HURRICANE PASS INLET MANAGEMENT PLAN

Phase I: Data Acquisition and Analysis:
Physical Inlet Characteristics
Environmental Analysis

Submitted to:

Pinellas County Department of Public Works
440 Court Street
Clearwater, FL 34616

Submitted by:

Applied Technology and Management, Inc.
502 NW 75th Street, Suite 95
Gainesville, FL 32607

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I. INTRODUCTION

A. Authorization

The development of an Inlet Management Plan for Hurricane Pass is being conducted for the Pinellas County Department of Public Works, Coastal Management Division (Capital Improvement No. 921628). Financial support for the study has been obtained from the Pinellas County Board of County Commissioners and the Florida Department of Natural Resources, Division of Beaches and Shores.

B. Purpose

The purpose of the study is to develop a sound, workable and economically viable Inlet Management Plan for Hurricane Pass. The Plan will provide a means for future management of the Pass region, while minimizing sediment losses to flood and ebb shoals, ensuring an equitable allocation of sand resources to Honeymoon Island State Park and Caladesi Island State Park, providing for navigation between the bay and Gulf, and protecting natural resources.

C. General Description

Hurricane Pass separates Honeymoon Island to the north from Caladesi Island to the south (see Figure 1). It is the northernmost of three passes separating Gulf of Mexico waters from bay waters behind northern Pinellas County barrier islands; Dunedin Pass (now closed) is approximately 2.5 miles south of Hurricane Pass and separates Caladesi Island from Clearwater Beach Island; Clearwater Pass is approximately 6.0 miles south of Hurricane Pass and separates Clearwater Beach Island from Sand Key.

The southern St. Joseph Sound bay area landward of Hurricane Pass is bordered by Dunedin Causeway to the north, Caladesi Island and Clearwater Beach Island to the west, and Clearwater Causeway to the south. The bay is approximately 5 miles long, 1.5 miles wide and is relatively shallow, with an average depth outside dredged areas and channels of 3 to 5 ft. The federally maintained Gulf Intracoastal Waterway, which passes through southern St. Joseph Sound via openings in the Dunedin and Clearwater Causeways, lies approximately 1.3 miles to the east of Hurricane Pass.

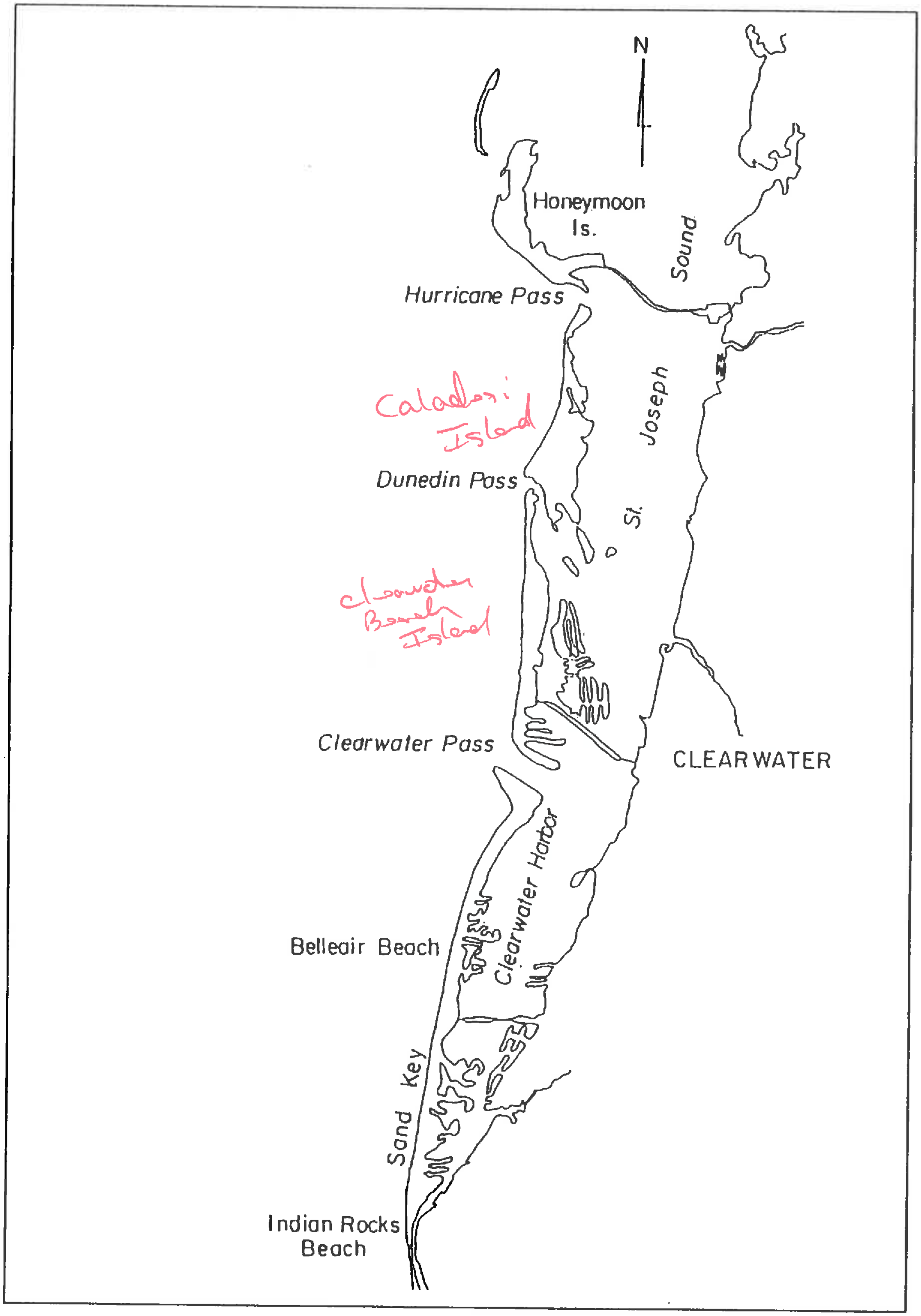

Figure 1. Hurricane Pass Location Map.

Hurricane Pass is a moderate sized inlet by Florida Gulf coast standards, approximately 700 ft wide and with a maximum depth near 20 ft. Depths across the ebb-tidal delta of the inlet generally vary from three to six ft. Sea grasses have colonized much of the flood tidal delta and back barrier waters.

Although the pass itself has not been jettied or otherwise modified, Honeymoon Island to the north has undergone extensive modification through dredge and fill projects, the construction of groins and the addition of beach nourishment. The changes at Honeymoon Island have had some impact on the configuration of Hurricane Pass.

The Hurricane Pass area has also been altered in recent years by the opening of two cuts across the northern tip of Caladesi Island during and following Hurricane Elena in 1985 -- South Willy's Cut and North Willy's Cut (see Figure 2). South Willy's Cut has since closed. With the recent closures of South Willy's Cut and Dunedin Pass, Hurricane Pass and North Willy's Cut now serve as the only conduit for direct flow and small craft navigation between the Gulf and southern St. Joseph Sound.

Recent investigations have characterized the unconsolidated sediments contained in the flood and ebb tidal deltas, the underlying Miocene limestone that is prevalent throughout the area, and benthic communities in the vicinity of the pass.

D. Scope

As was stated above, this study has been conducted to assess various inlet management alternatives for Hurricane Pass. The development and evaluation of the alternatives is based on the extensive physical and natural data base that resulted from several previous studies conducted for Pinellas County and the State of Florida, and that which resulted from field work conducted as part of this study.

This study supplements recent data collection and studies conducted by the University of South Florida Department of Geology (Honeymoon Island beach profiles, inlet cross-sections, inlet flow measurements, inlet shoal sediment characteristics and quantities, sediment budget estimates, and characterization of benthic communities) with additional beach profiles (Honeymoon Island and Caladesi Island), additional inlet cross-sections, spot current measurements in and near the pass, and additional biological community observations.

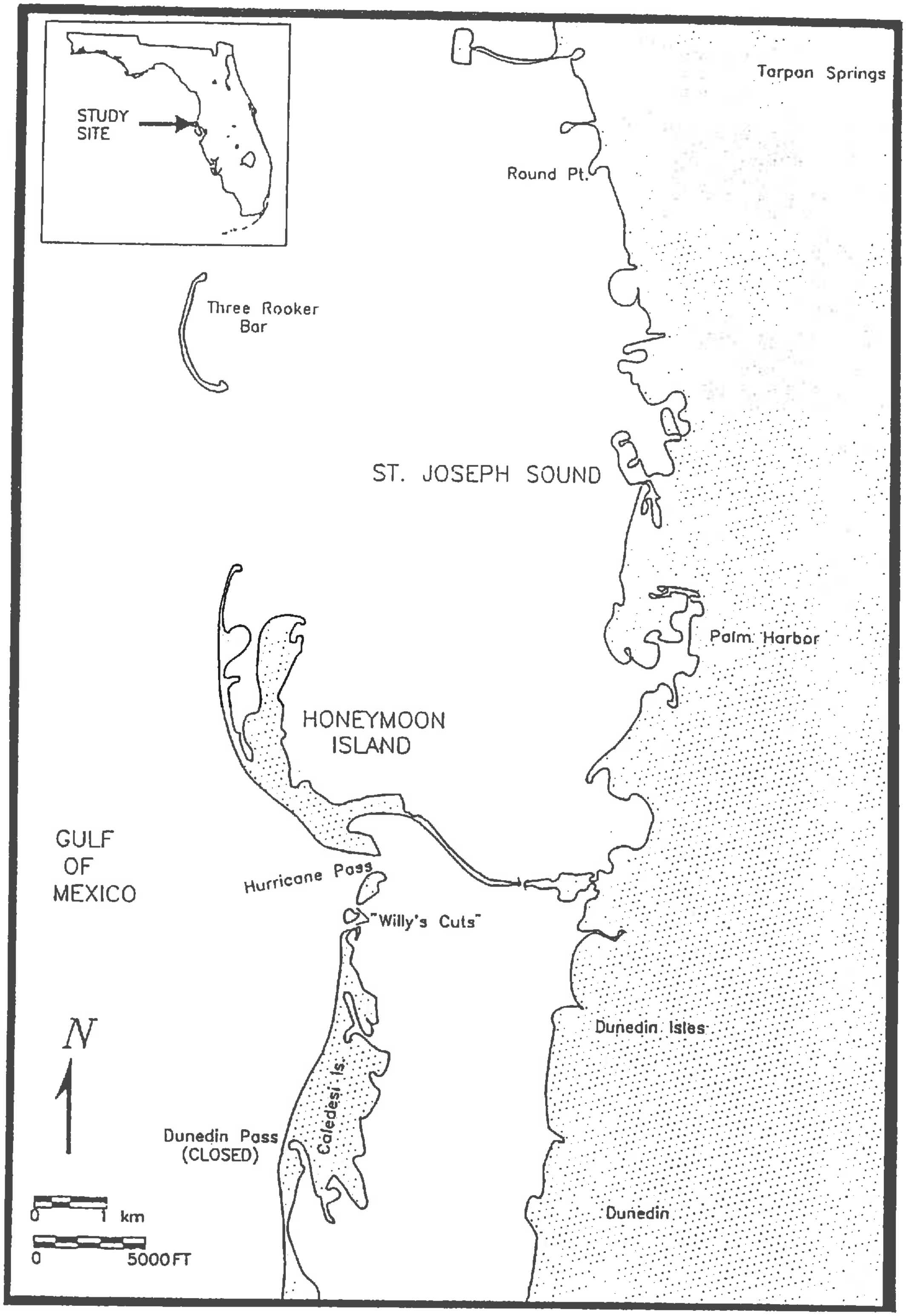

Figure 2. Vicinity Map Showing Hurricane Pass, South Willy's Cut and North Willy's Cut (from Inglin, 1991).

Alternatives that will be addressed in Sections IV, V and VI of this report have been grouped into the following categories: *Sediment Management* (i.e., pass dredging, beach nourishment, sand bypassing, structural modification and inlet closure alternatives), and *Navigation and Public Safety* (i.e., pass dredging, channel dredging and relocation, and structural modification alternatives). Alternatives evaluation and management plan development will take into account physical, economic and natural resources considerations.

E. Public Interests and Use

Public uses that are affected by Hurricane Pass include those that rely on navigation through the pass, those that are affected by changes in bay water quality and flushing through the pass, and those who use beaches at the two State parks adjacent to the pass.

Figures from the Florida Department of Natural Resources, Division of Recreation and Parks indicate that Honeymoon Island State Park is one of the most heavily used State Parks, with attendance figures for the park averaging 280,000 during the July-December period of 1987 through 1991 (see Table 1). Caladesi Island State Park attendance figures for the same period average 60,000.

While exact figures are not available for recreational and commercial vessel traffic through Hurricane Pass, the Pinellas County Marine Extension Program does not believe the latter to be significant. However, significant recreational traffic originates from trailer-launched small craft along the Dunedin Causeway, as well as from other points. Local FDNR staff estimated weekend traffic through the pass during spring, summer and early fall at 500 to 1,000 vessels per day; weekday use during the same period was estimated at approximately 200 to 300 vessels per day.

F. History of the Inlet

Hurricane Pass was formed during the hurricane of October 25, 1921 when Hog Island was breached near its midpoint. Prior to the storm, Hog Island extended north approximately five miles from Big Pass. The north and south ends of Hog Island were later renamed Honeymoon Island and Caladesi Island; Big Pass was renamed Dunedin Pass. Figure 3 shows the configuration of Hog Island and the adjacent inlets between 1883 and 1976.

Table 1. Attendance at Honeymoon Island and Caladesi Island State Parks, July-December period, 1987 through 1991 (source: FDNR)

Year	July-Dec. Attendance	
	Honeymoon	Caladesi
1987	266,723	54,271
1988	290,472	63,977
1989	362,720	64,428
1990	277,086	64,784
1991	196,470	49,130

(note that the drop in 1991 attendance is probably due to an increase in Park admission charges)

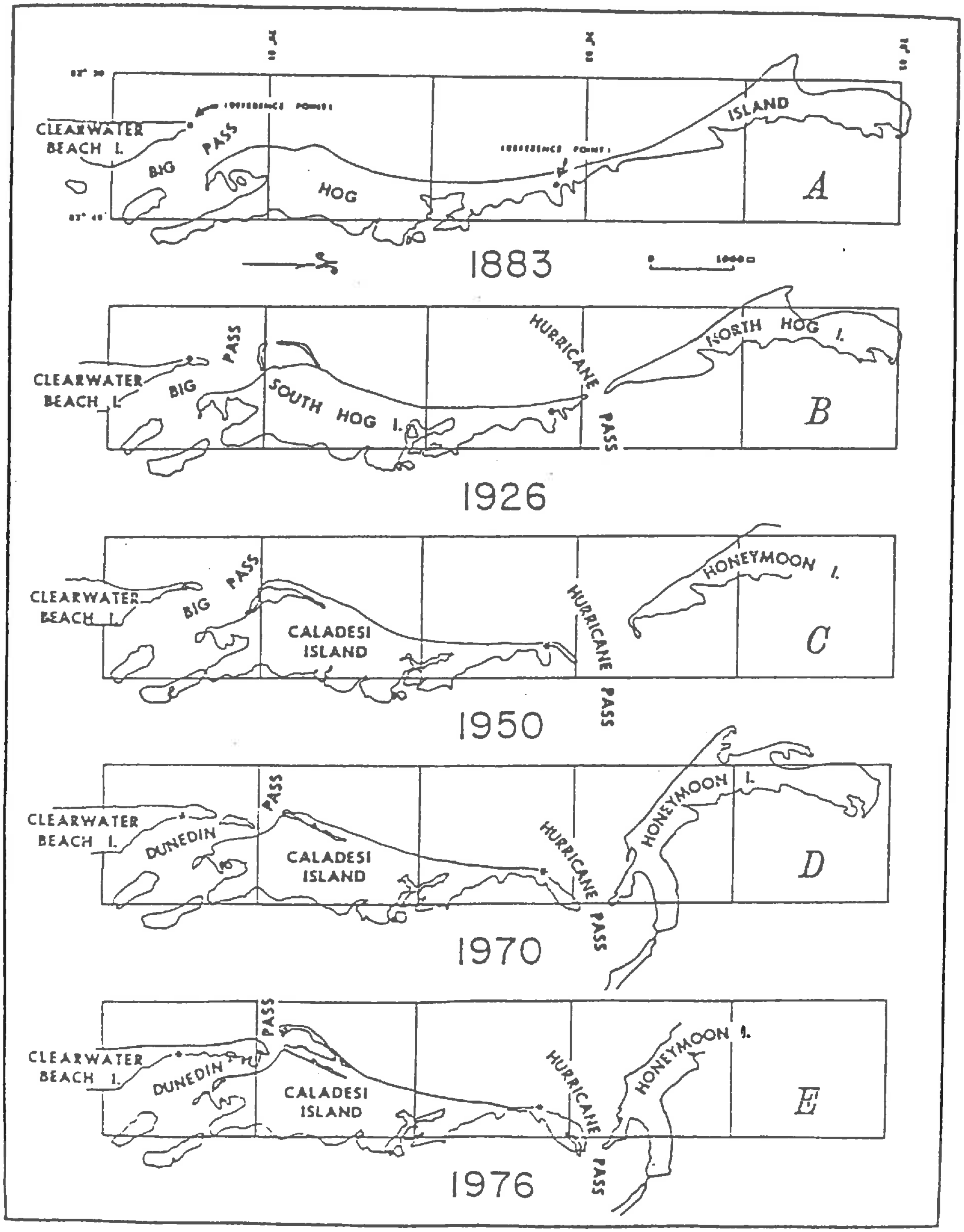

Figure 3. Changes in Caladesi Island, Honeymoon Island, Dunedin Pass and Hurricane Pass, 1883-1976 (from Lynch-Blosse Davis, 1977).

Table 2 summarizes relevant information concerning Hurricane Pass and its history, some of which is described in more detail below. Section II of this report also provides more information for some of the events of importance.

Following its opening in 1921, Hurricane Pass grew to become the dominant inlet connecting southern St. Joseph Sound and the Gulf of Mexico. This dominance came at the expense of Dunedin Pass, which closed in 1988. The eventual closure of Dunedin Pass and growth of Hurricane Pass were most likely due to several factors:

- enlargement of Clearwater Pass during the late 1800's and early 1900's,
- construction of the Clearwater Beach Causeway [1925-26],
- creation of Island Estates behind Dunedin Pass [1950-1958],
- construction of the Dunedin Causeway [1960-63],
- construction of the Gulf Intracoastal Waterway [1961-1963].

The partitioning of southern St. Joseph Sound by causeway construction, coupled with other reductions in bay area, northward directed sediment transport, storm impacts and the emergence of a more efficient hydraulic connection at Hurricane Pass, all led to the northward migration and closure of Dunedin Pass. While the relative importance of each factor has not been determined as part of this study, it stands to reason that causeway construction and the impacts of storms (including the formation of Hurricane Pass) were the dominant factors. It should be pointed out here that the formation and growth of Willy's Cuts probably played a minor role, if any, in the closure of Dunedin Pass.

Figure 4 illustrates the relative changes in inlet width at Hurricane Pass, Dunedin Pass and Clearwater Pass, between 1883 and 1992. It is apparent from the figure that during the 1880s Dunedin Pass was the dominant pass leading into the southern St. Joseph Sound area, but by 1900 Clearwater Pass had assumed that role. Construction of the Clearwater Causeway in 1925-26, however, led to a reduction in the width and influence of Clearwater Pass. By the late 1950s Hurricane Pass had enlarged significantly and assumed the role of dominant pass into southern St. Joseph Sound.

