
Greer-Mar Acres
Hawley Heights
Howard
Rockdale
RICHMOND HEIGHTS
Palmetto Lake
Lake Galloway
Snapper Creek Lake
Coral Lake
Westwood Lake
Blue Lake
Lake Catalina
Lake Oakland
Glenvar Lake
Dadeland Mall
Coral Reef Park
Coral Pine Park
Continental Park
Kendall Wayside Park
Ronald Ehman Park
Tropical Park
Bird Drive Park
Palmetto Golf Course
Briar Bay Golf Course
Briar Bay Urban Park
The Falls Mall
Parrot Jungle (Amusement Park)
Joaquin Park
Joycee Park
Granada Golf Course
Venetian Pool
Coral Gables Youth Center
University Park
Douglas Park
Palermo Park
Salvadore Park
Ferdinand Plaza (Park)
Schenley Park
Footbridges
BILTMORE
GOLF COURSE
Coral Gables Waterway
Coral Gables Hosp
Coral Gables High Sch
Metrorail Sta
Tri-Rail Sta
Douglas Park
Carver High Sch
Ponce de Leon Jr High Sch
Coconut Grove
Yacht Basin
Ingraham Park
Dinner Key Marina
Lago Maggiore
Isla Dorada
Hammock Lake
Dante B Fascell Park
Banyan Drive Park
Epiphany Sch
Gulliver Sch
Mark Flight Mem Sch
Palmetto Jr High Sch
Palmetto Sch
Zuckerman Sch
Kendall Acad
Miami-Killian High Sch
Miami-Douglas MacArthur High Sch
McGlannon Sch
Baptist Hosp
Kendall Hosp
Doctors Hosp
Larkin Hosp
South Miami Hosp
Baptist Hosp
Miami-Dade Community College (South Campus)
Richmond Heights Jr High Sch
Coral Reef Hold
Palmetto Golf Course
Rockdale Park
Alexander-Montessori Sch
Fairchild Sch
Carver High Sch
Tucker Sch
Metrorail Sta
Tri-Rail Sta
Coral Gables High Sch
Coral Gables Hosp
Doctors Hosp
Larkin Hosp
South Miami Hosp
Baptist Hosp
Kendall Hosp

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OPEN FILE REPORT 94-116
Key Biscayne quadrangle-PLATE 4
Murray, M. H., 1994, Storm-tide elevations produced by Hurricane Andrew along the southern Florida coasts, August 24, 1992

EXPLANATION

AREA INUNDATED BY STORM TIDE

LANDWARD EXTENT OF STORM-TIDE INUNDATION--Dashed where approximately located.

△ 35 6.5/5.0e (I) HIGH-WATER MARK, NUMBER, AND ELEVATIONS--Number in large type is mark number referenced in table 1. Numbers in small type are elevations in feet above sea level.* Upper value is elevation of high water, and lower value is elevation of land surface. High-water elevations at a site are designated as inside (I) or outside (o) marks. Estimated values are designated with an "e".

* Sea level refers to the National Geodetic Vertical Datum of 1929--a geodetic vertical datum derived from a general adjustment of the first-order level nets of the United States and Canada, formerly called Sea Level Datum of 1929.

Mapped by U. S. Coast and Geodetic Survey
Edited and published by the Geological Survey
Control by USGS and NOS/NOAA
Planimetry by photogrammetric methods from aerial photographs taken 1945. Topography by planetable surveys 1945. Revised by the Geological Survey from aerial photographs taken 1986
Field checked 1987. Map edited 1988
Selected hydrographic data compiled from NOS chart 11465(1984)
This information is not intended for navigational purposes

UTM GRID AND 1988 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

CONTOUR INTERVAL 5 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929
DEPTH CURVES AND SOUNDINGS IN FEET-DATUM IS MEAN LOWER LOW WATER
THE RELATIONSHIP BETWEEN THE TWO DATUMS IS VARIABLE

ROAD CLASSIFICATION
Primary highway, hard surface
Light-duty road, hard or improved surface
Secondary highway, hard surface
Unimproved road
Interstate Route U. S. Route State Route
County Route

KEY BISCAYNE, FLA.
25080-F2-TF-024
1988

PLATE 4.--MAP SHOWING WATER-SURFACE ELEVATIONS, HIGH-WATER MARK LOCATIONS, AND LANDWARD EXTENT OF STORM-TIDE INUNDATION IN AREAS AFFECTED BY HURRICANE ANDREW, KEY BISCAYNE, FLORIDA, QUADRANGLE.

U.S. DEPARTMENT OF THE INTERIOR
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PREPARED IN COOPERATION WITH THE
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OPEN FILE REPORT 94-116
Perrine quadrangle-PLATE 5
Murray, M. H., 1994, Storm-tide elevations produced by Hurricane Andrew along the southern Florida coasts, August 24, 1992

EXPLANATION

AREA INUNDATED BY STORM TIDE

LANDWARD EXTENT OF STORM-TIDE INUNDATION--
Dashed where approximately located.

△ 10 16.6/11.9e (I) HIGH-WATER MARK, NUMBER, AND ELEVATIONS--
Number in large type is mark number referenced in table 1.
Numbers in small type are elevations in feet above sea level.*
Upper value is elevation of high water, and lower value is elevation of land surface. High-water elevations at a site are designated as inside (I) or outside (o) marks.
Estimated values are designated with an "e".

* Sea level refers to the National Geodetic Vertical Datum of 1929--a geodetic vertical datum derived from a general adjustment of the first-order level nets of the United States and Canada, formerly called Sea Level Datum of 1929.

Mapped by U. S. Coast and Geodetic Survey
Edited and published by the Geological Survey
Control by USGS, NOS/NOAA, and Florida Department of Transportation
Planimetry in part compiled from aerial photographs taken 1942 and 1945. Topography by planetable surveys 1945-46
Revised by the Geological Survey from aerial photographs taken 1987. Field checked 1988. Map edited 1988
Selected hydrographic data compiled from NOS Charts 11465 (1984) and 11463 (1987). This information is not intended for navigational purposes

UTM GRID AND 1988 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

CONTOUR INTERVAL 5 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929
DEPTH CURVES AND SOUNDINGS IN FEET. DATUM IS MEAN LOWER LOW WATER
THE RELATIONSHIP BETWEEN THE DATUMS IS VARIABLE

QUADRANGLE LOCATION

ROAD CLASSIFICATION
Primary highway, hard surface
Light-duty road, hard or improved surface
Secondary highway, hard surface
Unimproved road
Interstate Route U. S. Route State Route
County Route

PERRINE, FLA.
1988

PLATE 5.--MAP SHOWING WATER-SURFACE ELEVATIONS, HIGH-WATER MARK LOCATIONS, AND LANDWARD EXTENT OF STORM-TIDE INUNDATION IN AREAS AFFECTED BY HURRICANE ANDREW, PERRINE, FLORIDA, QUADRANGLE.

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

PREPARED IN COOPERATION WITH THE
FEDERAL EMERGENCY MANAGEMENT AGENCY

OPEN FILE REPORT 94-116
Soldier Key quadrangle-PLATE 6
Murray, M. H., 1994, Storm-tide elevations produced by Hurricane Andrew along the southern Florida coasts, August 24, 1992

EXPLANATION

AREA INUNDATED BY STORM TIDE

HIGH-WATER MARK, NUMBER, AND ELEVATIONS--
Number in large type is mark number referenced in table 1. Numbers in small type are elevations in feet above sea level.* Upper value is elevation of high water, and lower value is elevation of land surface. High-water elevations at a site are designated as inside (I) or outside (o) marks. Estimated values are designated with an "e".