Table 2. History of Events Affecting Hurricane Pass and List of Important Data Collection Efforts and Reports

Date	Event/Data Collection/Report
Oct. 1921	Formation of Hurricane Pass by breaching of Hog Island
1925-1926	Construction of Clearwater Causeway
1950-1958	Dredging and construction of Island Estates inside Dunedin Pass, reducing the bay area served by the pass
1960-1963	Construction of Dunedin Causeway
1961-1963	Construction of the Gulf Intracoastal Waterway through St. Joseph Sound, east of Hurricane Pass
1967	Caladesi Island designated as a State Park
1969	1.1 million cubic yards of rock and sand dredged from area offshore of Honeymoon Island and placed on island, advancing shoreline, altering shoreline orientation and Hurricane Pass channel orientation
1970	Construction of two sand bag groins and rock terminal groin on Honeymoon Island
Oct. 1974	Initial FDNR beach profiles along Honeymoon Island and Caladesi Island
June 1975 - Jan. 1976	Lynch-Blosse (USF) field work -- topographic and bathymetric surveys near Hurricane Pass and Dunedin Pass; sediment and bedform analyses; inlet current measurements
Oct. 1977	USACOE field studies -- beach profiles, inlet and channel surveys, sediment sampling, tide and current measurements

continued

Table 2. Continued

Date	Event/Data Collection/Report
Dec. 1977	Lynch-Blosse thesis, *Inlet Sedimentation at Dunedin and Hurricane Passes* (Lynch-Blosse, 1977)
1980	USACOE *Sec. 107 Feasibility Report, Dunedin and Hurricane Passes* recommended federal participation in maintaining Hurricane Pass and Dunedin Pass (US Army Corps of Engineers, 1980)
1984	Installation of UF CDN wave gage off Clearwater Beach
Sep. 1985	Formation of South Willy's Cut by hurricane Elena
1986	Opening of North Willy's Cut
1986	Honeymoon Island State Park opened
1987	FDNR *Beach Restoration Management Plan* identified Project PI-1, Honeymoon Island Feeder Beach, using sediment dredged from the Dunedin Pass outer bar (FDNR, 1987)
Sep. 1987 - Nov. 1987	USF field work -- inlet flow measurements and cross-sections, Hurricane Pass, North Willy's Cut and South Willy's Cut
1988	Closure of Dunedin Pass
Dec. 1988 - Jan. 1989	USF field work -- inlet flow measurements and cross-sections, Hurricane Pass, North Willy's Cut and South Willy's Cut
Apr. 1989	FDNR report (Clark, 1989) identified areas of high erosion on Honeymoon Is. (R-6 to R-12; critical) and Caladesi Is. (R-16 to R-25; noncritical)

continued

Table 2. Continued

Date	Event/Data Collection/Report
July 1989	Completion of 230,000 cu yd nourishment project on Honeymoon Island (sand trucked to island from mainland location)
Nov. 1989	Initiation of Honeymoon Island nourishment project monitoring study by USF, Coastal Research Laboratory
Dec. 1989	USF field work -- bathymetric, seismic and side scan sonar surveys between Hurricane Pass and Anclote Key; vibracoring, sediment and benthic analyses in potential borrow areas
May 1990	USF report, *Honeymoon Island Study, Phase One - Sand Source Investigation* (Davis and Klay, 1989)
Fall 1990	Navigation channel along south side of Dunedin Causeway between Hurricane Pass and the Intracoastal Waterway was dredged; spoil placed on upland site.
Oct. 1990	Pinellas Co. field work -- post-dredge hydrographic survey of area between Hurricane Pass and Intracoastal Waterway.
Feb. 1991	USF report, *Honeymoon Island Study, Phase Two - Monitoring* (Coastal Research Laboratory, 1991)
May 1991	USF field work -- additional vibracoring and sediment/benthic analyses in potential borrow site at Hurricane Pass ebb-tidal delta
July 1991	Cuffe (USF) field work -- vibracoring and sediment analyses at Hurricane Pass ebb- and flood-tidal deltas

continued

Table 2. Continued (dates in **bold** indicate field work during past year considered part of inlet management plan studies)

Date	Event/Data Collection/Report
Jul. 1991 - Sep. 1991	USF field work -- inlet flow measurements and cross-sections, Hurricane Pass, North Willy's Cut and South Willy's Cut
Fall 1991	Closure of South Willy's Cut
Dec. 1991	Cuffe thesis, *Development and Stratigraphy of Ebb- and Flood-Tidal Deltas at Hurricane Pass* (Cuffe, 1991)
Dec. 1991	Inglin thesis, *Sediment Budget for Honeymoon Island* (Inglin, 1991)
Mar. 1992	USF report, *Honeymoon Island Study, Phase Three - Sand Source Investigation of Hurricane Pass Ebb-Tidal Delta* (Gibeaut and Inglin, 1992)
Mar. 1992	Pinellas Co. field work -- hydrographic survey of area between Hurricane Pass and Intracoastal Waterway
Apr. 1992	Relocation of two Honeymoon Island State Park bathhouses threatened by erosion
May 1992	ATM/USF field work -- establishment of beach survey monuments and inlet survey monuments, beach profiles, inlet cross-sections, current measurements and biological observations
June 1992	USF field work -- vibracoring at closed South Willy's Cut
June 1992 -	establishment of horizontal and vertical control on new monuments by Pinellas Co. Public Works

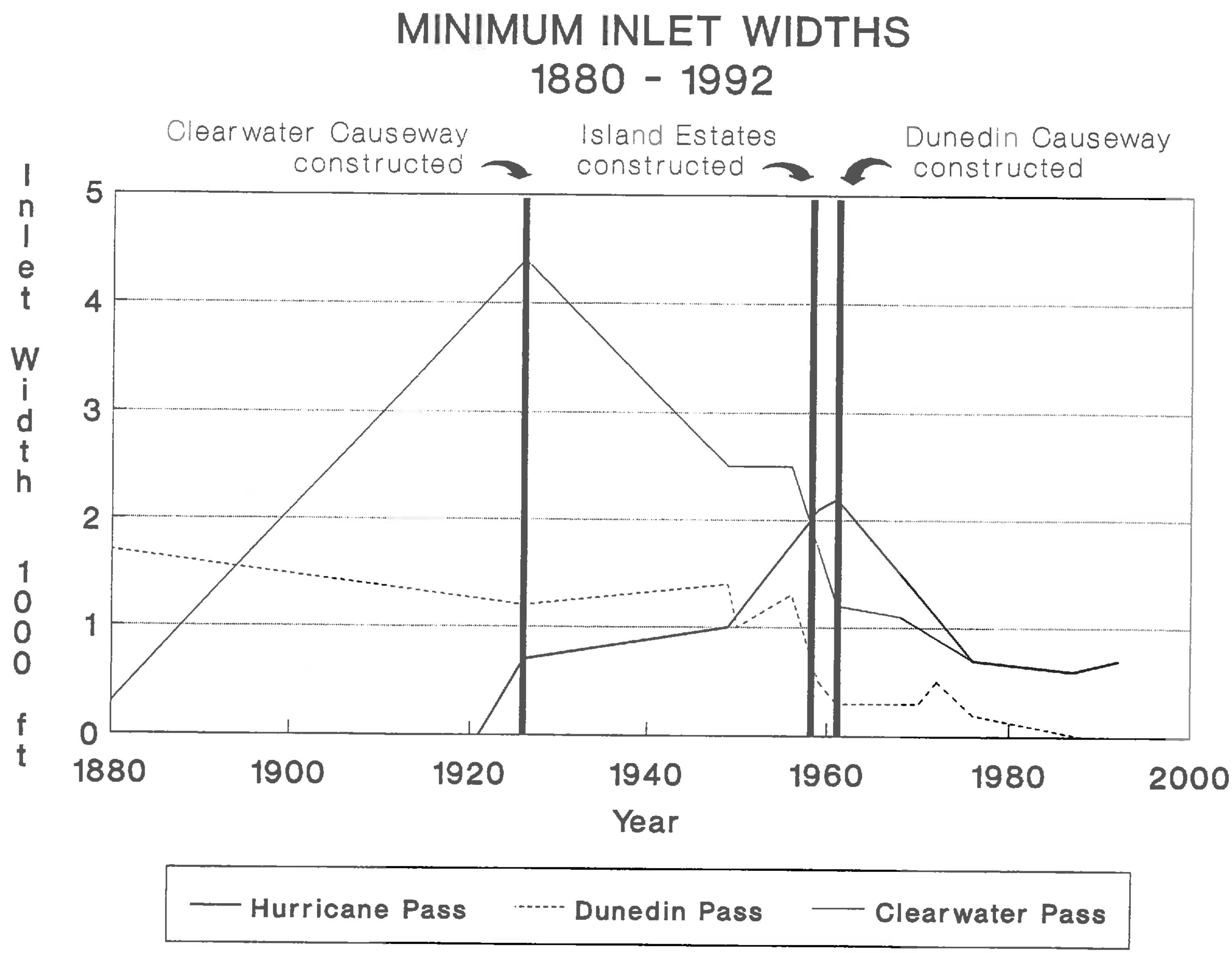

Figure 4. Comparison of Pass Widths, 1880-1992 (adapted from Lynch-Blosse and Davis, 1977).

According to Lynch-Blosse and Davis (1977), reductions in bay area, construction of the Dunedin Causeway and storm-induced changes (e.g., deposition and pass migration during the 1950, 1963 and 1972 storms) led to further reductions in the size of Dunedin Pass. Later storms aided the closure of Dunedin Pass by causing continued northward migration of the north tip of Clearwater Island (lengthening the channel), and by contributing sediment input to the pass channel.

Causeway construction, increased northward sediment bypassing at Dunedin Pass and alterations to Honeymoon Island in the late 1960s also led to significant changes at Hurricane Pass. The latter has profound implications for the management of the beach area on Honeymoon Island to the north of Hurricane Pass. Figure 5 shows the locations of dredging and disposal during a 1969 project where over 1.1 million cu yds of rock and sand were dredged from Hurricane Pass and from the area immediately seaward of Honeymoon Island, and used as fill to create uplands for planned development. The consequences of the 1969 project include:

- rotation of the Honeymoon Island shoreline to a more northerly (i.e., non-equilibrium) orientation, leading to erosion of unconsolidated sediment along the southern Gulf shoreline and deposition along the pass shoreline,

- creation of a resistant headland on Honeymoon Island, due to weathering of the rock placed during the project (leading to a poor quality recreational beach in the fill area),

- alteration of the Hurricane Pass channel orientation, from southwest to northwest,

- deepening and narrowing of the Hurricane Pass cross-section.

Rapid erosion followed the 1969 fill project, as the shoreline tried to restore itself to its equilibrium orientation. As a result, three groins were constructed to contain the fill. These groins were only partially effective. Following the opening of Honeymoon Island State Park, erosion and poor-quality beach conditions along the shoreline opposite the parking area and bath houses led to the 1989 nourishment project, where 230,000 cu yds were trucked from an inland location and placed along the beach in the vicinity of the 1969 project (see Figure 6). This sediment has also migrated rapidly toward Hurricane Pass, leaving beach conditions at the north end of the fill area little improved and requiring the relocation of two bath houses.

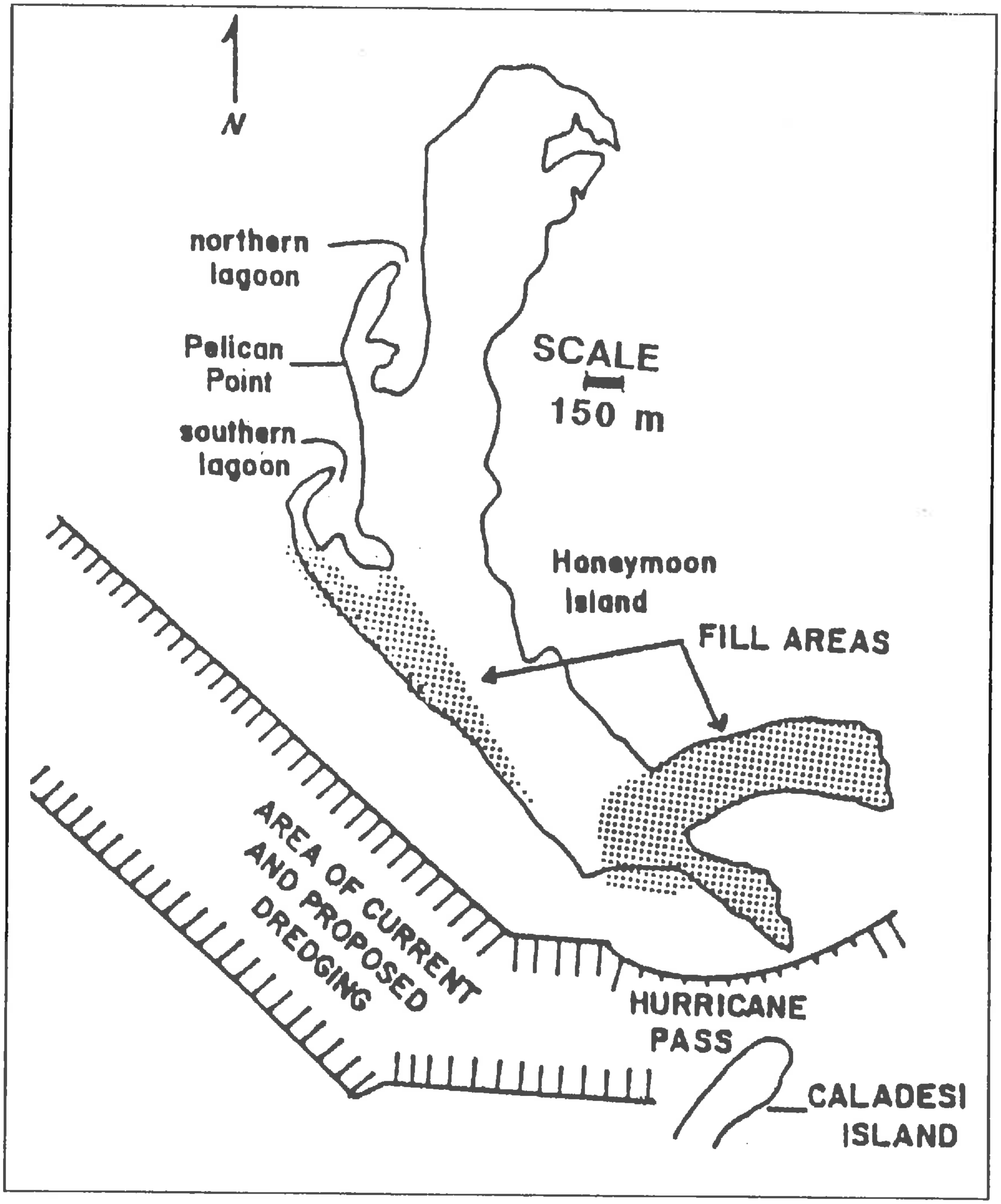

Figure 5. Location of 1969 Dredging and Upland Disposal (from Wright and O'Donnell, 1973, as shown in Inglin, 1991).

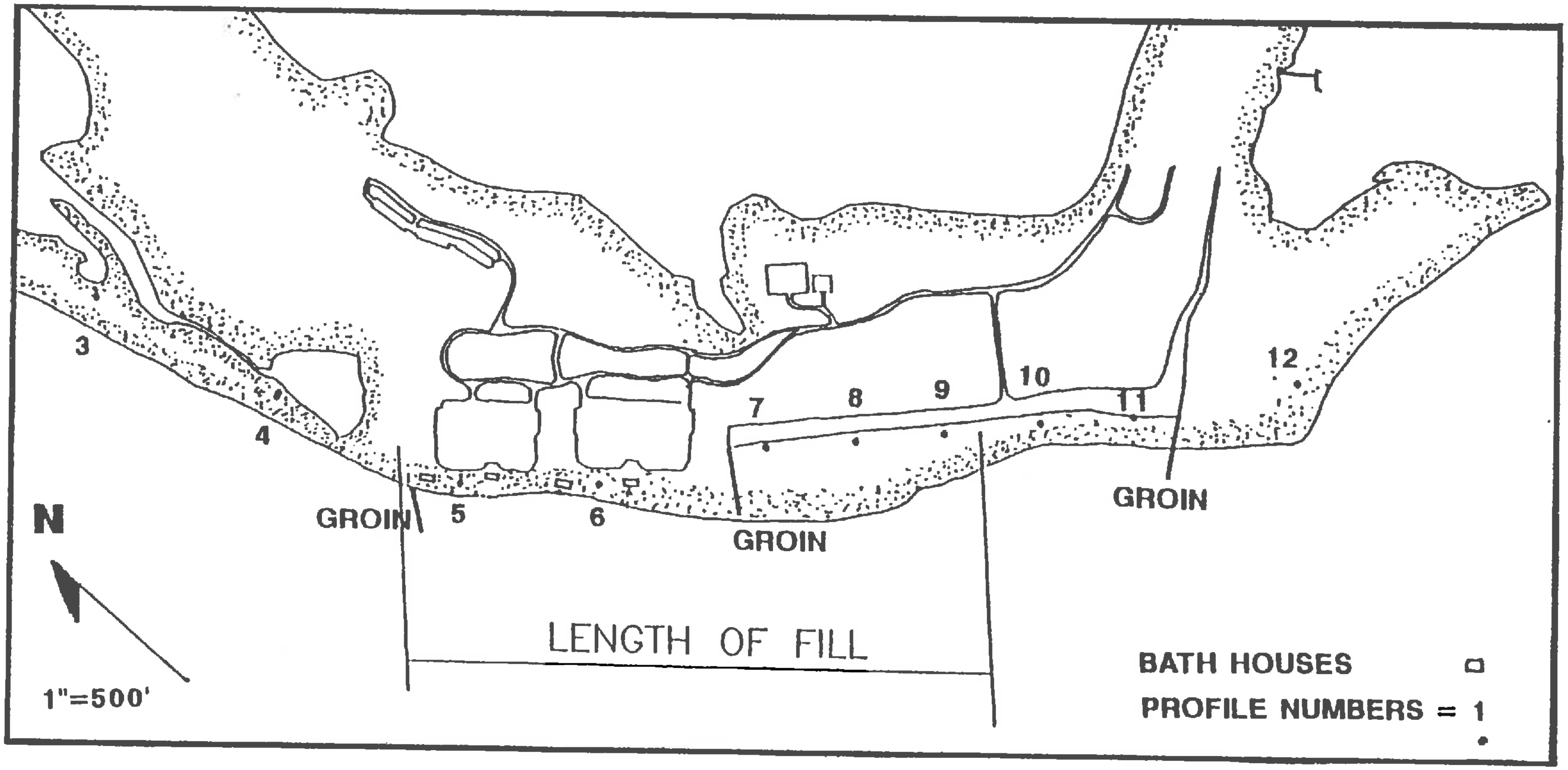

Figure 6. Location Map Showing 1989 Beach Nourishment Project, Pre-existing Groins and Beach Profile Monitoring Stations (from Inglin, 1991).

Hurricane Elena breached the north end of Caladesi Island in September 1985 and formed South Willy's Cut. North Willy's Cut subsequently opened in 1986. Initially, South Willy's Cut was the dominant of the two cuts; however, by early 1989 the two cuts were of equal size, with the cross-section of each equal to approximately 20 percent of the Hurricane Pass cross-section (see Figure 7 and Table 3). Further enlargement of North Willy's Cut and contraction of South Willy's Cut eventually led to the closure of South Willy's Cut in 1991. North Willy's Cut is now the only remaining cut; its May 1992 cross-sectional area was nearly one-half that of Hurricane Pass (3,100 sq ft versus 6,700 sq ft).

Figures 8, 9 and 10 show relative changes in the throat cross-sections of Hurricane Pass, South Willy's Cut and North Willy's Cut between 1987 and May 1992. The cross-sections measured between September 1987 and July 1991 were surveyed by USF in conjunction with ongoing studies; the May 1992 sections were surveyed in conjunction with the inlet management plan study. It should be pointed out, however, that the inlet cross-sections could have been measured at slightly different locations. No permanent survey monuments were established between 1987 and 1991, so it is not possible to match the earlier cross-sections with those surveyed in May 1992 from permanent monuments established during the management plan study.