*Sea level refers to the National Geodetic Vertical Datum of 1929--a geodetic vertical datum derived from a general adjustment of the first-order level nets of the United States and Canada, formerly called Sea Level Datum of 1929.

Produced by the United States Geological Survey
Control by USGS and NOS/NOAA
Topography by photogrammetric methods from aerial photographs taken 1986. Field checked 1988. Map edited 1988
Supersedes U. S. Coast and Geodetic Survey map dated 1956
Selected hydrographic data compiled from chart 11465 (1987)
This information is not intended for navigational purposes
Projection and 10,000-foot grid ticks: Florida coordinate system, east zone (transverse Mercator)
1000-meter Universal Transverse Mercator grid, zone 17
1927 North American Datum

UTM GRID AND 1988 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

ENTIRE AREA BELOW 5 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929
DEPTH CURVES AND SOUNDINGS IN FEET--DATUM IS MEAN LOWER LOW WATER
THE RELATIONSHIP BETWEEN THE TWO DATUMS IS VARIABLE
THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS

QUADRANGLE LOCATION

ROAD CLASSIFICATION
No roads or trails in this area

SOLDIER KEY, FLA.
25080-E2-TF-024
1988

PLATE 6.-- MAP SHOWING WATER-SURFACE ELEVATIONS AND HIGH-WATER MARK LOCATIONS WITHIN A LAND AREA TOTALLY INUNDATED BY HURRICANE ANDREW, SOLDIER KEY, FLORIDA, QUADRANGLE.

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

PREPARED IN COOPERATION WITH THE
FEDERAL EMERGENCY MANAGEMENT AGENCY

OPEN FILE REPORT 94-116
Arsenicker Keys quadrangle-PLATE 7
Murray, M. H., 1994, Storm-tide elevations produced by Hurricane Andrew along the southern Florida coasts, August 24, 1992

EXPLANATION

AREA INUNDATED BY STORM TIDE

LANDWARD EXTENT OF STORM-TIDE INUNDATION--
Dashed where approximately located.

△ 7 6.7/5.7e (I) HIGH-WATER MARK, NUMBER, AND ELEVATIONS--
Number in large type is mark number referenced in table 1.
Numbers in small type are elevations in feet above sea level.*
Upper value is elevation of high water, and lower value is elevation of land surface. High-water elevations at a site are designated as inside (I) or outside (o) marks.
Estimated values are designated with an "e".

* Sea level refers to the National Geodetic Vertical Datum of 1929--a geodetic vertical datum derived from a general adjustment of the first-order level nets of the United States and Canada, formerly called Sea Level Datum of 1929.

Mapped by U. S. Coast and Geodetic Survey
Edited and published by the Geological Survey
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Planimetry by photogrammetric methods from aerial photographs taken 1946. Topography by planetable surveys 1946-47
Revised by the Geological Survey from aerial photographs taken 1986
Field checked 1988. Map edited 1988
Selected hydrographic data compiled from NOS chart 11463 (1987)
This information is not intended for navigational purposes
Projection and 10,000-foot grid ticks: Florida coordinate system, east zone (transverse Mercator)
1000-meter Universal Transverse Mercator grid, zone 17
1927 North American Datum

UTM GRID AND 1988 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

CONTOUR INTERVAL 5 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929
DEPTH CURVES AND SOUNDINGS IN FEET-DATUM IS MEAN LOWER LOW WATER
THE RELATIONSHIP BETWEEN THE DATUMS IS VARIABLE

QUADRANGLE LOCATION

ROAD CLASSIFICATION
Primary highway, hard surface — Light-duty road, hard or improved surface
Secondary highway, hard surface — Unimproved road
Interstate Route U. S. Route State Route
County Route

ARSENICKER KEYS, FLA.
25080-D3-TF-024
1988

PLATE 7.--MAP SHOWING WATER-SURFACE ELEVATIONS, HIGH-WATER MARK LOCATIONS, AND LANDWARD EXTENT OF STORM-TIDE INUNDATION IN AREAS AFFECTED BY HURRICANE ANDREW, ARSENICKER KEYS, FLORIDA, QUADRANGLE.

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Elliot key quadrangle-PLATE 8
Murray, M. H., 1994, Storm-tide elevations produced by Hurricane Andrew along the southern Florida coasts, August 24, 1992

EXPLANATION

AREA INUNDATED BY STORM TIDE

LANDWARD EXTENT OF STORM-TIDE INUNDATION--Dashed where approximately located.

△ 12 $\frac{9.2}{1.7e}$ (o) HIGH-WATER MARK, NUMBER, AND ELEVATIONS--Number in large type is mark number referenced in table 1. Numbers in small type are elevations in feet above sea level.* Upper value is elevation of high water, and lower value is elevation of land surface. High-water elevations at a site are designated as inside (I) or outside (o) marks. Estimated values are designated with an "e".

* Sea level refers to the National Geodetic Vertical Datum of 1929--a geodetic vertical datum derived from a general adjustment of the first-order level nets of the United States and Canada, formerly called Sea Level Datum of 1929.

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Planimetry by photogrammetric methods from aerial photographs taken 1946. Topography by planetable surveys 1946-47
Revised by the Geological Survey from aerial photographs taken 1986
Field checked 1988. Map edited 1988
Selected hydrographic data compiled from NOS charts 11462 (1984), 11463 and 11465 (1987). This information is not intended for navigational purposes
Projection and 10,000-foot grid ticks: Florida coordinate system, east zone (transverse Mercator)
1000-meter Universal Transverse Mercator grid, zone 17
1927 North American Datum

UTM GRID AND 1988 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

CONTOUR INTERVAL 5 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929
DEPTH CURVES AND SOUNDINGS IN FEET-DATUM IS MEAN LOWER LOW WATER
THE RELATIONSHIP BETWEEN THE TWO DATUMS IS VARIABLE
THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS

QUADRANGLE LOCATION

ROAD CLASSIFICATION
Trails

ELLIOTT KEY, FLA.
25080-D2-TF-024
1988

PLATE 8.--MAP SHOWING WATER-SURFACE ELEVATIONS, HIGH-WATER MARK LOCATIONS, AND LANDWARD EXTENT OF STORM-TIDE INUNDATION IN AREAS AFFECTED BY HURRICANE ANDREW, ELLIOT KEY, FLORIDA, QUADRANGLE.

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Glades quadrangle-PLATE 9
Murray, M. H., 1994, Storm-tide elevations produced by Hurricane Andrew along the southern Florida coasts, August 24, 1992

Mapped by U. S. Coast and Geodetic Survey
Edited and published by the Geological Survey
Control by USGS and NOS/NOAA
Planimetry by photogrammetric methods from aerial photographs taken 1946. Topography by planetable surveys 1947
Revised by the Geological Survey from aerial photographs taken 1986
Field checked 1987. Map edited 1988
Selected hydrographic data compiled from NOS chart 11451 (1986)
This information is not intended for navigational purposes
Projection and 10,000-foot grid ticks: Florida coordinate system, east zone (transverse Mercator)
1000-meter Universal Transverse Mercator grid, zone 17
1927 North American Datum

UTM GRID AND 1988 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

CONTOUR INTERVAL 5 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929
DEPTH CURVES AND SOUNDINGS IN FEET. DATUM IS MEAN LOWER LOW WATER
THE RELATIONSHIP BETWEEN THE DATUMS IS VARIABLE

QUADRANGLE LOCATION

ROAD CLASSIFICATION
Primary highway, hard surface
Light-duty road, hard or improved surface
Secondary highway, hard surface
Unimproved road
Interstate Route U. S. Route State Route
County Route

GLADES, FLA.
25080-C4-TF-024
1988

PLATE 9.--MAP SHOWING WATER-SURFACE ELEVATIONS AND HIGH-WATER MARK LOCATIONS IN AREAS AFFECTED BY HURRICANE ANDREW, GLADES, FLORIDA, QUADRANGLE.