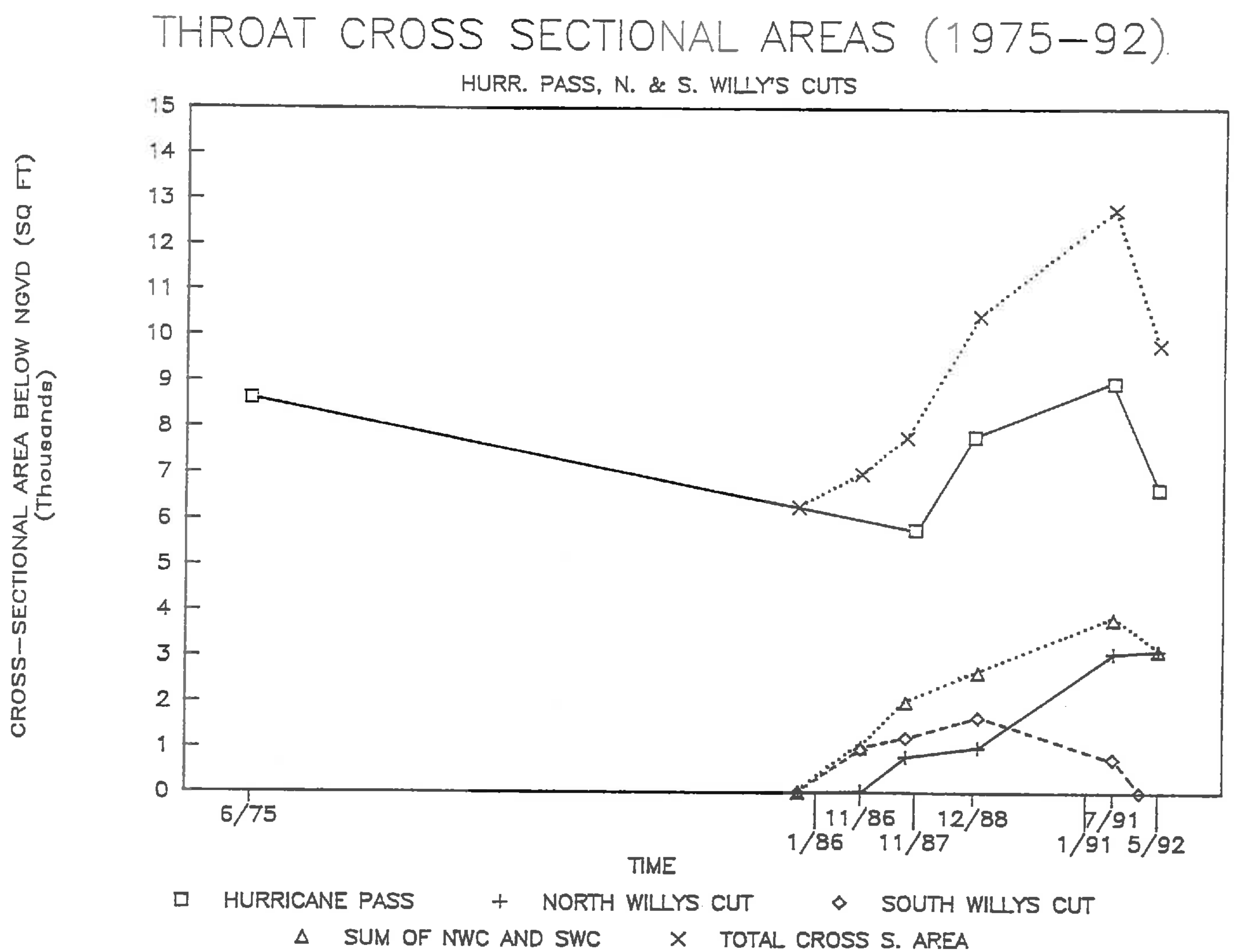

Figure 7. Comparison of Throat Cross-Sectional Areas of Hurricane Pass, North Willy's Cut and South Willy's Cut, 1975-1992 [6/75 area from Lynch-Blosse (1977); 11/86 through 7/91 areas from USF studies; 5/92 areas from inlet management plan field work].

Table 3. Comparison of Hurricane Pass, North Willy's Cut and South Willy's Cut Cross-Sectional Areas (sq ft below NGVD)

Date	Cross-Sectional Area				
	Hurric. Pass	N. Cut	S. Cut	N & S Total	Total Area
6/75	8,600	0	0	0	8,600
11/86	6,990	30	960	990	7,980
9-11/87	5,780	790	1,190	1,980	7,760
12/88	7,790	990	1,650	2,640	10,430
7/91	8,970	3,070	740	3,810	12,780
5/92	6,670	3,130	0	3,130	9,800

note: 10/77 USACOE Hurricane Pass cross-section is not included in this table. The USACOE report shows an approximate MTL width of 900 ft and a cross-sectional area greater than 11,000 sq ft -- both figures are inconsistent with other data and are not considered accurate; it appears that the USACOE cross-section was not measured directly across the inlet throat.

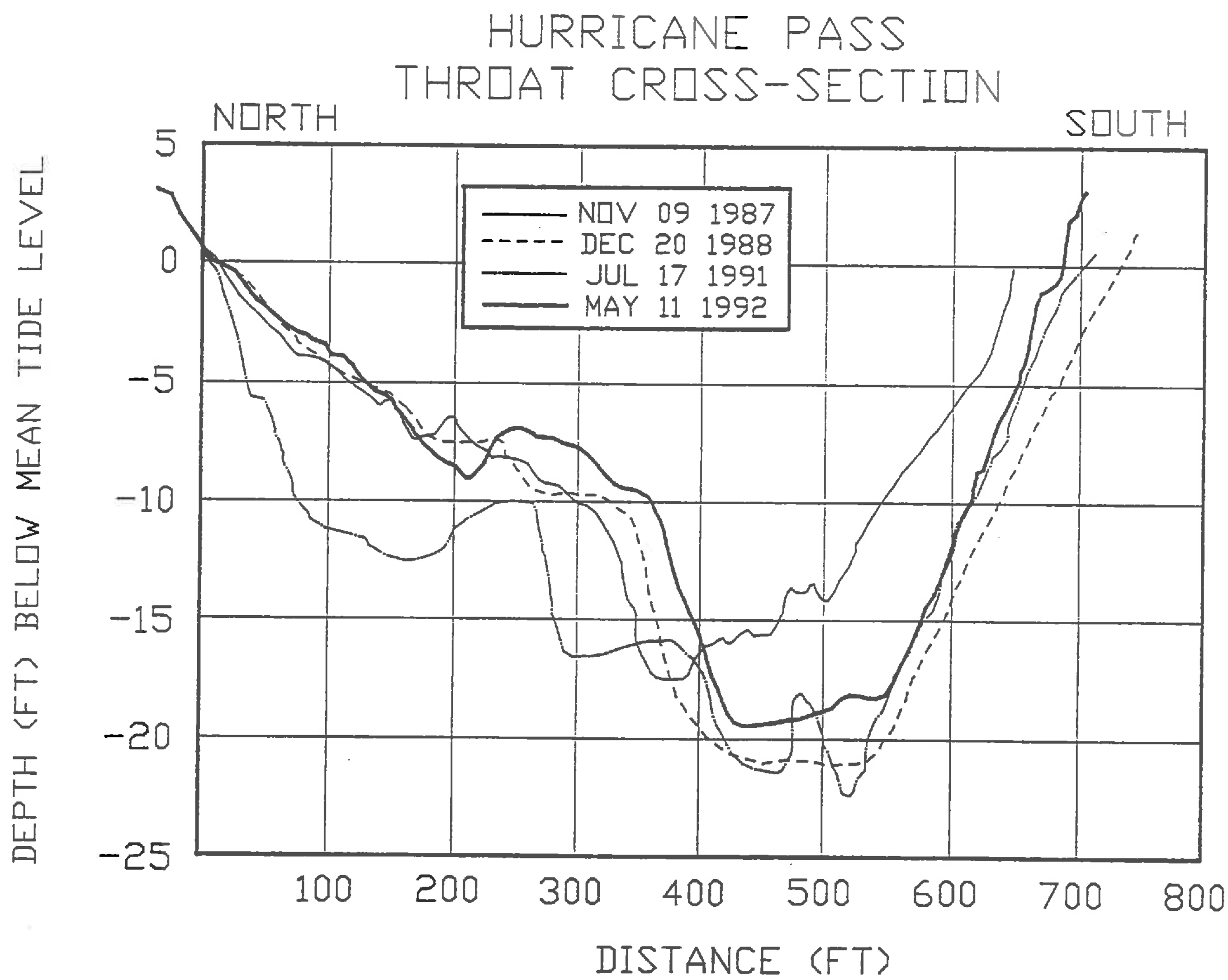

Figure 8. Comparison of Hurricane Pass Cross-Sections, 1987-1992 (note that only the May 1992 survey was referenced to survey monuments; side-to-side matching of profiles is approximate).

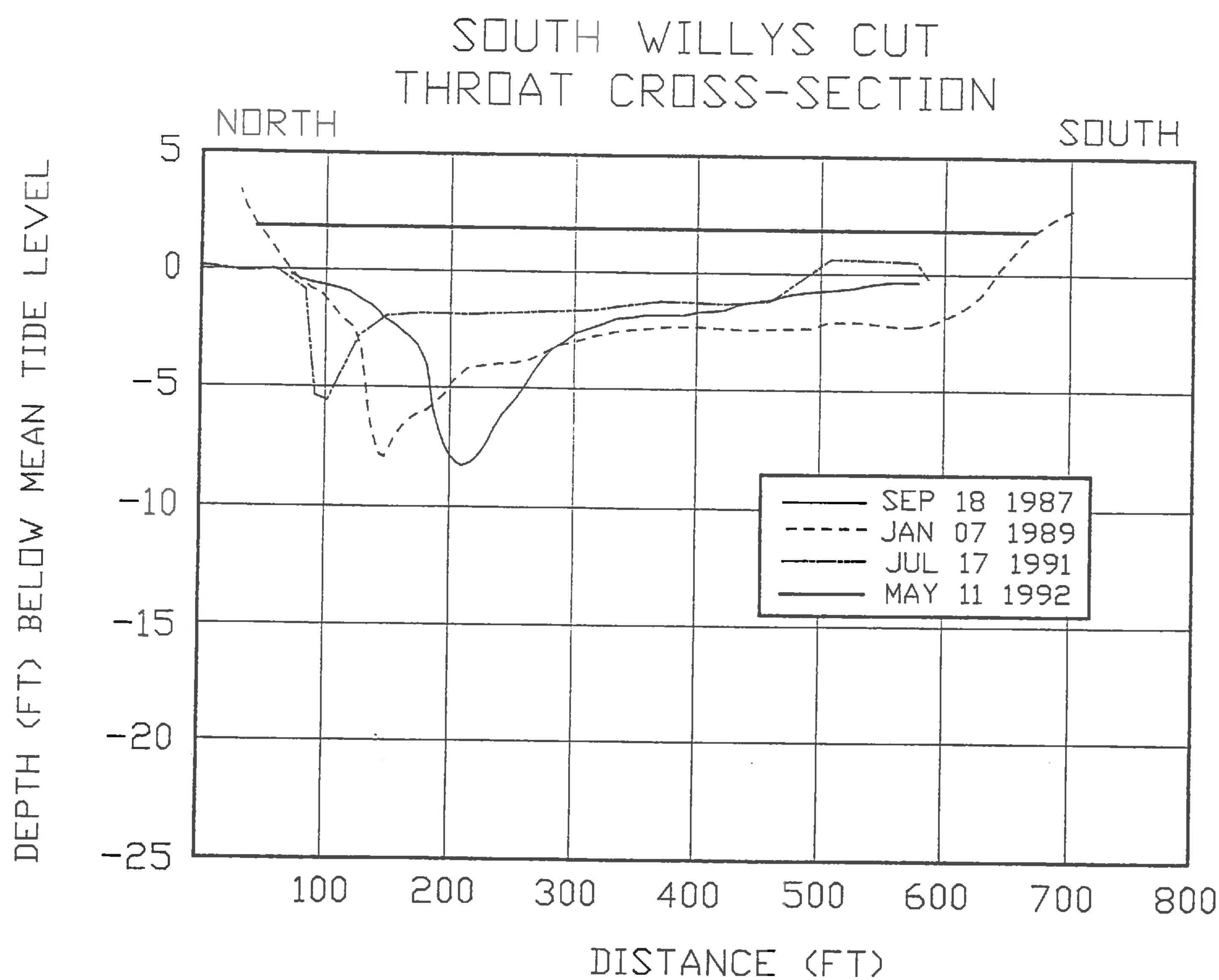

Figure 9. Comparison of South Willy's Cut Cross-Sections, 1987-1992 (note that only the May 1992 survey was referenced to survey monuments; side-to-side matching of surveys is approximate).

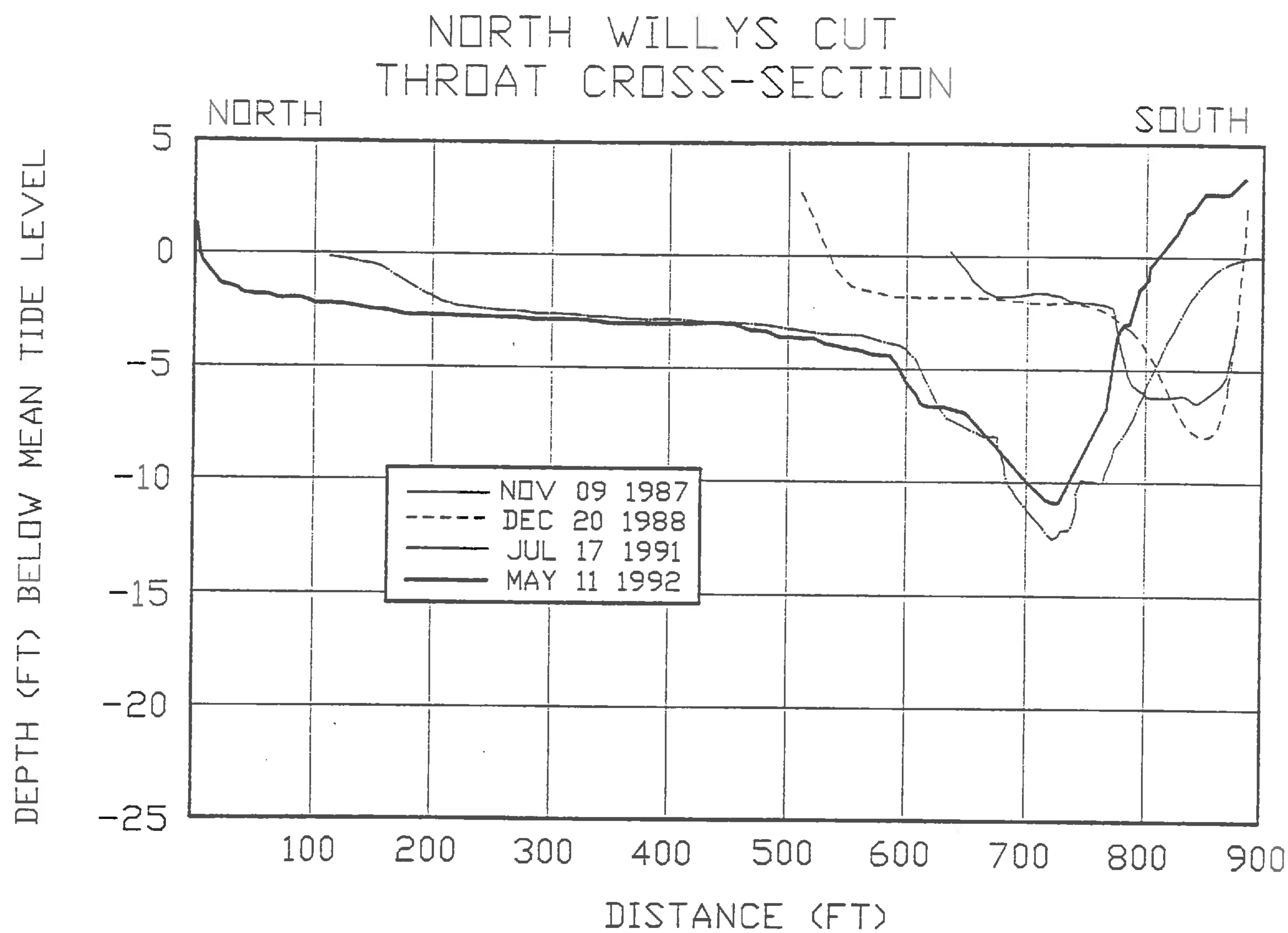

Figure 10. **Comparison of North Willy's Cut Cross-Sections, 1987-1992 (note that only the May 1992 survey was referenced to survey monuments; side-to-side matching of surveys is approximate).**

II. PHYSICAL INLET CHARACTERISTICS

A. General

The size, configuration and location of Hurricane Pass are a result of natural processes and man's actions. All have contributed to the present day situation where Hurricane Pass serves as the dominant tidal connection between southern St. Joseph Sound and the Gulf of Mexico. The recent emergence of North Willy's Cut and closure of Dunedin Pass have also affected the Hurricane Pass area.

Specific information on adjacent shoreline changes, structure impacts, pass stability and the area sediment budget will be described in the following sections. Much of this information has been gathered from previous reports (e.g., Davis and Klay, 1989; Coastal Research Laboratory, 1991; Cuffe, 1991; Inglin, 1991; Gibeaut and Inglin, 1992). Some of the information contained in the following sections results from additional field work conducted as part of the Inlet Management Plan study and subsequent reanalysis of the entire Hurricane Pass database.

B. Inlet Influence

Hine, et al. (1988) briefly reviewed the history and impacts of Hurricane Pass. They determined that the pass influenced the updrift (i.e., south) beach for a distance of 3,300 ft and the downdrift (north) beach for a distance of 3,000 ft. These determinations were made by examining distortions in offshore depth contours in the vicinity of Hurricane Pass.

By examining May 1992 beach profile data collected as part of this study, it was determined that the downdrift area of influence has not changed significantly from the 3,000 ft length described above. However, the updrift area of influence has increased to approximately 4,500 ft south of Hurricane Pass (i.e., to a point near Sta. R-20). The updrift area of influence has increased due to North Willy's Cut and the ebb-tidal delta developing there.

Figures 11 and 12 show comparisons of May 1992 beach profiles measured south of Hurricane Pass, matched at elevation +2.5 ft NGVD (note that beach profile monuments installed during the inlet management plan field work have been designated R-16G, R-18G, R-18AG, R-19G and R-21G; see Figure 13 for the profile locations). The profiles and field inspections carried out as part of this study indicate that profile R-21G is unaffected by the presence of

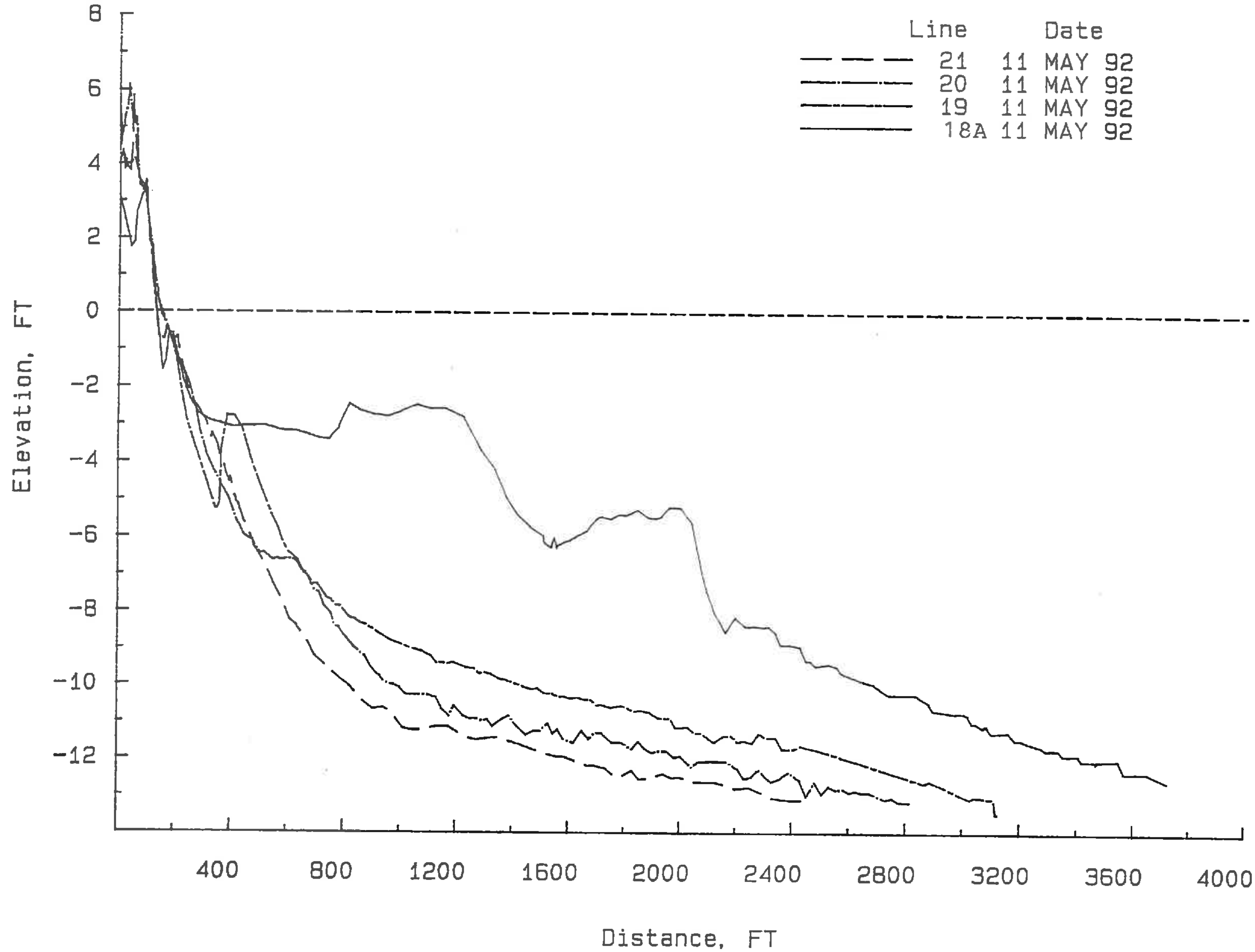

Figure 11. **May 1992 Profiles South of North Willy's Cut [R-21G, R-20, R-19G and R-18AG] Matched at +2.5 ft NGVD (note increasing distortion of profile in south to north direction).**