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Card Sound quadrangle-PLATE 10
Murray, M. H., 1994, Storm-tide elevations produced by Hurricane Andrew along the southern Florida coasts, August 24, 1992

EXPLANATION

△ 1 3.8/3.8 (o) HIGH-WATER MARK, NUMBER, AND ELEVATIONS--Number in large type is mark number referenced in table 1. Numbers in small type are elevations in feet above sea level.* Upper value is elevation of high water, and lower value is elevation of land surface. High-water elevations at a site are designated as inside (I) or outside (o) marks.

* Sea level refers to the National Geodetic Vertical Datum of 1929--a geodetic vertical datum derived from a general adjustment of the first-order level nets of the United States and Canada, formerly called Sea Level Datum of 1929.

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Planimetry by photogrammetric methods from aerial photographs taken 1946. Topography by planetable surveys 1947
Revised by the Geological Survey from aerial photographs taken 1986
Field checked 1988. Map edited 1988
Selected hydrographic data compiled from NOS charts 11462 (1984) and 11463 (1987). This information is not intended for navigational purposes
Projection and 10,000-foot grid ticks: Florida coordinate system, east zone (transverse Mercator)
1000-meter Universal Transverse Mercator grid, zone 17
1927 North American Datum

UTM GRID AND 1988 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

CONTOUR INTERVAL 5 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929
DEPTH CURVES AND SOUNDINGS IN FEET. DATUM IS MEAN LOWER LOW WATER
THE RELATIONSHIP BETWEEN THE DATUMS IS VARIABLE

QUADRANGLE LOCATION

ROAD CLASSIFICATION
Primary highway, hard surface — Light-duty road, hard or improved surface
Secondary highway, hard surface — Unimproved road
Interstate Route — U. S. Route — State Route
County Route

CARD SOUND, FLA.
25080-C3-TF-024
1988

PLATE 10.-- MAP SHOWING WATER-SURFACE ELEVATIONS AND HIGH-WATER MARK LOCATIONS IN AREAS AFFECTED BY HURRICANE ANDREW, CARD SOUND, FLORIDA, QUADRANGLE.

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Blackwater Sound quadrangle-PLATE 11
Murray, M. H., 1994, Storm-tide elevations produced by Hurricane Andrew along the southern Florida coasts, August 24, 1992

PLATE 11.--MAP SHOWING WATER-SURFACE ELEVATIONS AND HIGH-WATER MARK LOCATIONS IN AREAS AFFECTED BY HURRICANE ANDREW, BLACKWATER SOUND, FLORIDA, QUADRANGLE.

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Garden Cove quadrangle-PLATE 12
Murray, M. H., 1994, Storm-tide elevations produced by Hurricane Andrew along the southern Florida coasts, August 24, 1992

EXPLANATION

△ 1 3.3/3.3 (o) **HIGH-WATER MARK, NUMBER, AND ELEVATIONS--** Number in large type is mark number referenced in table 1. Numbers in small type are elevations in feet above sea level.* Upper value is elevation of high water, and lower value is elevation of land surface. High-water elevations at a site are designated as inside (I) or outside (o) marks.

* Sea level refers to the National Geodetic Vertical Datum of 1929--a geodetic vertical datum derived from a general adjustment of the first-order level nets of the United States and Canada, formerly called Sea Level Datum of 1929.

Mapped by U. S. Coast & Geodetic Survey
Edited and published by the Geological Survey

Control by USC&GS

Culture and shoreline compiled from aerial photographs taken 1946
Topography by plane-table methods 1947

Polyconic projection. 1927 North American datum
10,000-foot grid based on Florida coordinate system, east zone.