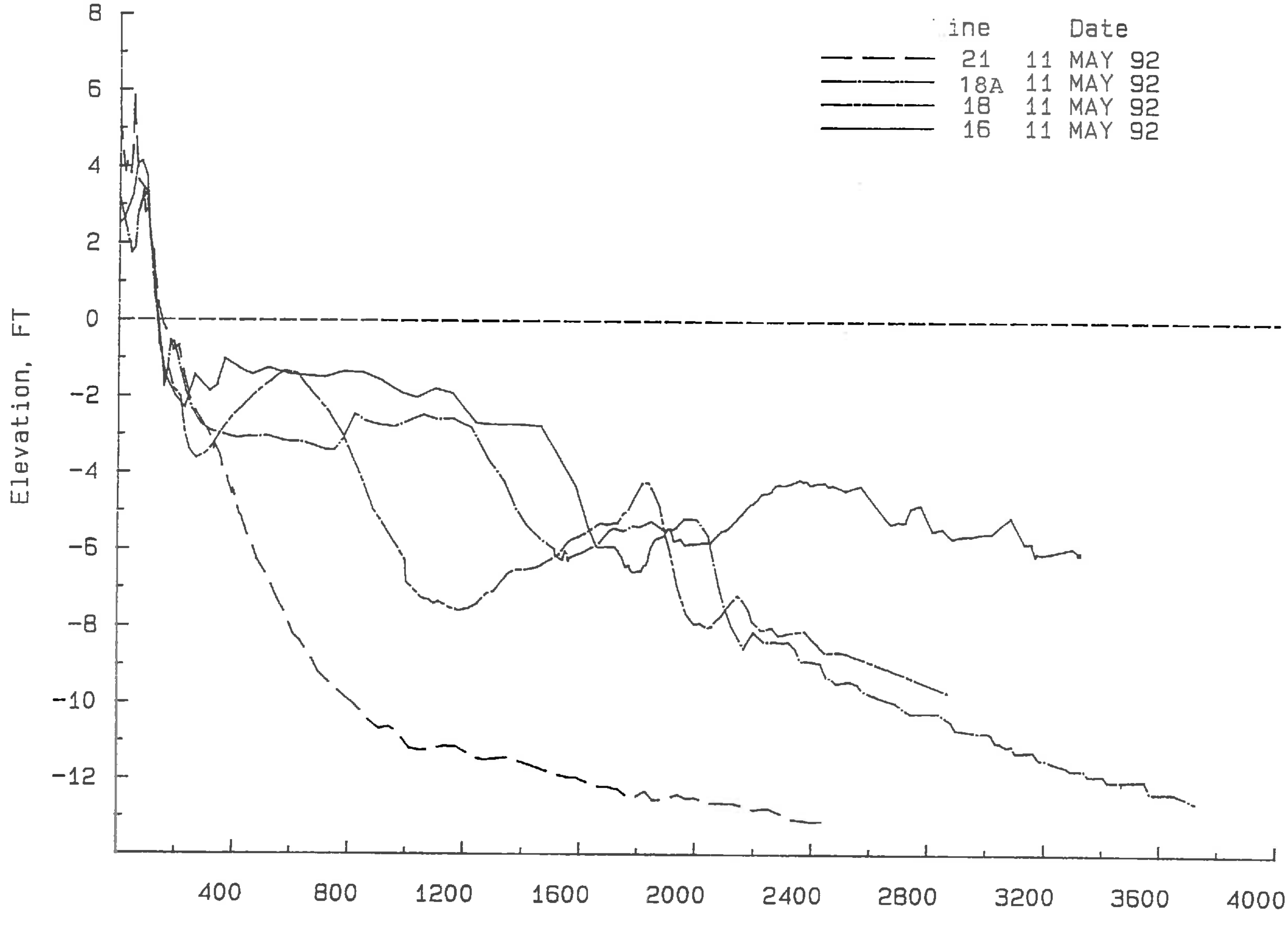

Figure 12. May 1992 Profiles South of Hurricane Pass [R-21G, R-18AG, R-18G and R-16G] Matched at +2.5 ft NGVD (note increasing distortion of profile in south to north direction).

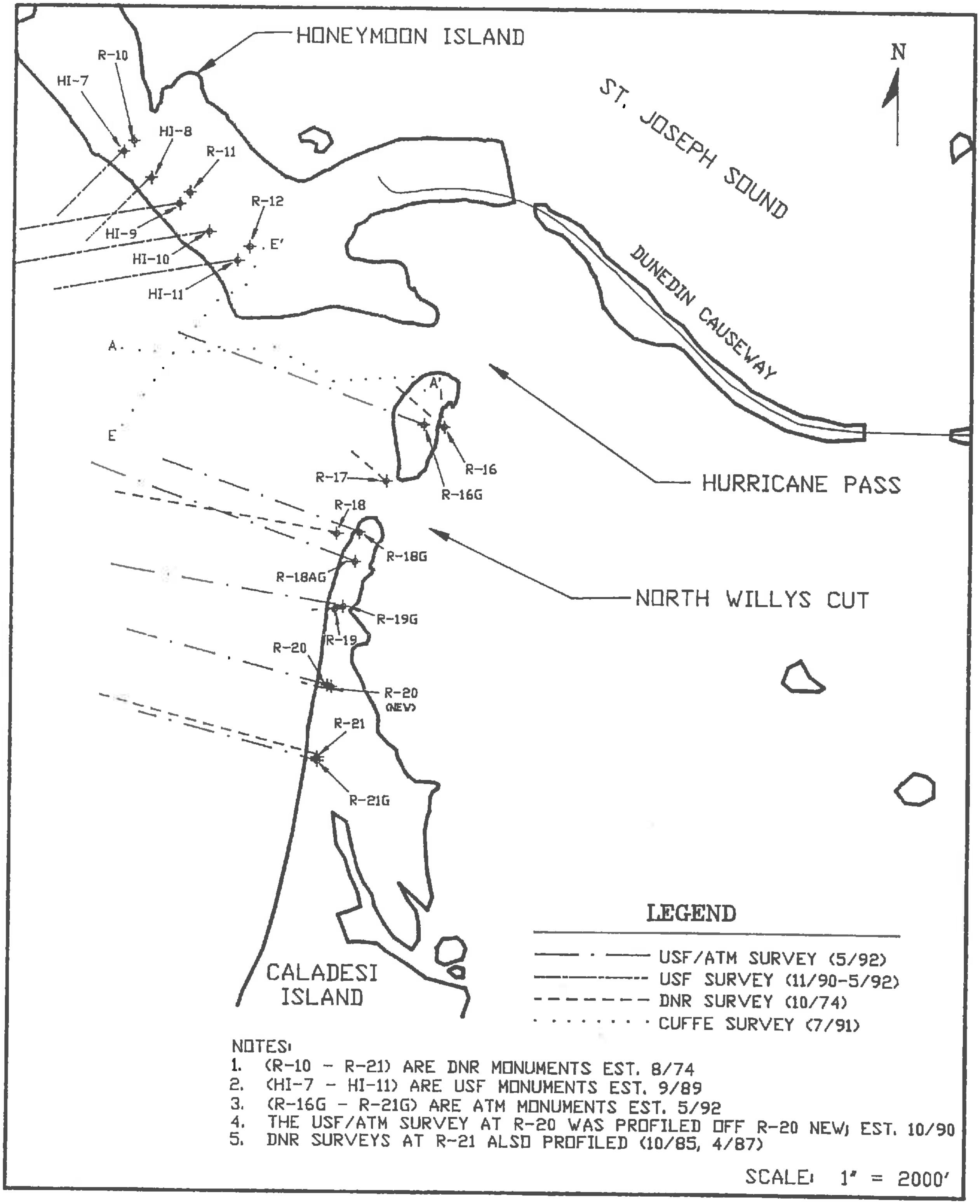

Figure 13. Locations of beach profile monuments and surveys in the vicinity of Hurricane Pass.

Hurricane Pass or North Willy's Cut. Profile R-21G, therefore, is considered a "typical" beach profile and has be used as a basis for comparing other profiles which are affected by the inlets. It is evident from Figures 11 and 12 that as one moves north from R-21G the offshore profile becomes more and more distorted as the North Willy's Cut/Hurricane Pass ebb-tidal delta becomes more prominent. A quantitative comparison of profiles R-20, R-19G, R-18AG, R-18G and R-16G with profile R-21G, is shown in Table 4.

C. Shoreline History

Historic shorelines in the vicinity of Hurricane Pass were previously digitized from charts and aerial photographs by Cuffe (1991). This study supplemented Cuffe's 1883-1990 shoreline history with the addition of a 1992 shoreline taken from March 1992 aerial photographs (supplied by Pinellas County) and May 1992 beach profiles. Figure 14 shows a comparison of the 1883, 1926, 1962, 1979 and 1992 shorelines, which are assumed to be approximate high water shorelines. The significance of each of the shorelines is described below:

- 1883: Hog Island is shown prior to the 1921 hurricane that formed Hurricane Pass.
- 1926: The shoreline shows the early configuration of the pass, just prior to any significant impact caused by the construction of the Clearwater Causeway.
- 1962: The shoreline shows the location of the pass during the period when the Dunedin Causeway was being constructed, but prior to the 1969 dredge and fill project that altered Honeymoon Island and Hurricane Pass.
- 1979: Hurricane Pass is shown following the 1969 dredge and fill project and after construction of three groins on Honeymoon Island, but prior to hurricane Elena and the formation of Willy's Cuts.
- 1992: Present day conditions are shown, following the closure of South Willy's Cut.

Several observations can be made from the shorelines shown in Figure 14. First, the shoreline of Caladesi Island rotated clockwise approximately 20 degrees about a point

Table 4. Comparison of Sediment Volumes Contained in Beach Profiles Affected by the Hurricane Pass/North Willy's Cut Ebb-Tidal Delta with Profile R-21G

Profile	Distance Between Hurricane Pass Centerline and Profile (ft)	Approximate Difference Between Profile Unit Volume (cu yds/ft) and R-21G Unit Volume, Measured Between +2.5 ft NGVD and -15 ft NGVD (approx. 2,600 to 3,000 ft from shore)
R-21G	5,500	0
R-20	4,500	+60
R-19G	3,500	+150
R-18AG	2,800	+600
R-18G	2,300	+470
R-16G	1,000	+850

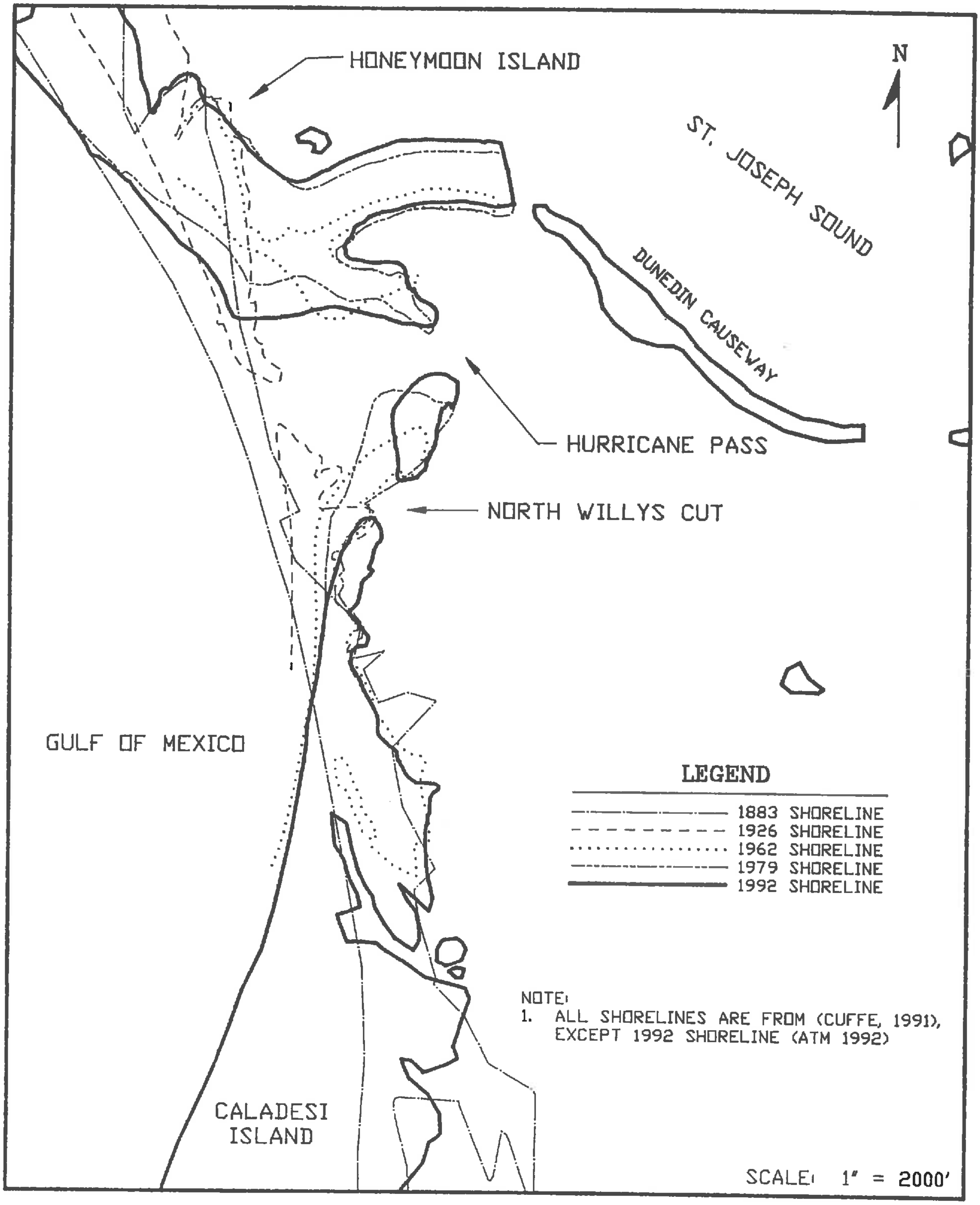

Figure 14. Comparison of historic shorelines in the vicinity of Hurricane Pass, 1883-1992.

near R-20 between the breaching of Hog Island in 1921 and causeway construction in the early 1960s. Part of the rotation was undoubtedly due to the emergence and development of Hurricane Pass, while some was due to the accretion that occurred along southern Caladesi Island, north of Dunedin Pass. Since 1962, shoreline changes along northern Caladesi Island have been less severe, and limited to the area immediately around Hurricane Pass.

Second, following an initial 40-year period of pass widening, the northern tip of Caladesi Island has migrated northward and Hurricane Pass has narrowed. This has resulted from northward directed littoral drift, man-made alterations along Honeymoon Island and causeway construction impacts. Continued northward migration of the north end of Caladesi Island in the future will depend upon the continued supply of northward directed littoral drift across North Willy's Cut and the relative stabilities of Hurricane Pass and North Willy's Cut (see Section II-F).

Finally, the 1969 Honeymoon Island dredge and fill project and subsequent groin construction and beach nourishment have forced the Honeymoon Island shoreline to a more northerly orientation. The southern end of the Gulf shoreline has been advanced approximately 600 ft since 1962. This alteration in shoreline orientation is in conflict with prevailing coastal processes that formed the island; therefore, continued erosional stress can be expected along the southern Gulf shoreline, between Honeymoon Island profile stations 5 and 11.

Historic shorelines shown in Figure 14 were compared to determine total and average annual rates of change. The results of this analysis are shown in Table 5. It is apparent from the table that, since 1979, the northern Caladesi Island shoreline has eroded at an average rate of 10 ft/yr to 30 ft/yr.

This trend is supported by a comparison of 1974 and 1992 beach profiles measured at or near DNR ranges. Figures 15, 16, 17 and 18 show profile comparisons at R-18, R-19, R-20 and R-21 (note that the 1974 profiles were projected onto the 1992 profiles due to differences between the 1974 and 1992 profile alignments). Table 6 contains a quantitative comparison of the 1974 and 1992 surveys. The Table shows similar rates of shoreline recession and approximate average annual volumetric losses of -2.9 cu yd/ft/yr between North Willy's Cut and R-21. Profile comparisons at R-16 and R-17 could not be made due to significantly different profile alignments at R-16, and due to the fact that station R-17 now lies in North Willy's Cut.

Table 5. Approximate Locations of 1926, 1962, 1979 and 1992 Shorelines Relative to the 1883 Shoreline (+ indicates accretion since 1883; - indicates erosion since 1883)

Profile	Shoreline Location Relative to 1883 Shoreline (ft)				Avg. Rate of Change, 1979-1992 (ft/yr)
	1926	1962	1979	1992	
HI-8	-660	-870	-370	-280	+6.9
HI-10	-550	-850	-1,100	-420	+52.3
.... Hurricane Pass					
R-16	-600	-2,600	-2,000	-2,400	-30.8
R-17	-550	-1,600	-1,650	-1,800	-11.5
R-18	-420	-830	-1,000	-1,300	-23.1
R-18AG	-300	-650	-850	-1,000	-11.5
R-19	-50	-350	-450	-500	-3.9
R-20	+250	-50	-100	-150	-3.9
Average, R-16 to R-20					-14.1

note that accretion rates at HI-8 and HI-10 are due to the 1989 nourishment project

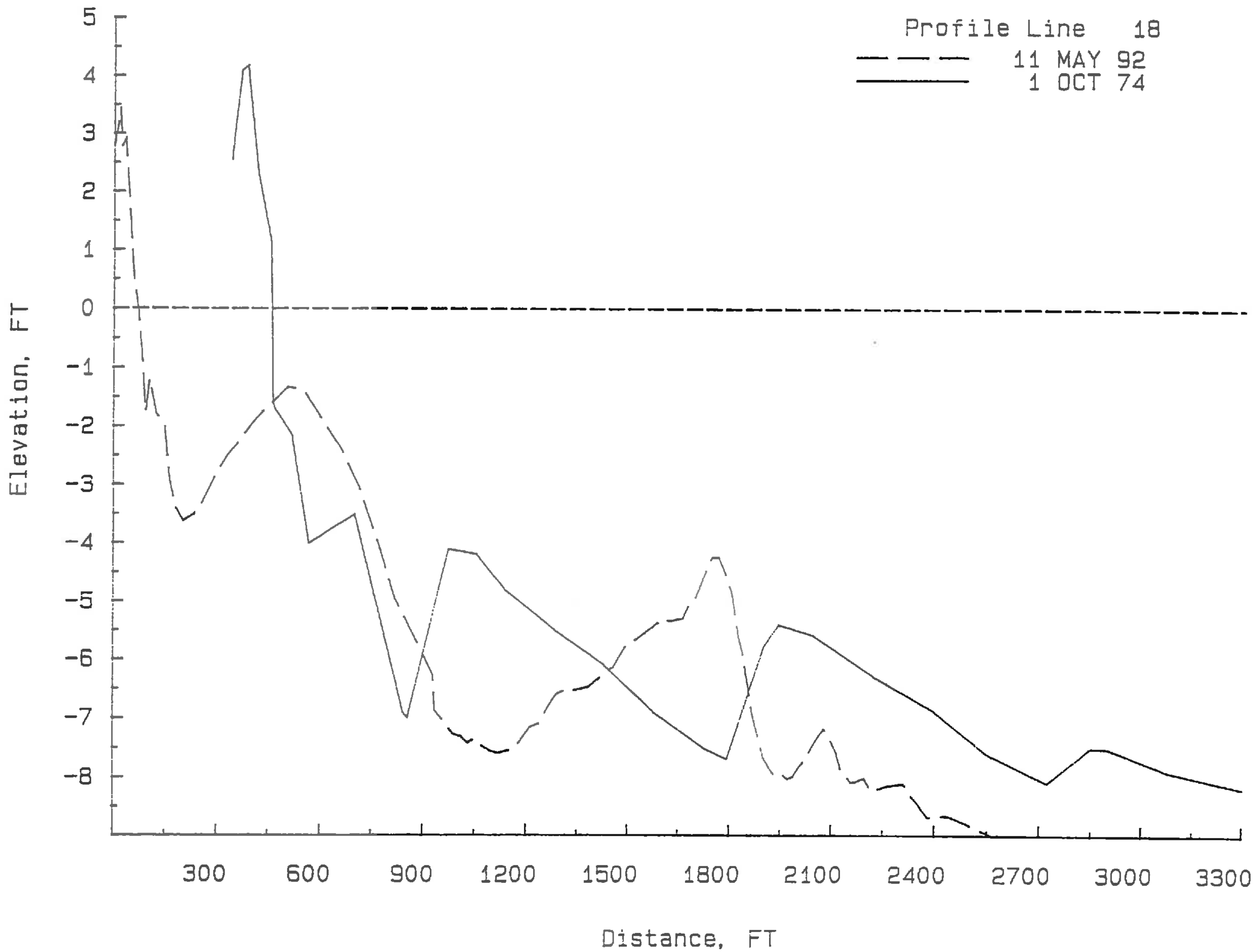

Figure 15. October 1974 - May 1992 Profile Comparison, Station R-18G.