UTM GRID AND 1969 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

CONTOUR INTERVAL 5 FEET
DATUM IS MEAN SEA LEVEL
SHORELINE SHOWN REPRESENTS THE APPROXIMATE LINE OF MEAN HIGH WATER
THE AVERAGE RANGE OF TIDE IS APPROXIMATELY 2 FEET

QUADRANGLE LOCATION

ROAD CLASSIFICATION
Heavy-duty — Light-duty
Medium-duty — Unimproved dirt
U. S. Route

USC&GS T-8807

GARDEN COVE, FLA.
N2507.5—W8015/7.5
1947

PLATE 12.--MAP SHOWING WATER-SURFACE ELEVATIONS AND HIGH-WATER MARK LOCATIONS IN AREAS AFFECTED BY HURRICANE ANDREW, GARDEN COVE, FLORIDA, QUADRANGLE.

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Rock Harbor quadrangle-PLATE 13
Murray, M. H., 1994, Storm-tide elevations produced by Hurricane Andrew along the southern Florida coasts, August 24, 1992

PLATE 13.--MAP SHOWING WATER-SURFACE ELEVATIONS AND HIGH-WATER MARK LOCATIONS IN AREAS AFFECTED BY HURRICANE ANDREW, ROCK HARBOR, FLORIDA, QUADRANGLE.

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Lake Ingraham west quadrangle-PLATE 14
Murray, M. H., 1994, Storm-tide elevations produced by Hurricane Andrew along the southern Florida coasts, August 24, 1992

EXPLANATION

△ 2 $\frac{9.5}{9.5}$ (o) HIGH-WATER MARK, NUMBER, AND ELEVATIONS--
Number in large type is mark number referenced in table 1. Numbers in small type are elevations in feet above sea level.* Upper value is elevation of high water, and lower value is elevation of land surface. High-water elevations at a site are designated as inside (I) or outside (o) marks.

* Sea level refers to the National Geodetic Vertical Datum of 1929--a geodetic vertical datum derived from a general adjustment of the first-order level nets of the United States and Canada, formerly called Sea Level Datum of 1929.

Mapped, edited, and published by the Geological Survey

Control by USGS and USC&GS

Orthophotomap prepared from aerial photograph taken February 15, 1971. Topography by planetable surveys 1972

Selected hydrographic data compiled from USC&GS Charts 598 SC (1971) and 1253 (1970). This information is not intended for navigational purposes

UTM GRID AND 1972 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

CONTOUR INTERVAL 5 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929
DEPTH CURVES AND SOUNDINGS IN FEET--DATUM IS MEAN LOW WATER
THE MEAN RANGE OF TIDE IS APPROXIMATELY 2.9 FEET

QUADRANGLE LOCATION

ROAD CLASSIFICATION
No roads or trails in this area

LAKE INGRAHAM WEST, FLA.
N2507.5—W8107.5/7.5
1972

PLATE 14.--MAP SHOWING WATER-SURFACE ELEVATIONS AND HIGH-WATER MARK LOCATIONS IN AREAS AFFECTED BY HURRICANE ANDREW, LAKE INGRAHAM WEST, FLORIDA, QUADRANGLE.

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Lake Ingraham east quadrangle-PLATE 15
Murray, M. H., 1994, Storm-tide elevations produced by Hurricane Andrew along the southern Florida coasts, August 24, 1992

Mapped, edited, and published by the Geological Survey

Control by USGS and USC&GS

Orthophotomap prepared from aerial photograph taken January 16, 1971
Topography by planetable surveys 1972. Field checked 1972

Selected hydrographic data compiled from USC&GS Chart 598 SC (1972)
This information is not intended for navigational purposes

UTM GRID AND 1972 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

CONTOUR INTERVAL 5 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929
DEPTH CURVES AND SOUNDINGS IN FEET—DATUM IS MEAN LOW WATER
THE MEAN RANGE OF TIDE IS APPROXIMATELY 2.9 FEET

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS

ROAD CLASSIFICATION
Trails

LOCATION

LAKE INGRAHAM EAST, FLA.
N2507.5—W8100/7.5
1972

PLATE 15.--MAP SHOWING WATER-SURFACE ELEVATIONS AND HIGH-WATER MARK LOCATIONS IN AREAS AFFECTED BY HURRICANE ANDREW, LAKE INGRAHAM EAST, FLORIDA, QUADRANGLE.

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Flamingo quadrangle-PLATE 16
Murray, M. H., 1994, Storm-tide elevations produced by Hurricane Andrew along the southern Florida coasts, August 24, 1992

Mapped, edited, and published by the Geological Survey

Control by USGS and USC&GS

Orthophotomap prepared from aerial photographs taken January 16, 1971. Topography by planetable surveys 1973

Selected hydrographic data compiled from USC&GS Chart 598 SC (1971)
This information is not intended for navigational purposes

Projection and 10,000-foot grid ticks: Florida coordinate system, east zone (transverse Mercator)
1000-meter Universal Transverse Mercator grid ticks, zone 17, shown in blue. 1927 North American datum

UTM GRID AND 1971 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

CONTOUR INTERVAL 5 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929
SOUNDINGS IN FEET—DATUM IS MEAN LOW WATER
THE MEAN RANGE OF TIDE IS APPROXIMATELY 2 FEET

QUADRANGLE LOCATION

ROAD CLASSIFICATION
Primary highway, hard surface — Light-duty road, hard or improved surface
Secondary highway, hard surface — Unimproved road
Trails
Interstate Route — U. S. Route — State Route

FLAMINGO, FLA.
N2507.5—W8052.5/7.5
1973

PLATE 16.--MAP SHOWING WATER-SURFACE ELEVATIONS AND HIGH-WATER MARK LOCATIONS IN AREAS AFFECTED BY HURRICANE ANDREW, FLAMINGO, FLORIDA, QUADRANGLE.

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Everglades City quadrangle-PLATE 17
Murray, M. H., 1994, Storm-tide elevations produced by Hurricane Andrew along the southern Florida coasts, August 24, 1992

Mapped, edited, and published by the Geological Survey

Control by USGS, and NOS/NOAA

Orthophotomap prepared from aerial photograph taken January 27, 1971
Topography by planetable surveys 1974

Selected hydrographic data compiled from NOS 642 SC (1971) and 1254 (1974). This information is not intended for navigational purposes

UTM GRID AND 1974 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

CONTOUR INTERVAL 5 FEET
NO CONTOURS SHOWN IN SAW GRASS OR WETLAND AREAS
NATIONAL GEODETIC VERTICAL DATUM OF 1929
DEPTH CURVES AND SOUNDINGS IN FEET—DATUM IS MEAN LOW WATER
THE MEAN RANGE OF TIDE IS APPROXIMATELY 2 FEET

LOCATION

ROAD CLASSIFICATION

Primary highway, hard surface
Light-duty road, hard or improved surface
Secondary highway, hard surface
Unimproved road
Trails
Interstate Route U. S. Route State Route

EVERGLADES CITY, FLA.
N2545—W8122.5/7.5

1974

PLATE 17.--MAP SHOWING WATER-SURFACE ELEVATIONS AND HIGH-WATER MARK LOCATIONS IN AREAS AFFECTED BY HURRICANE ANDREW, EVERGLADES CITY, FLORIDA, QUADRANGLE.

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OPEN FILE REPORT 94-116
Chokoloskee quadrangle-PLATE 18
Murray, M. H., 1994, Storm-tide elevations produced by Hurricane Andrew along the southern Florida coasts, August 24, 1992

EXPLANATION

△ 3 4.7/4.0e (o) HIGH-WATER MARK, NUMBER, AND ELEVATIONS--Number in large type is mark number referenced in table 1. Numbers in small type are elevations in feet above sea level.* Upper value is elevation of high water, and lower value is elevation of land surface. High-water elevations at a site are designated as inside (I) or outside (o) marks. Estimated values are designated with an "e".