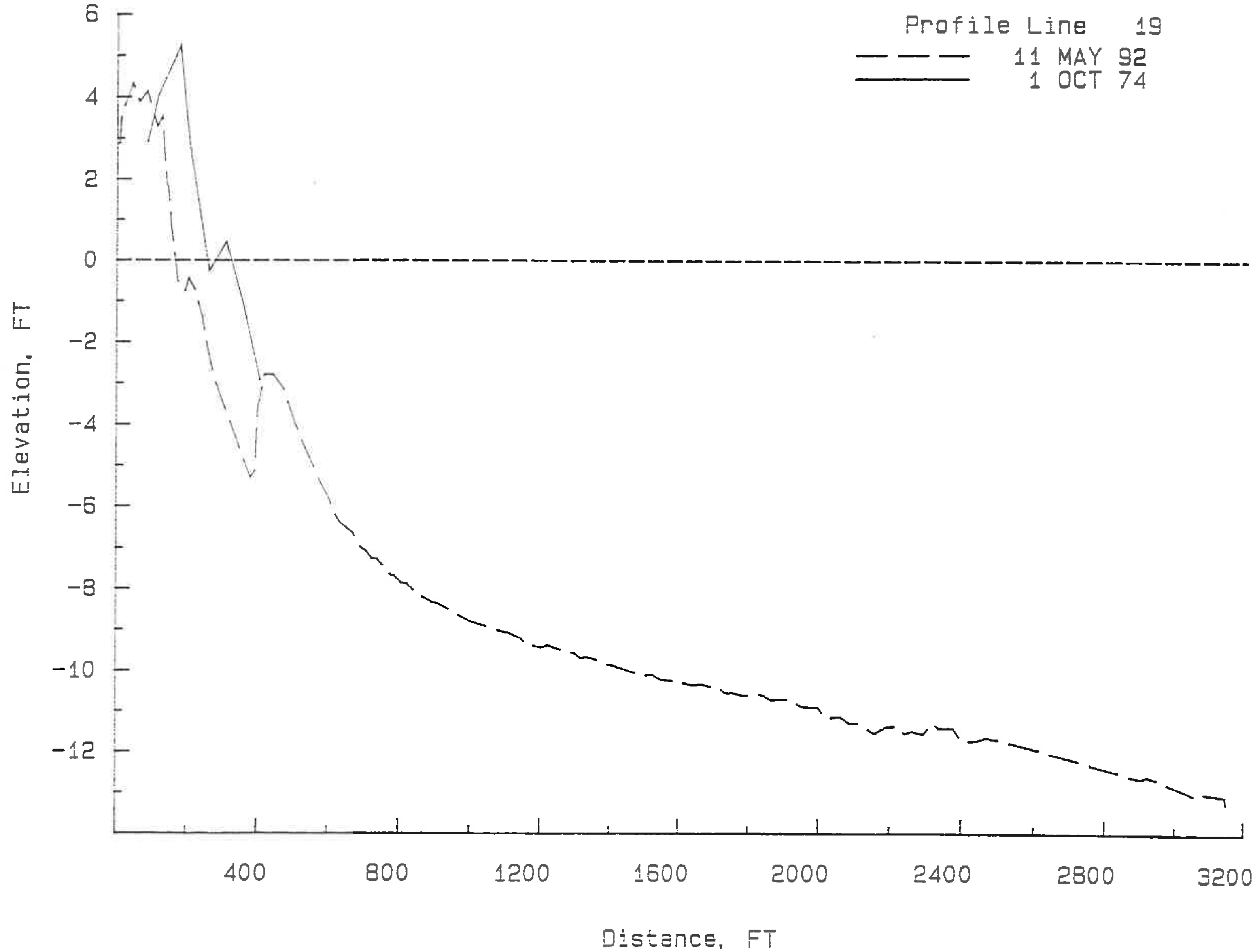

Figure 16. **October 1974 - May 1992 Profile Comparison, Station R-19G.**

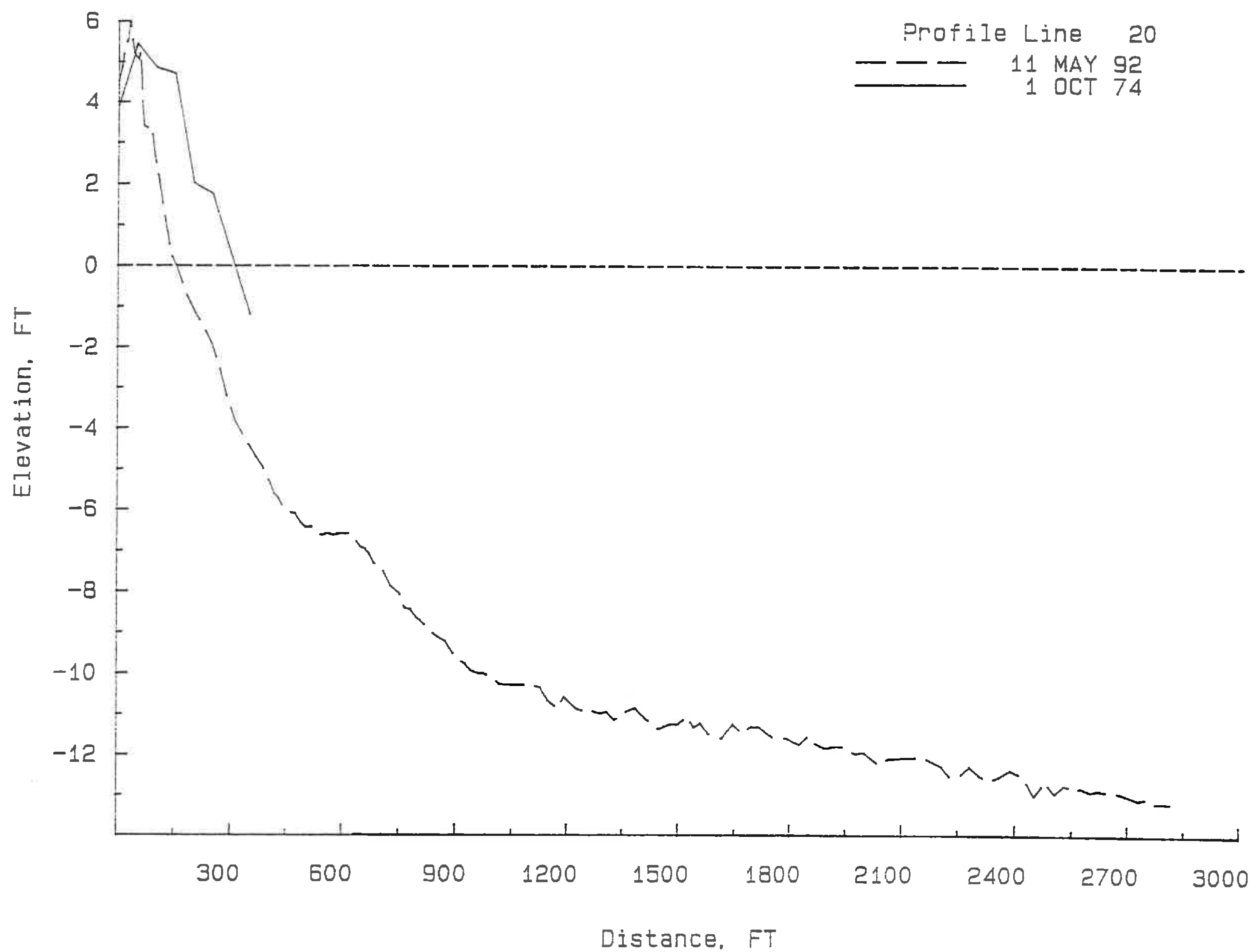

Figure 17. October 1974 - May 1992 Profile Comparison, Station R-20.

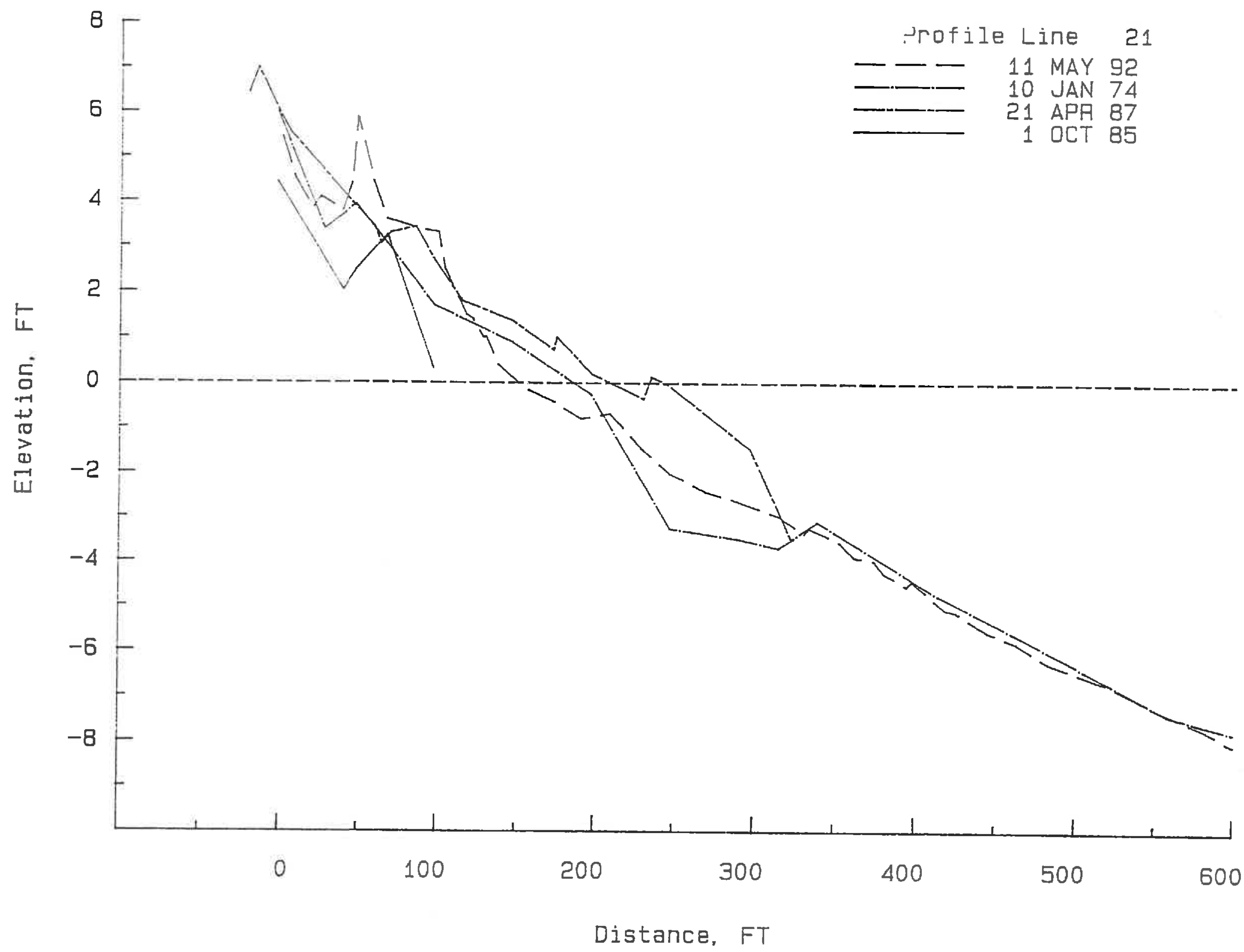

Figure 18. January 1974 - May 1992 Profile Comparison, Station R-21G.

Table 6. Comparison of 1974 and 1992 Beach Profiles Measured South of Hurricane Pass.

Profile	NGVD Change (ft)	Annual NGVD Change (ft/yr)	Volume Change (cu yd/ft)	Annual Volume Change (cu yd/ft/yr)
R-18	-380	-21.1	-71	-3.9
R-19	-170	-9.4	-35	-1.9
R-20	-150	-8.3	-50	-2.8
R-21	-35	-1.9	-55	-3.1
Average	-184	-10.2	-53	-2.9

notes:

1) + indicates accretion and - indicates erosion,

2) some volume changes were estimated, due to lack of profile closure,

3) compare against USACOE (1980) results for 1974-1977 period:

R-16 to R-18	-17.2 ft/yr
R-18 to R-20	-18.3 ft/yr

Recent profile comparisons were also made for the Honeymoon Island area between stations HI-5 and HI-12, based on quarterly monitoring surveys conducted by USF. These comparisons are shown in Figures 19 through 26. Recall that the 1989 beachfill was placed between HI-5 and HI-10. Table 7 clearly shows the results of this comparison, namely the tendency for sediments to shift southward out of the fill area and onto the shoreline along the north margin of Hurricane Pass.

D. Inlet Bathymetry

Bathymetry in and adjacent to Hurricane Pass and North Willy's Cut is shown in Figure 27 (a larger version of the figure, which shows more detailed bathymetry, will be enclosed as Attachment 1 to the final inlet management plan). The bathymetry shown in Figure 27 was created using data from several field surveys:

- May 1992 beach/offshore profiles and inlet cross-sections measured during the inlet management plan study, coupled with March 1992 vertical aerial photographs, were used to describe bathymetry seaward of the passes,

- 1990-1991 USF surveys of ebb- and flood-tidal deltas were used to supplement May 1992 data in the immediate vicinity of the passes,

- March 1992 Pinellas County survey data between Hurricane Pass and the ICWW were used to supplement May 1992 beach and inlet cross-section data (see Figure 28 for County and other inlet/interior channel survey locations).

Maximum depths observed in May 1992 at Hurricane Pass and North Willy's Cut were -19 ft NGVD and -12 ft NGVD, respectively.

Recent USF investigations of the Hurricane Pass region have documented the size, volume and characteristics of ebb-and flood-tidal deltas (Davis and Klay, 1990; Cuffe, 1991; Gibeaut and Inglin, 1992). Cores and surface sediment samples taken between 1989 and 1991 (see Figure 29) serve as the basis for conclusions drawn by these studies. Based on the USF work and recent field observations, the following are known:

- The Hurricane Pass/Willy's Cuts ebb-tidal delta covered approximately 4.8 million sq ft (109 acres) in 1990,

Table 7. 1989-1992 Volumetric Changes Following Placement of the 1989 Honeymoon Island Beachfill (see Figure 6 for profile locations and Figures 19 through 26 for profile comparisons).

Profile Station	Volume Changes (cu yd/ft) (measured to ±1,000 ft from shore) 12/89 to 6/90	6/90 to 11/90	11/90 to 5/91	5/91 to 5/92	12/89 to 5/92
HI-5	-6.2	+0.2	+6.6	-9.3	-8.7
HI-6	-42.0	+17.9	-25.5	-4.8	-54.4
HI-7	+2.0	-12.0	-18.9	-37.4	-66.3
HI-8	+22.6	-1.8	-21.5	-49.0	-49.7
HI-9	+24.2	+1.7	-6.7	-23.0	-3.8
HI-10	-2.8	+14.7	+31.5	+8.9	+52.3
HI-11	-18.4	-10.8	+38.7	+18.1	+27.6
HI-12	+5.6	+7.6	+3.6	0.0	+16.8

note that + indicates accretion and - indicates erosion.

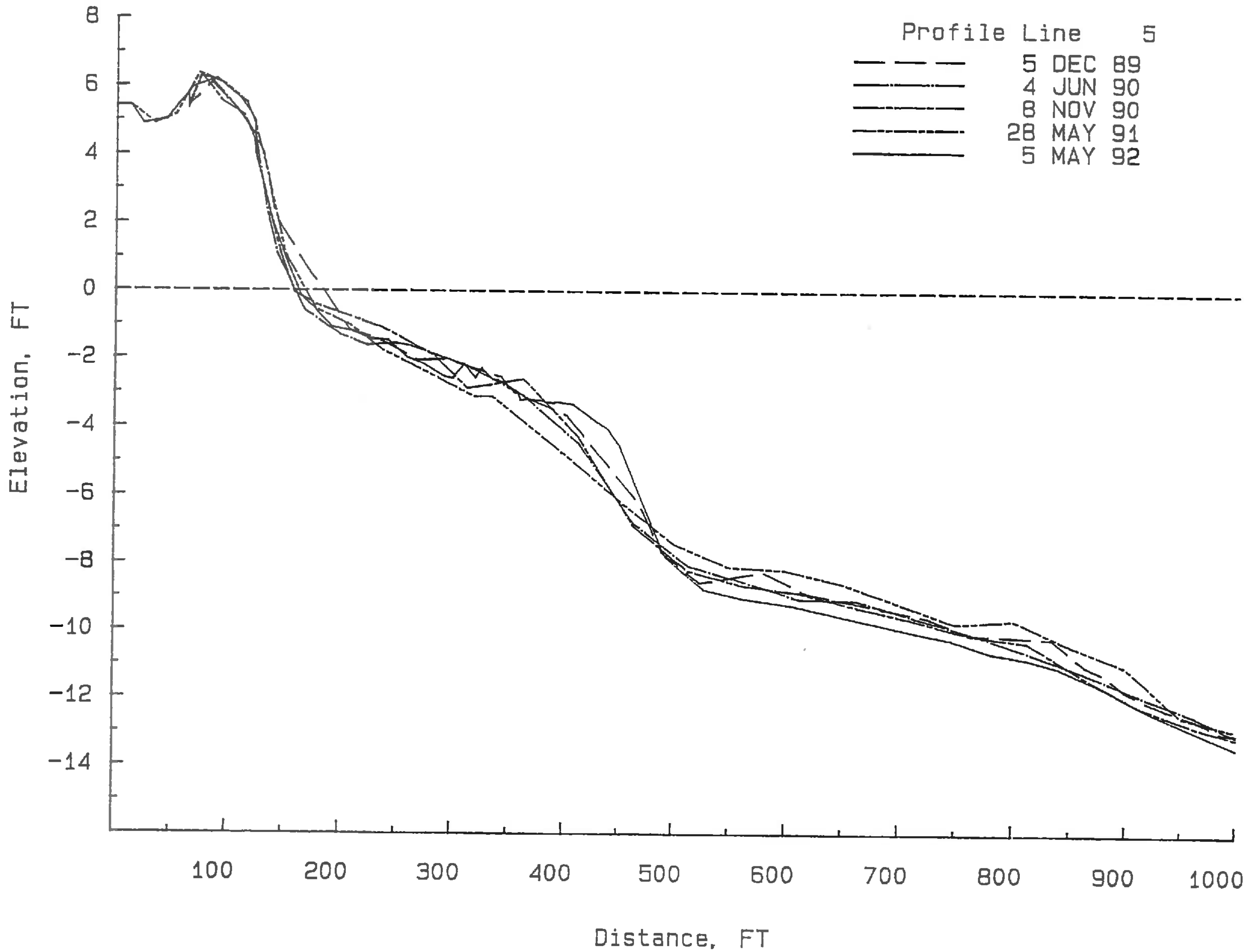

Figure 19. **December 1989 - May 1992 Profile Comparison, Station HI-5.**

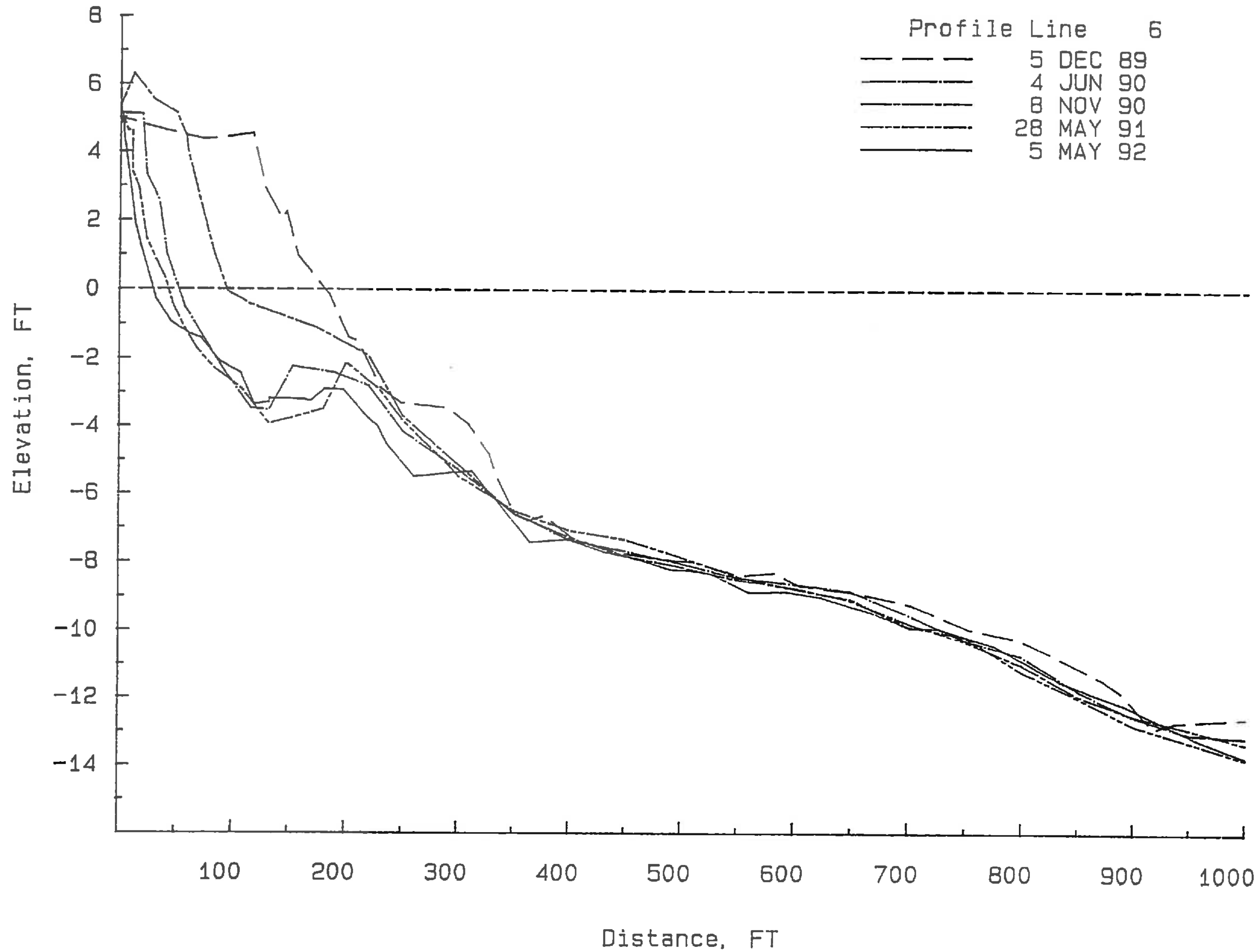

Figure 20. **December 1989 - May 1992 Profile Comparison, Station HI-6.**

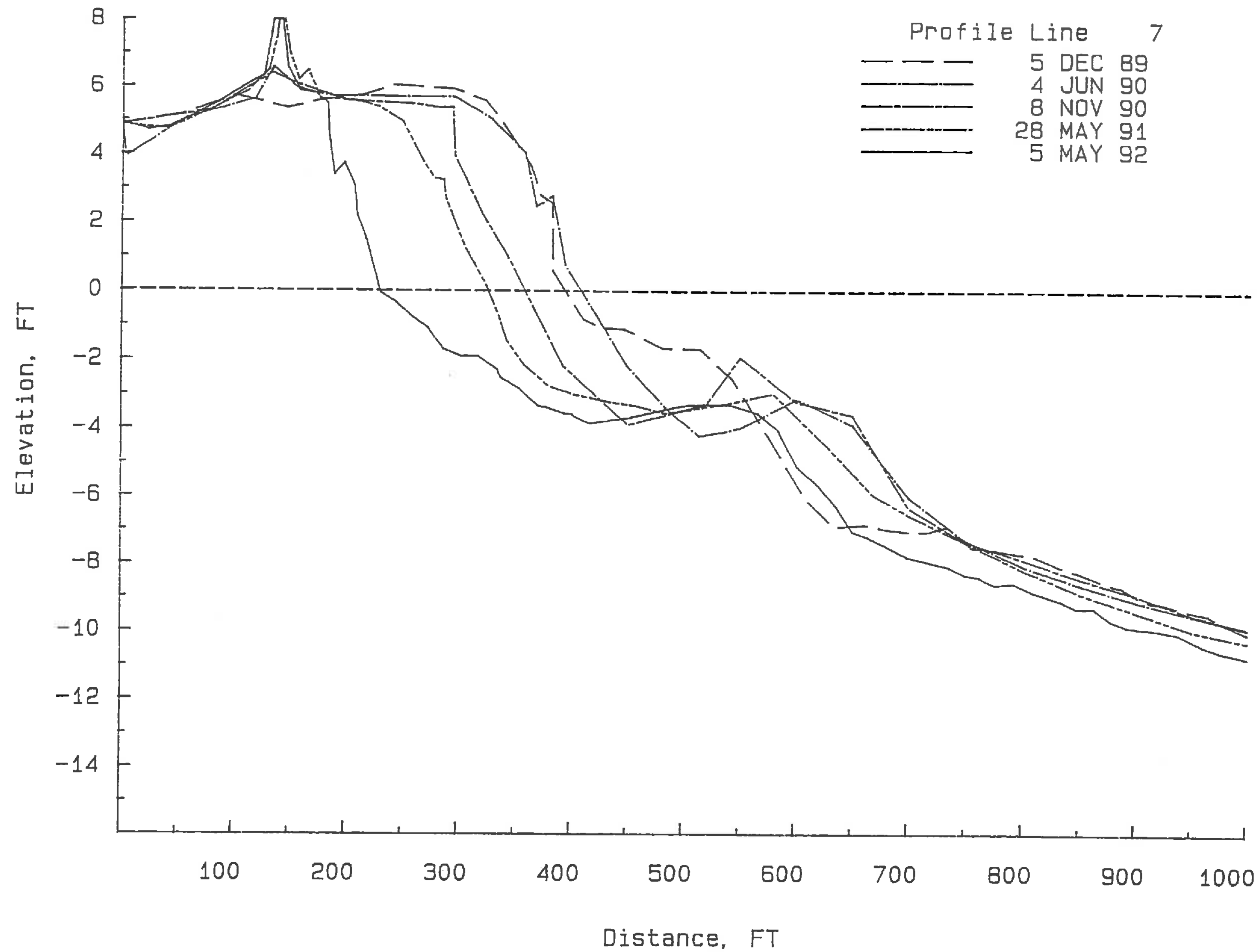

Figure 21. **December 1989 - May 1992 Profile Comparison, Station HI-7.**

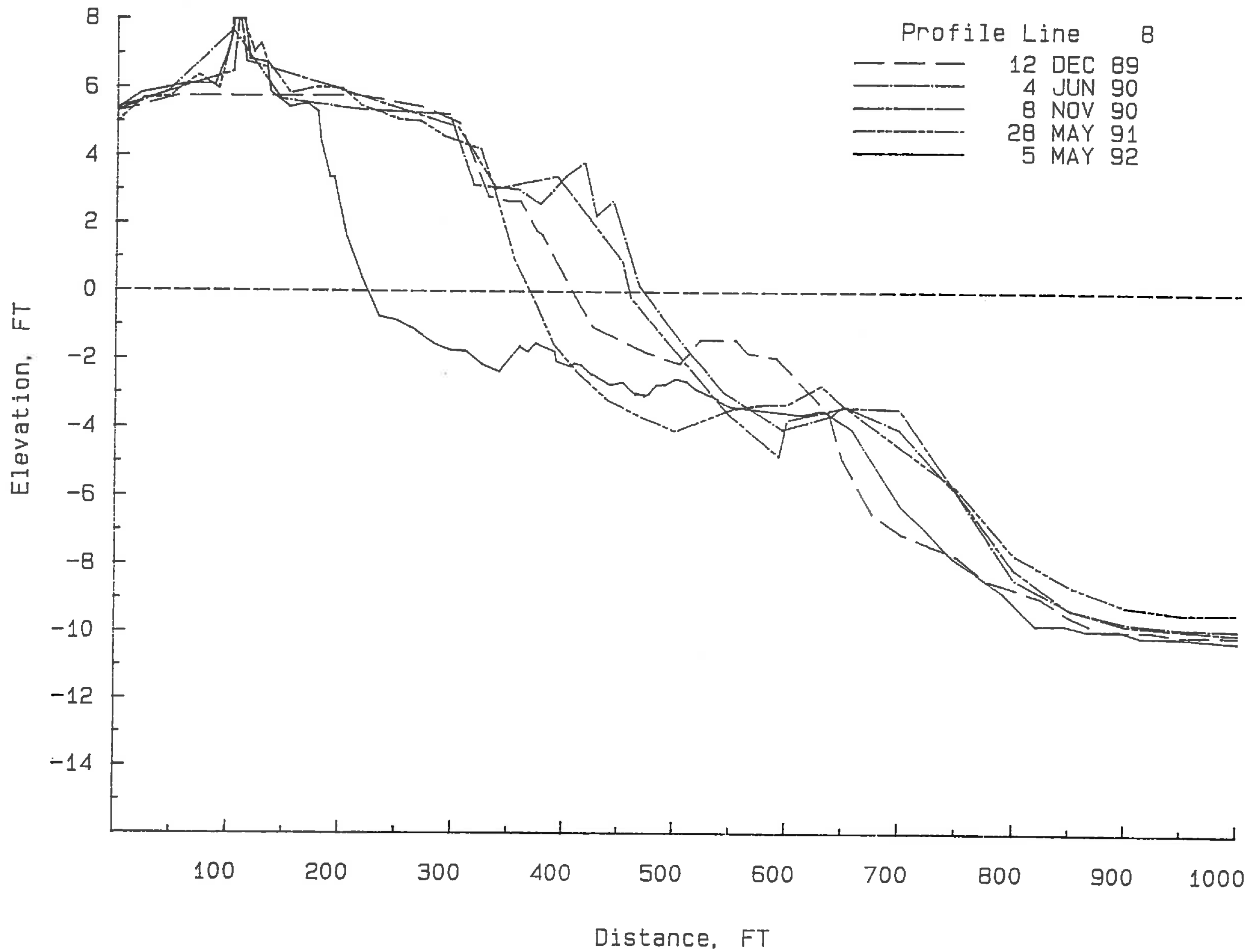

Figure 22. **December 1989 - May 1992 Profile Comparison, Station HI-8.**

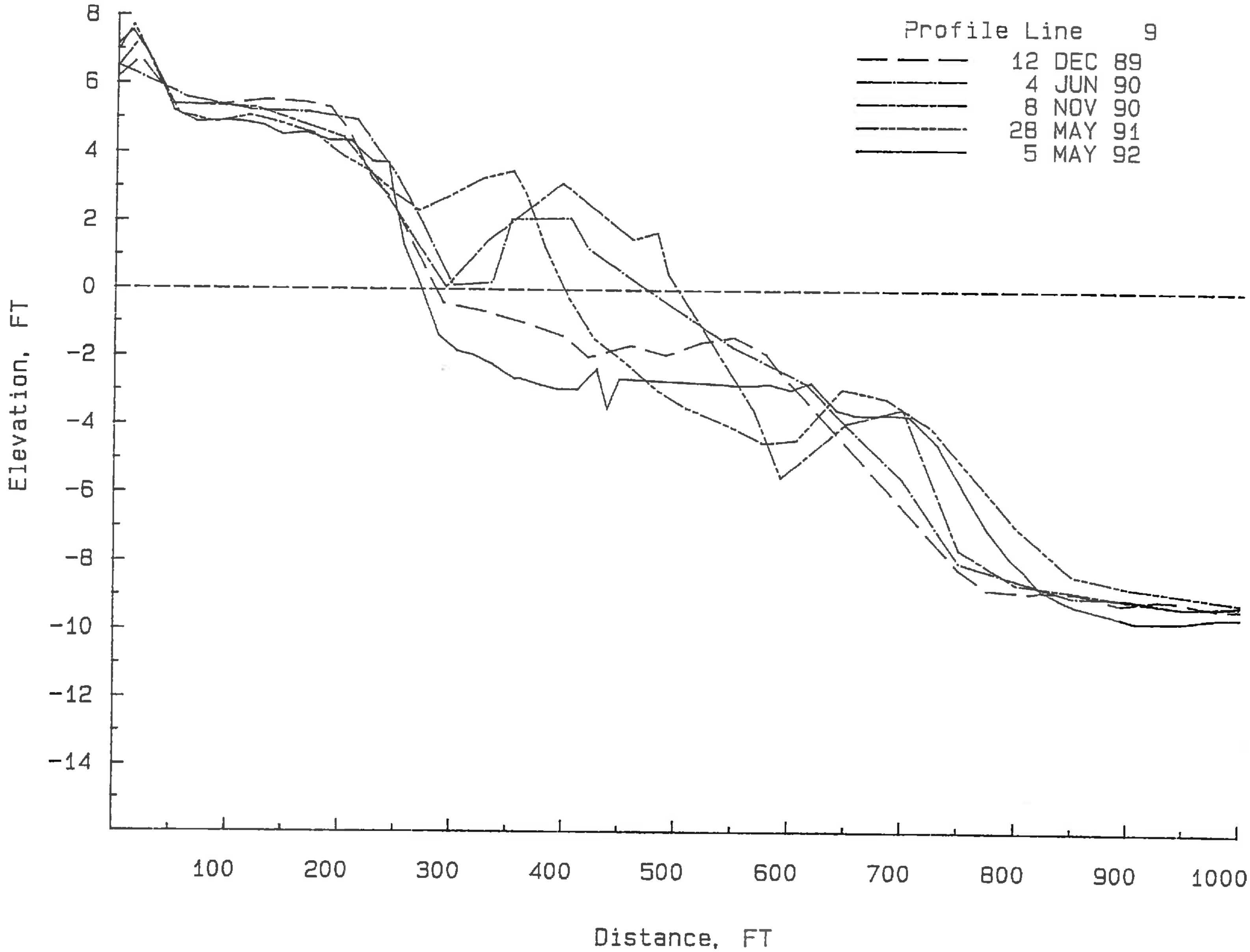

Figure 23. December 1989 - May 1992 Profile Comparison, Station HI-9.

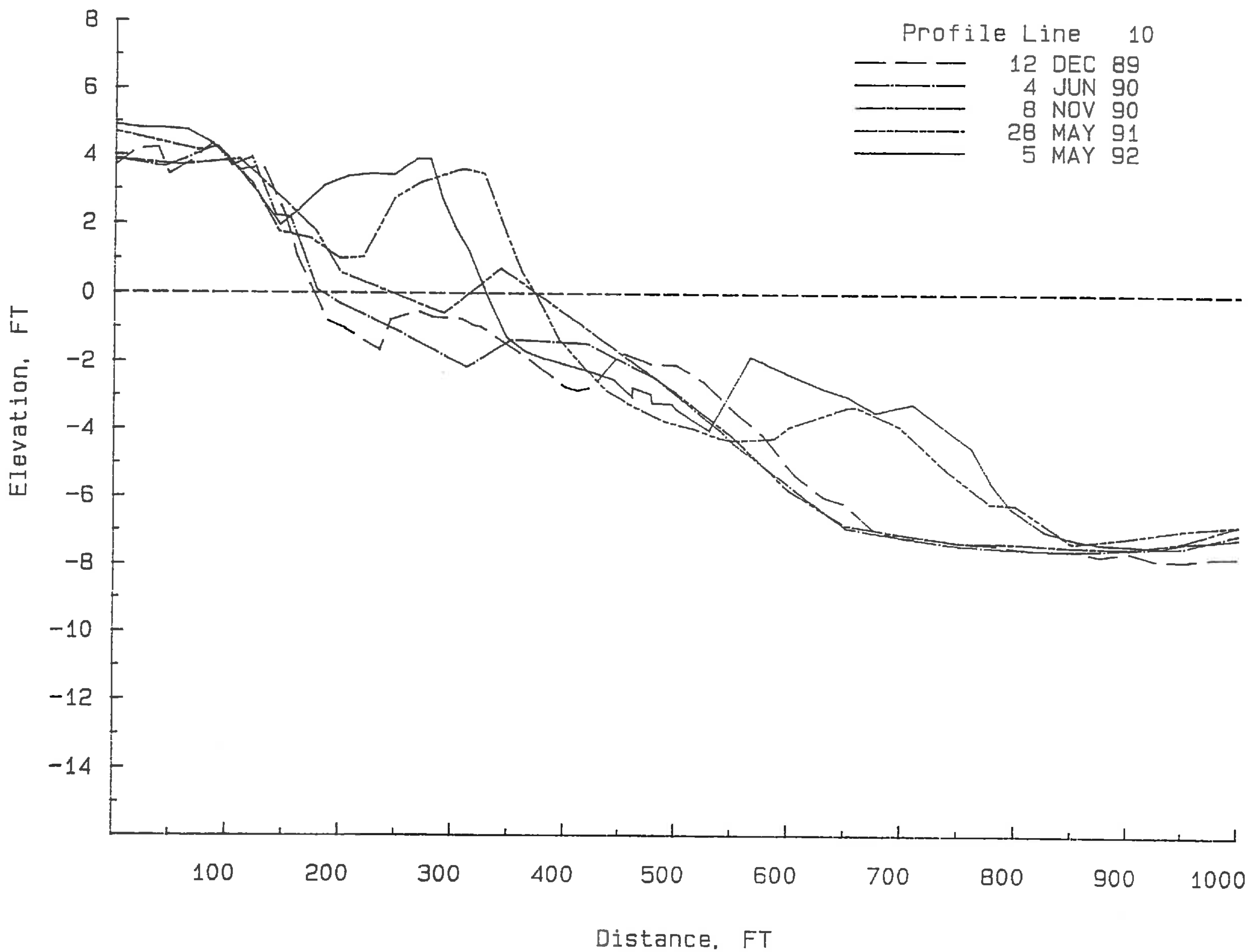

Figure 24. December 1989 - May 1992 Profile Comparison, Station HI-10.

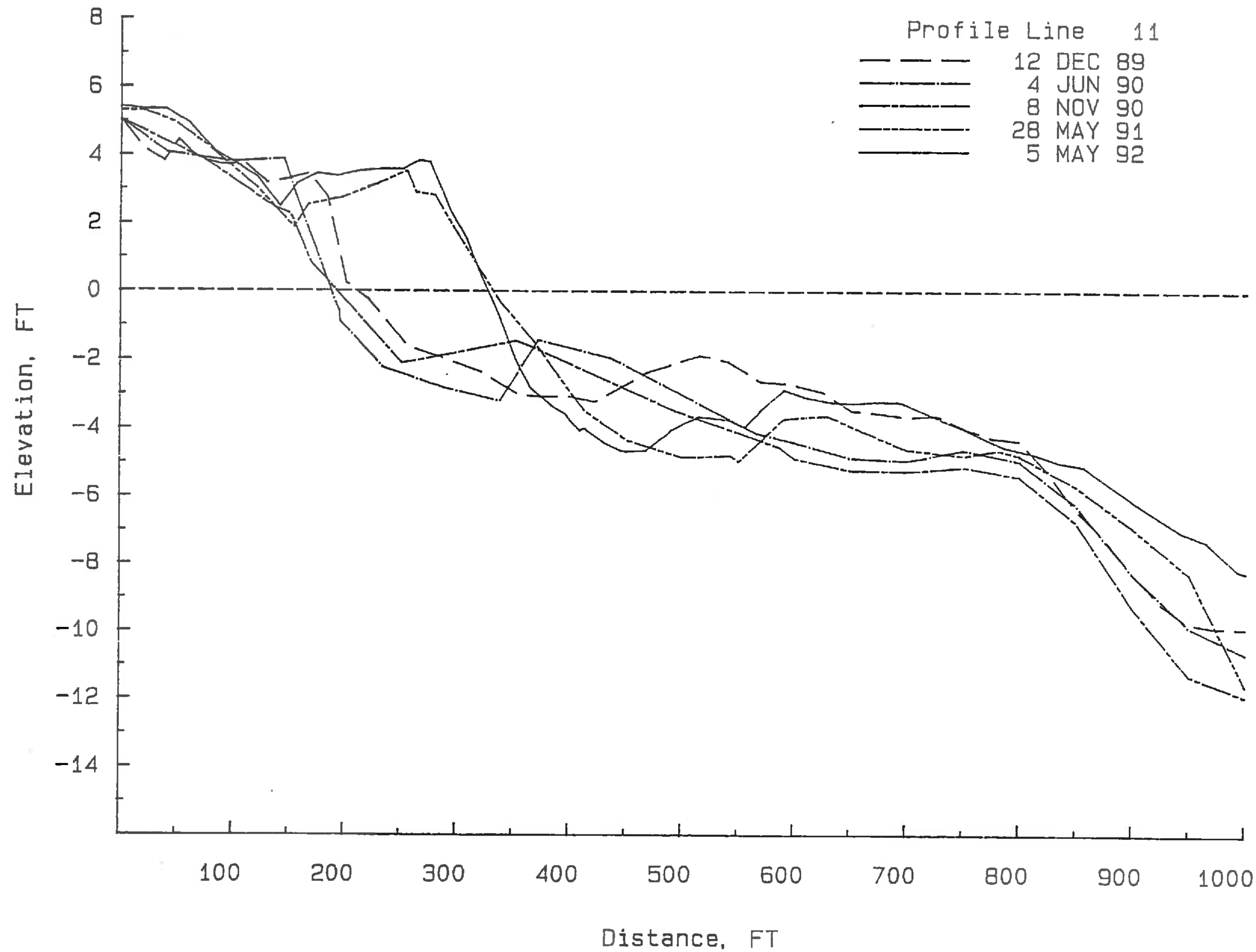

Figure 25. December 1989 - May 1992 Profile Comparison, Station HI-11.