* Sea level refers to the National Geodetic Vertical Datum of 1929--a geodetic vertical datum derived from a general adjustment of the first-order level nets of the United States and Canada, formerly called Sea Level Datum of 1929.

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Orthophotomap prepared from aerial photograph taken January 27, 1971. Field checked 1974

Selected hydrographic data compiled from NOS 642 SC and 1254 (1974). This information is not intended for navigational purposes.

UTM GRID AND 1974 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

CONTOUR INTERVAL 5 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929
CONTOURS OMITTED IN WETLANDS AND SAW GRASS AREAS
SOUNDINGS IN FEET—DATUM IS MEAN LOW WATER
THE MEAN RANGE OF TIDE IS APPROXIMATELY 3.5 FEET

LOCATION

ROAD CLASSIFICATION

Primary highway, hard surface — Light-duty road, hard or improved surface
Secondary highway, hard surface — Unimproved road
Trails
Interstate Route — U. S. Route — State Route

CHOKOLOSKEE, FLA.
N2545—W8115/7.5
1974
AMS 4735 IV SE—SERIES V8450

PLATE 18.--MAP SHOWING WATER-SURFACE ELEVATIONS AND HIGH-WATER MARK LOCATIONS IN AREAS AFFECTED BY HURRICANE ANDREW, CHOKOLOSKEE, FLORIDA, QUADRANGLE.

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Marco Island quadrangle-PLATE 19
Murray, M.H., 1994, Storm-tide elevations produced by Hurricane Andrew along the southern Florida coasts, August 24, 1992

EXPLANATION

AREA INUNDATED BY STORM TIDE

LANDWARD EXTENT OF STORM-TIDE INUNDATION

△ 4 5.2/4.2 (o) HIGH-WATER MARK, NUMBER, AND ELEVATIONS--Number in large type is mark number referenced in table 1. Numbers in small type are elevations in feet above sea level.* Upper value is elevation of high water, and lower value is elevation of land surface. High-water elevations at a site are designated as inside (I) or outside (o) marks.

* Sea level refers to the National Geodetic Vertical Datum of 1929--a geodetic vertical datum derived from a general adjustment of the first-order level nets of the United States and Canada, formerly called Sea Level Datum of 1929.

Mapped, edited, and published by the Geological Survey

Control by USGS, USC&GS, and USCE

Orthophotomap prepared from aerial photograph taken January 27, 1971
Topography by planetable surveys 1973

Selected hydrographic data compiled from USC&GS Chart 642 SC(1973)
This information is not intended for navigational purposes

UTM GRID AND 1973 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

CONTOUR INTERVAL 5 FEET
CONTOURS OMITTED IN WETLANDS AND SAW GRASS AREAS
NATIONAL GEODETIC VERTICAL DATUM OF 1929
DEPTH CURVES AND SOUNDINGS IN FEET—DATUM IS MEAN LOW WATER
THE MEAN RANGE OF TIDE IS APPROXIMATELY 2.6 FEET

QUADRANGLE LOCATION

ROAD CLASSIFICATION

Primary highway, hard surface — Light-duty road, hard or improved surface
Secondary highway, hard surface — Unimproved road
Trails
Interstate Route — U. S. Route — State Route

MARCO ISLAND, FLA.
25081-H6-TF-024
1973

PLATE 19.--MAP SHOWING WATER-SURFACE ELEVATIONS, HIGH-WATER MARK LOCATIONS, AND LANDWARD EXTENT OF STORM-TIDE INUNDATION IN AREAS AFFECTED BY HURRICANE ANDREW, MARCO ISLAND, FLORIDA, QUADRANGLE.

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