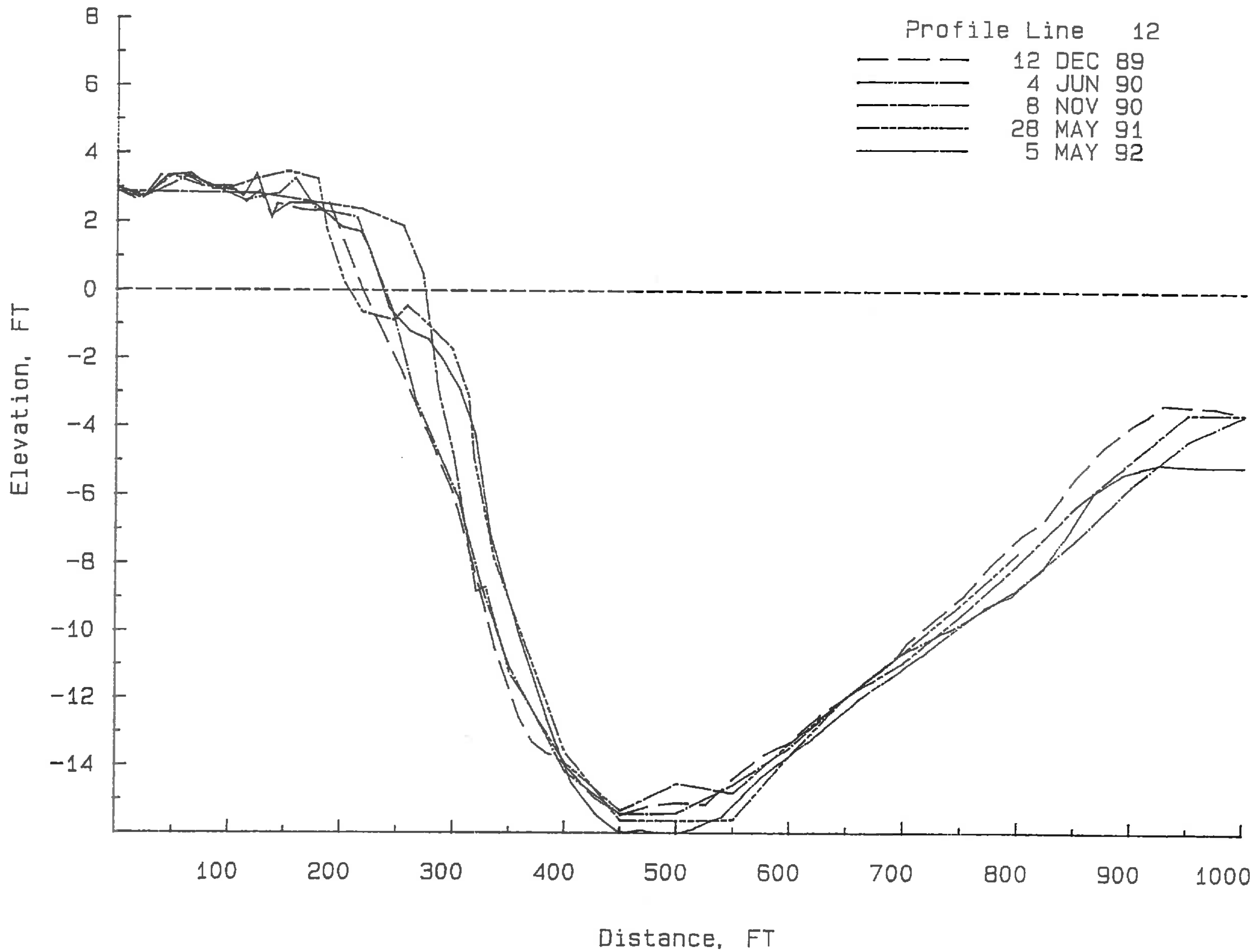

Figure 26. **December 1989 - May 1992 Profile Comparison, Station HI-12.**

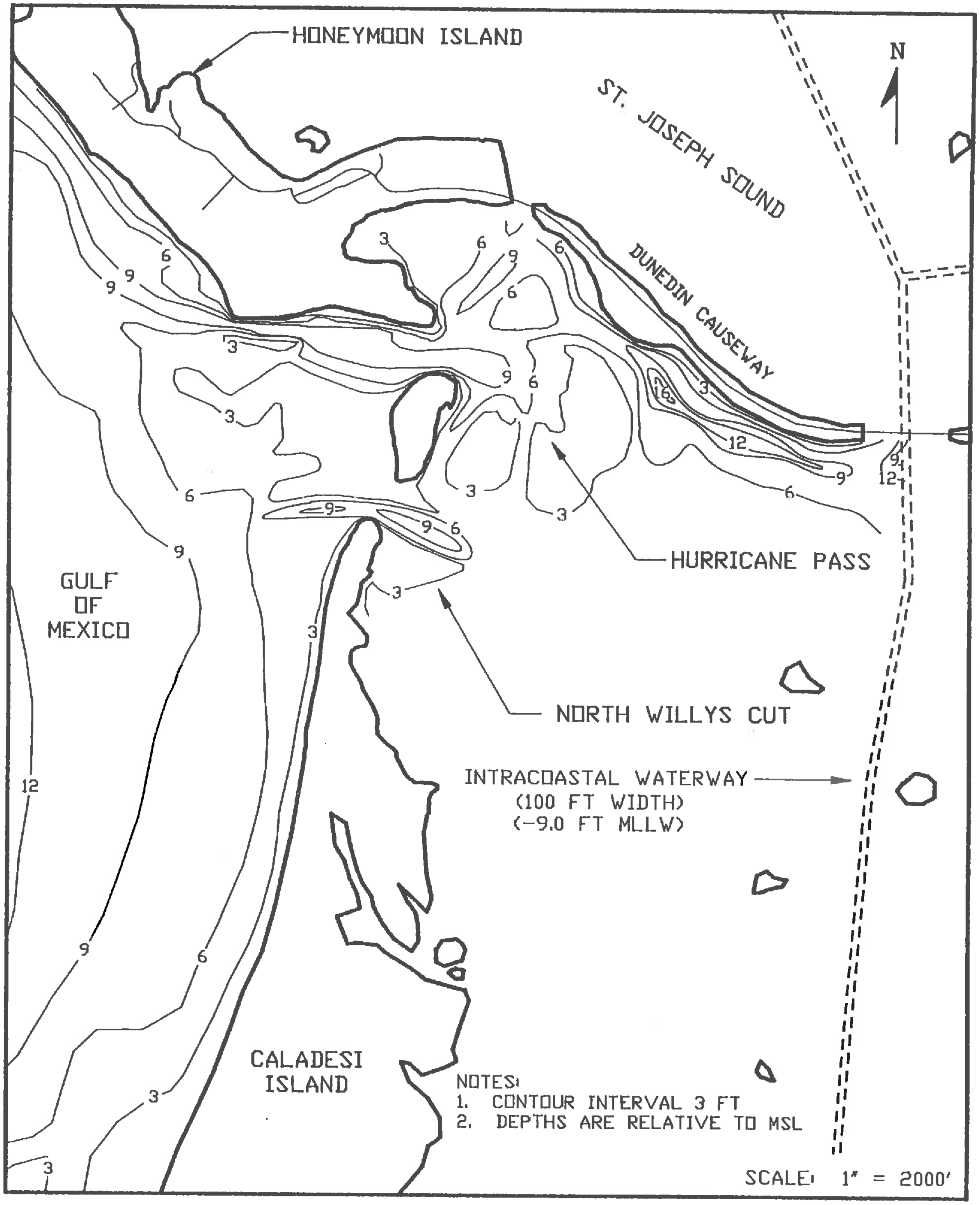

Figure 27. Hurricane Pass and Vicinity Bathymetry, Derived from May 1992 Inlet and Beach Profiles and 1990-1992 Interior Inlet Surveys.

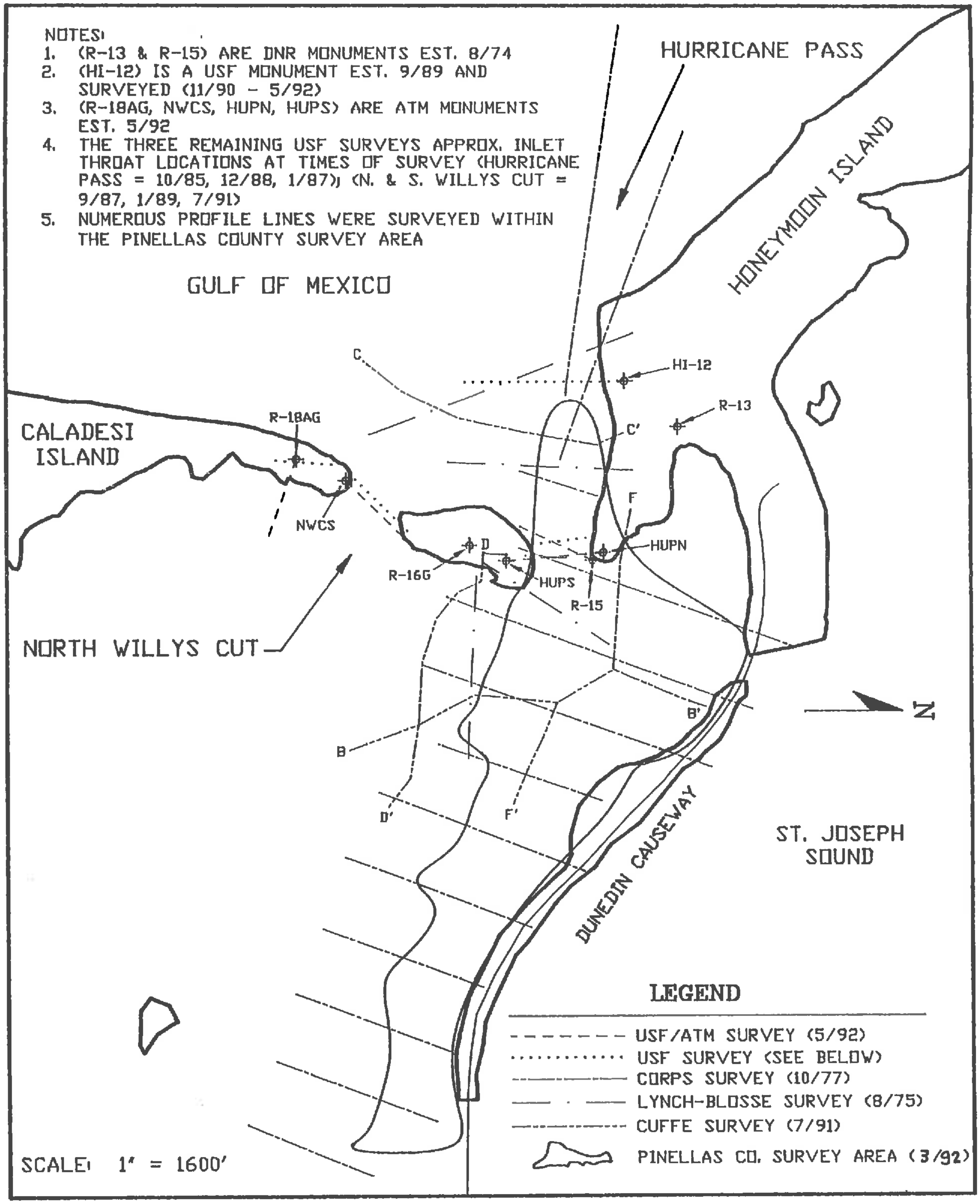

Figure 28. Hurricane Pass and Vicinity, Interior Inlet Survey Locations.

- The Hurricane Pass/Willy's Cuts flood-tidal delta covered approximately 4.5 million sq ft (102 acres) in 1990,

- Ebb- and flood-tidal delta surface areas were approximately the same in March/May 1992,

- The ebb-tidal delta deposits of Hurricane Pass have an average thickness of approximately 5 ft, and are composed predominantly of sand-sized sediments,

- The Hurricane Pass/Willy's Cuts ebb tidal delta contains over 1,000,000 cubic yards of sediment, much of which is suitable for beach nourishment (see below),

  Hurricane Pass flood-tidal delta deposits average 2.5 ft in thickness, and are composed predominantly of sand and shell,

- The flood-tidal delta contains approximately 500,000 cubic yards of sediment; much of this is covered by seagrasses.

The *Honeymoon Island Study, Phase One - Sand Source Investigation* (Davis and Klay, 1990) located and examined six potential sand sources between Anclote Key and Hurricane Pass for future Honeymoon Island beach nourishment projects, including the Hurricane Pass ebb-and flood-tidal deltas. The study concluded that the ebb-tidal delta of Hurricane Pass was the most likely source for maintenance nourishment.

A more detailed examination of the ebb-tidal delta in the *Honeymoon Island Study, Phase Three* (Gibeaut and Inglin, 1992) located approximately 800,000 cubic yards of sediment on the swash platform, of which 240,000 cubic yards were proposed for future use (see Figure 30). It should be noted, however, that Gibeaut and Inglin expressed concern over possible impacts of sediment removal on local sedimentation patterns.

Information on the depth and extent of underlying rock in the vicinity of Hurricane Pass has been limited to data gathered during coring operations (see Figure 29). However, it is known that the presence of bedrock can exert control over the location and behavior of Pinellas County barriers and inlets. More exact information on underlying rock and its influence might be obtained from an analysis of seismic and side scan sonar records collected during 1989 (see Figure 31); these records have not been fully analyzed to date.

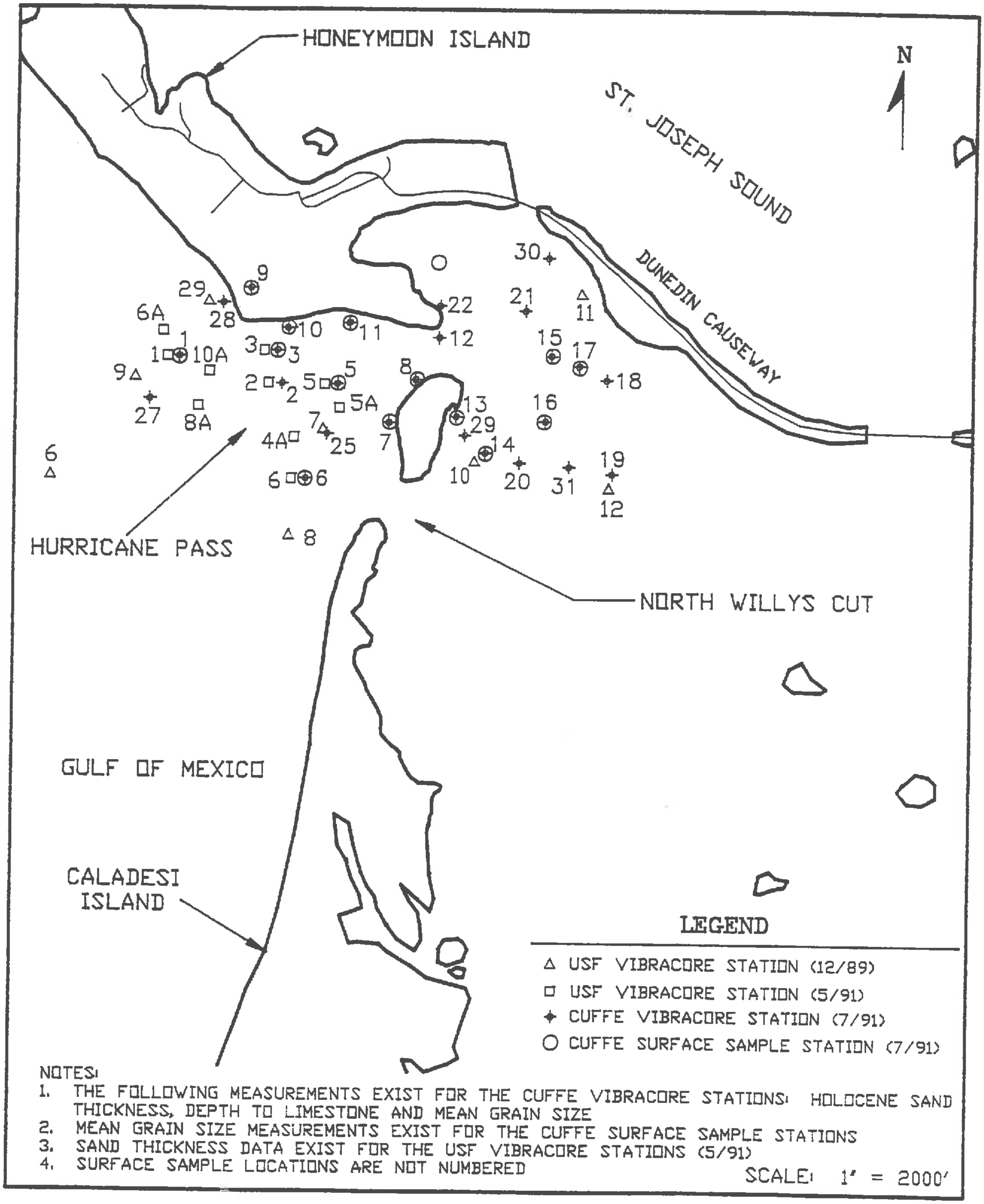

Figure 29. Location of Hurricane Pass and Vicinity Vibracores and Sediment Samples.

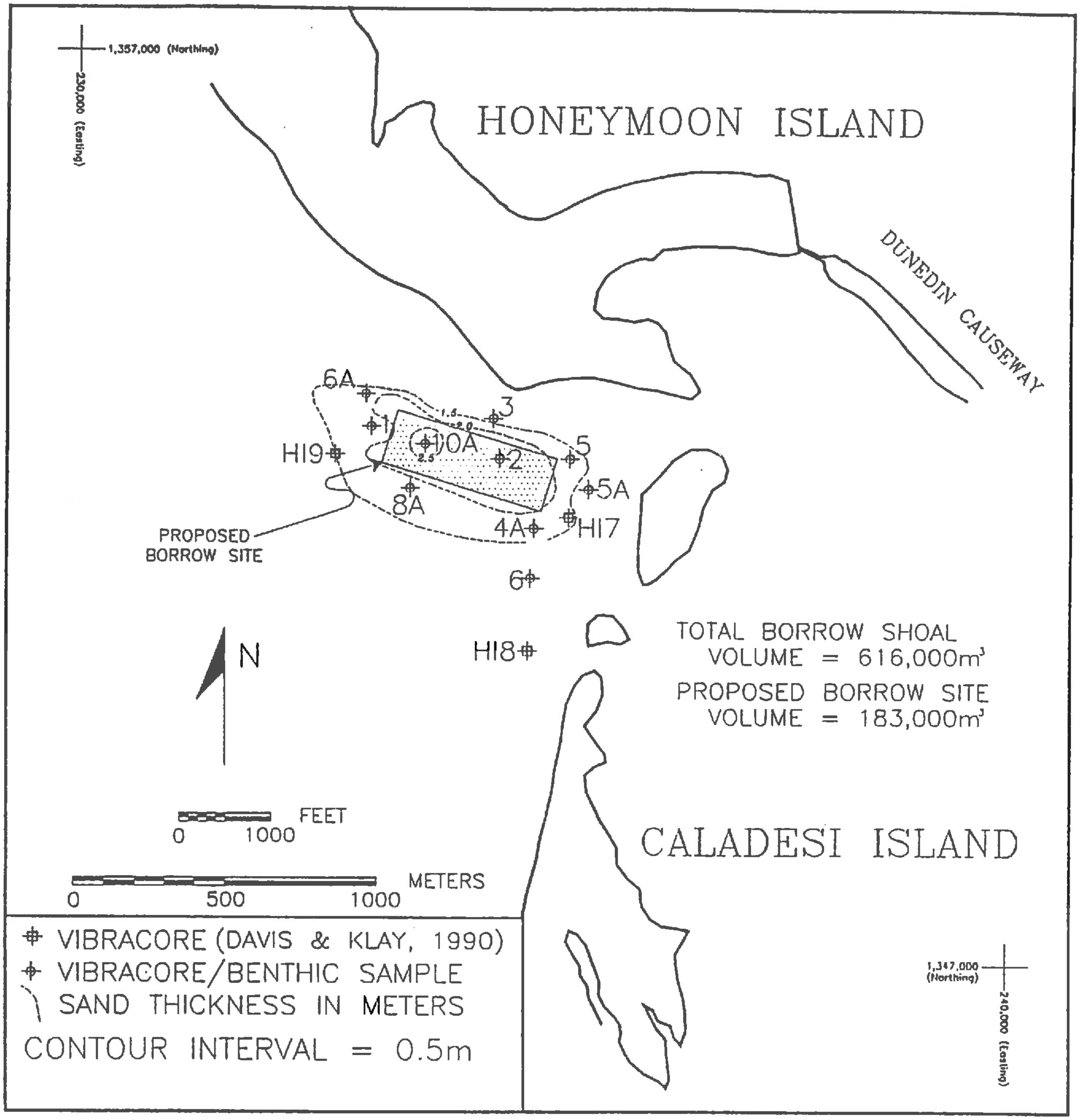

Figure 30. Sediment Thickness Map of Nourishment Quality Material in the Hurricane Pass Ebb-Tidal Delta (taken from Gibeaut and Inglin, 1992).

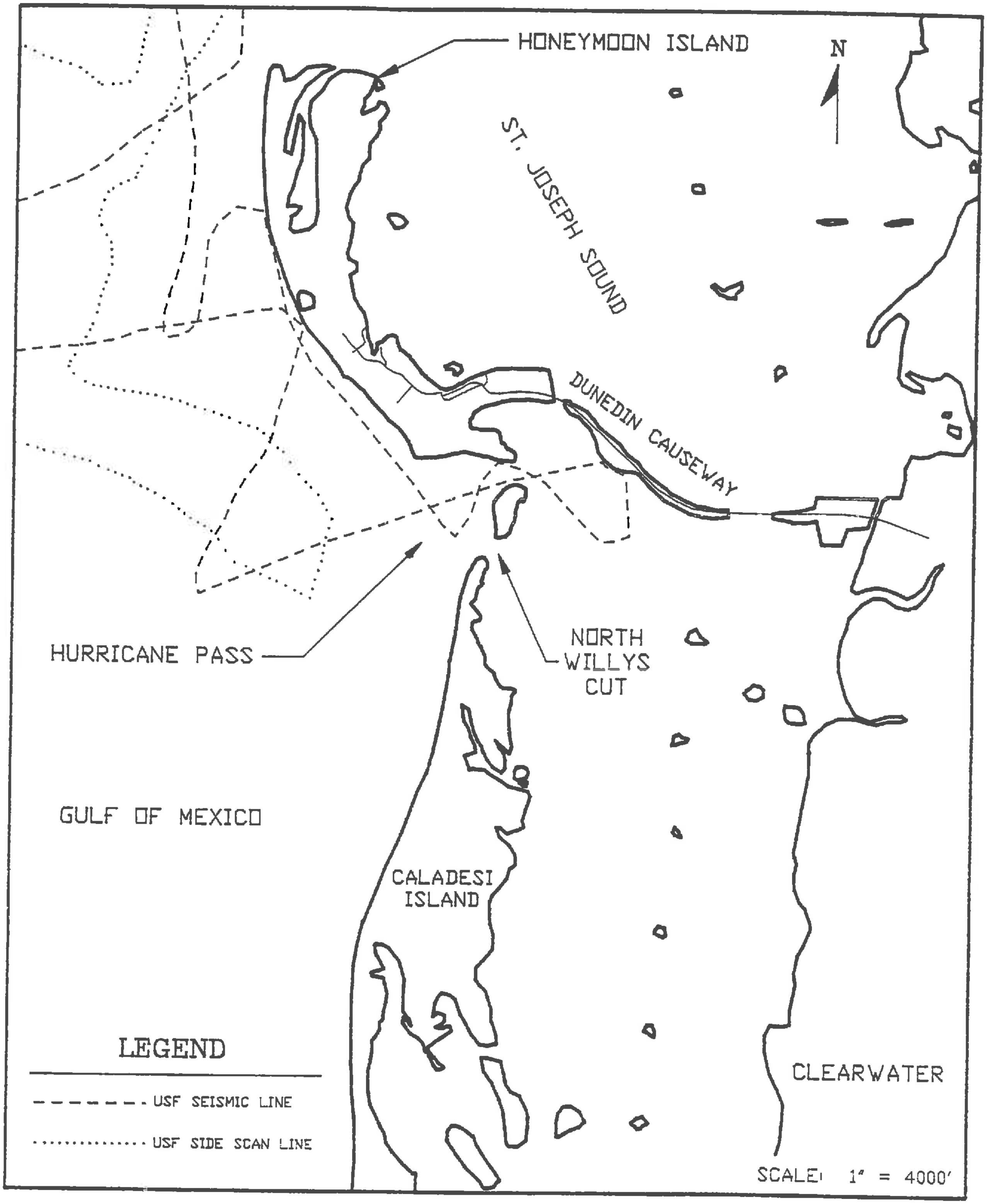

Figure 31. 1989 Seismic and Side Scan Sonar Tracks.

E. Sediment Budget

An approximate sediment budget for the Hurricane Pass area can be constructed from the information contained in Inglin (1991). Inglin derived a sediment budget for Honeymoon Island based on beach profile data, earlier studies of inlet and delta changes, aerial photographs and morphologic evidence. Inglin concluded:

- approximately 13,000 to 26,000 cu yds bypass Hurricane Pass annually and move onto Honeymoon Island,

- a small but unknown volume is lost each year to the flood-tidal delta,

- losses to the ebb-tidal delta are thought to be small.

The quantity estimated to bypass Hurricane Pass each year was at one time contributing to the growth of the Hurricane Pass ebb-tidal delta. Cuffe (1991) determined that most of the ebb-tidal delta growth occurred between 1921 and 1957; since that time the ebb-tidal delta area has diminished somewhat in size. This trend is consistent with the general history of Hurricane Pass (see Figure 4) where the inlet width (and presumably, size) grew until the Dunedin Causeway was constructed.

The opening of Willy's Cuts appears to have affected the distribution of ebb-tidal delta sediments, but does not appear to have significantly increased the ebb-tidal delta volume. Of course, if North Willy's Cut continues to grow in size this statement may no longer hold. Future changes in ebb-tidal delta volume and configuration, and in sediment bypassing will depend upon the combined sizes of Hurricane Pass and North Willy's Cut.

Davis and Gibeaut (1988) estimated the net littoral drift at Hurricane Pass to be approximately 75,000 cu yds/yr to the south). However, given the prevailing wave climate, local drift rates and directions are easily influenced by slight changes in shoreline orientation or the presence of ebb-tidal deltas. This accounts for the northward directed bypassing at the Hurricane Pass (and the northward migration of Dunedin Pass prior to its closure).

F. Stability and Hydraulic Characteristics of the Inlet

An examination of the history of Hurricane Pass shows that the pass has responded quickly to changes in bay area and other factors affecting its existence. The fact that the pass grew rapidly following its initial formation and continued to grow until construction of the Dunedin Causeway indicates Hurricane Pass is the preferred hydraulic connection into southern St. Joseph Sound. The recent closure of Dunedin Pass reinforces this notion.

The emergence and growth of North Willy's Cut, with little or no apparent impact on Hurricane Pass, indicates that Hurricane Pass alone cannot efficiently fill the bay. In fact, calculations based on USF flow measurements in July and September 1991 show that Hurricane Pass was supplying only 40 to 45 percent of the total tidal prism to the bay. North Willy's Cut was providing approximately 15 percent of the bay tidal prism at the same time. South Willy's Cut was supplying only 1 to 2 percent of the bay tidal prism. The remaining prism was being supplied by openings through the Dunedin and Clearwater Causeways. [These figures are based on a bay surface area of 2.51×10^8 ft^2, and spring bay tidal prism of 7.03×10^8 ft^3.]

Comparison of July 1991 inlet cross-sections and tidal prisms (see Figure 32) shows that Hurricane Pass, North Willy's Cut and South Willy's Cut all followed the Gulf coast prism-area relationship developed by Jarrett (1976). All three inlets were in sedimentary equilibrium. The fact that South Willy's Cut closed shortly thereafter shows that the cut was not stable at its July 1991 size.

Transformation of Jarrett's prism-area relationship into a velocity-area relationship shows that a non-jettied or single-jettied Gulf coast inlet must possess a cross-sectional area greater than 2,000 ft^2 in order to support average maximum flow velocities of 2.2 ft/sec on a semidiurnal tide, probably near the lower threshold for hydraulic stability. While this analysis is simplistic in the case of multiple inlets (where stable inlets can drive flow through a small, unstable inlet), it does correlate with the observed behavior of South Willy's Cut.

Examination of *NOS Tide Tables* shows that the ratio of mean tide ranges at Dunedin (Sta. 3715) and the South end of Anclote Key (Sta. 3717) is 0.90 (1.9 ft/2.1 ft); the ratio of diurnal tide ranges is 0.93 (2.8 ft/3.0 ft). If it is assumed that the Dunedin tide is typical of the bay tide and the Anclote Key tide is typical if the Gulf of Mexico tide,

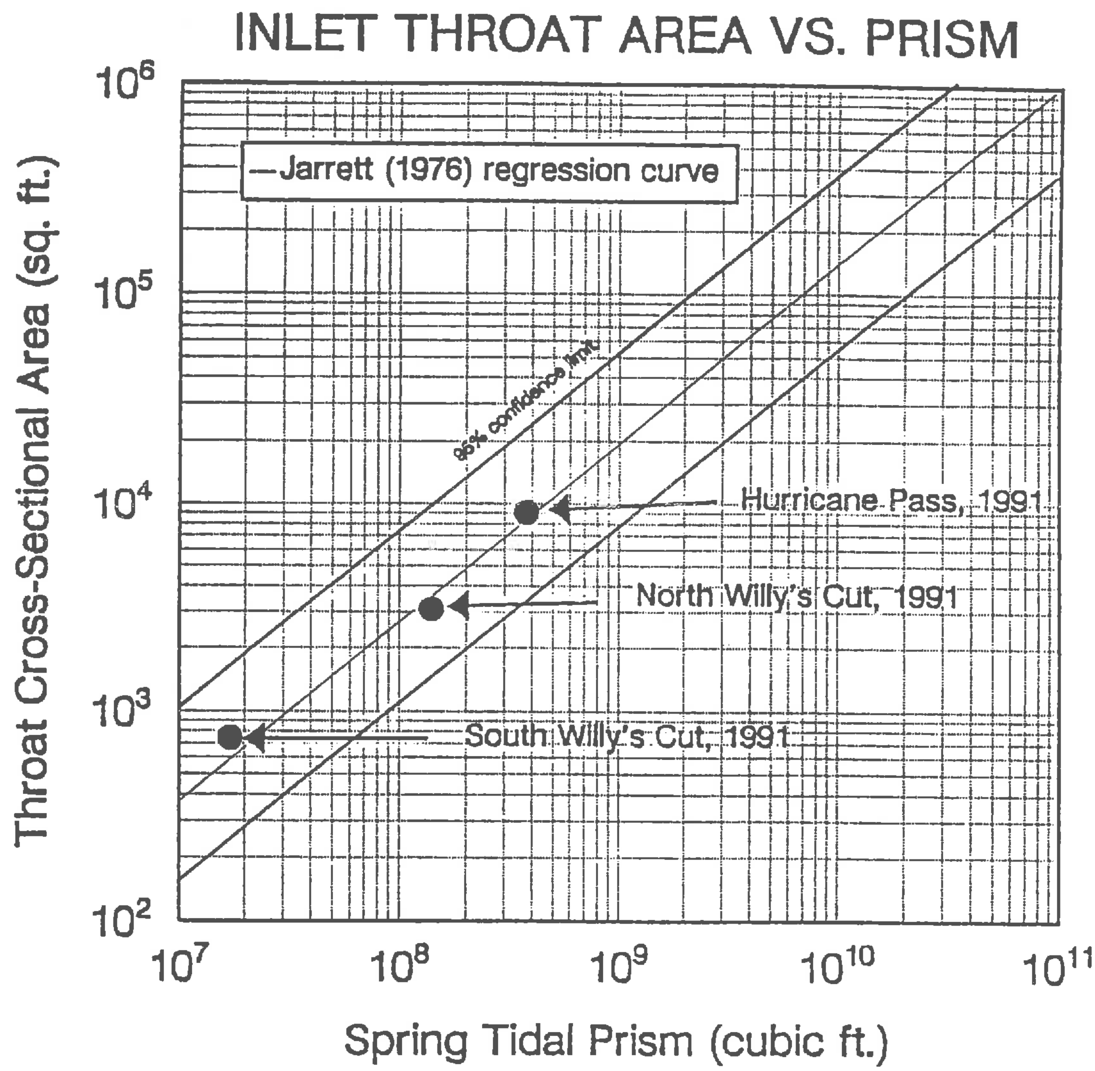

Figure 32. Comparison of July 1991 Inlet Cross-Sections and Tidal Prisms (from Gibeaut and Inglin, 1992).

then there is some potential for additional growth of an inlet without a corresponding reduction in another inlet or causeway opening into the bay.

This may be what is happening at North Willy's Cut. If so, it appears that North Willy's Cut may further increase its size and contribution to the total prism. However, at some point one of three scenarios will play out: 1) Hurricane Pass and North Willy's Cut will exist in equilibrium; 2) North Willy's Cut will enlarge and Hurricane Pass will grow smaller; 3) North Willy's Cut will gradually close and Hurricane Pass will again serve as the primary conduit for flow into and out of the bay.

Erosion, overwash and occasional breaching along the northern end of Caladesi Island over the past 70 years points to the continued potential for breaching and pass formation in the area, even if North Willy's Cut closes. This indicates the likelihood that, over the long term, scenario 1) or 2) above will take place. Prolonged northward migration of North Willy's Cut may ultimately result in the passes joining together. Future monitoring of inlet cross-sections using the monuments installed in May 1992 will help to assess inlet changes and guide management of the Hurricane Pass region.

G. Wind and Wave Climate

Winds in the area vary seasonally and during storms. Winds during the summer tend to be light, and mostly from the south. Strong winds during the fall and winter are associated with the passage of cold fronts, and tend to be from the north. With the exception of strong thunderstorms and tropical storms, waves and sediment transport tend to be higher during the winter months.

Wave data for the area are available from three sources: the University of Florida Coastal Data Network (CDN) gage off Clearwater, Corps of Engineers' Wave Information Studies (WIS) hindcasts, and Littoral Environment Observations (LEO) made by FDNR, Division of Recreation and Parks staff at Honeymoon Island.

Data from the Clearwater CDN gage (approximately for the years 1984 through 1989 are summarized in Table 8. The data show an average annual significant wave height of 0.26 m (0.85 ft) and an mean wave period of 5.11 sec. Extreme wave height statistics derived from the data are shown in Figure 33. The extreme wave analysis predicts 20-year, 50-year and 100-year return frequency wave heights of 2.7 m, 3.1 m and 3.3 m.

Table 8. 1984-1989 Clearwater CDN Gage Data from Wang, et al., (1990); water depth at gage = 5.0 m.

Year/Season	Mean H_S (m)	Maximum H_S (m)	Mean Period (s)
1984			
spring	0.25	1.28	5.69
summer	0.21	0.62	5.20
fall	0.16	0.89	4.43
winter	0.18	1.22	5.26
average	0.20	1.28	5.19
1985			
spring	0.34	1.39	6.02
summer	0.25	1.22	5.04
fall	0.28	1.22	5.31
winter	0.37	1.09	5.79
average	0.30	1.39	5.55
1986			
spring	0.36	1.65	5.63
summer	0.14	0.65	4.60
fall	0.24	0.74	4.61
winter	0.29	0.96	5.13
average	0.27	1.65	5.09
1987			
spring	0.45	2.47	5.96
summer	0.22	1.31	4.49
fall	0.15	0.56	4.05
winter	0.27	1.30	4.97
average	0.28	2.47	4.93
1988			
spring	0.34	1.36	5.41
summer	0.36	1.41	5.67
fall	0.23	1.46	4.98
winter	0.27	1.13	4.93
average	0.29	1.46	5.17
1989			
spring	0.27	1.37	5.16
summer	0.23	0.97	4.44
fall	0.17	0.48	4.52
winter	0.22	0.82	4.66
average	0.23	1.37	4.71
1984-1989	0.26	2.47	5.11

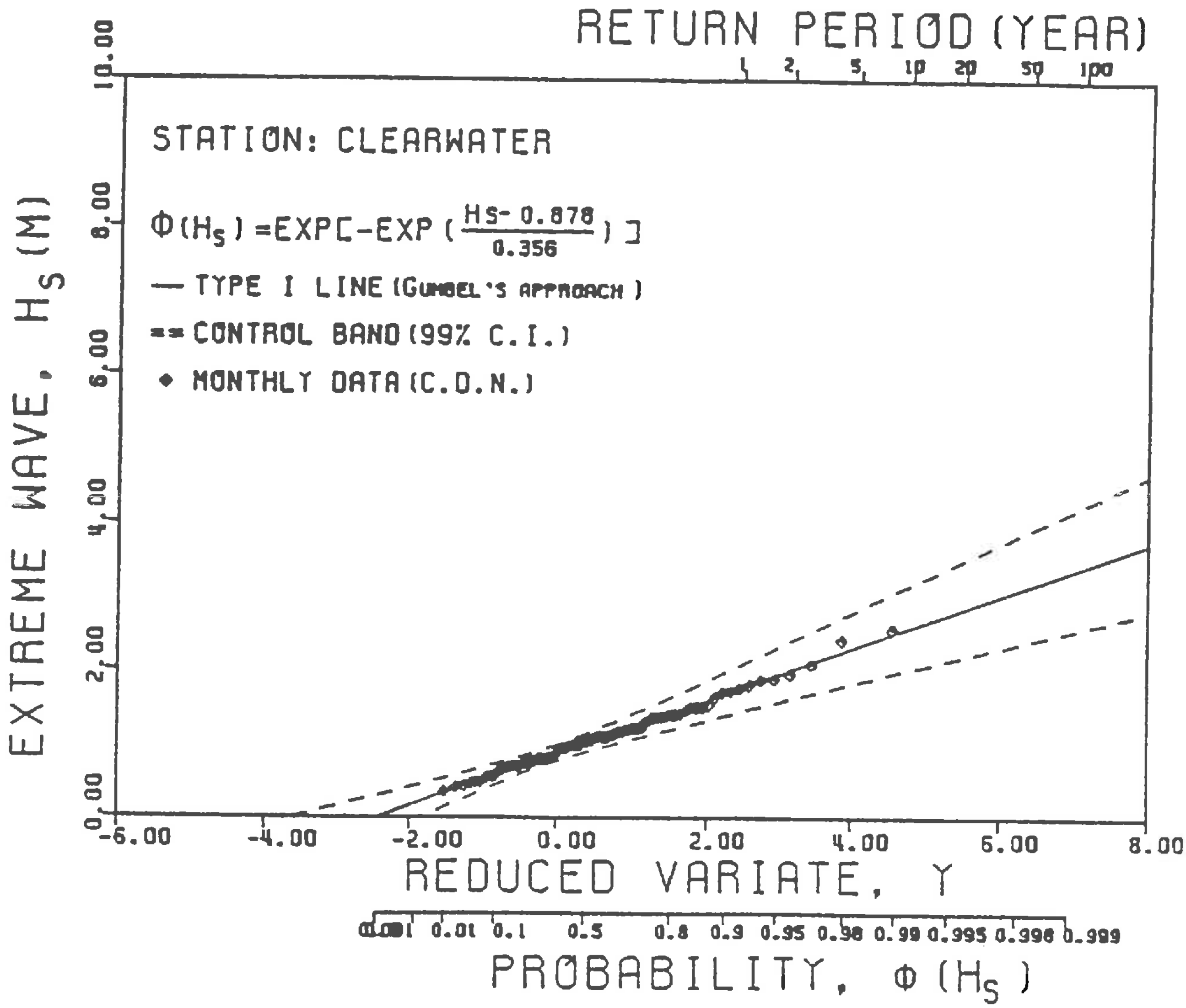

Figure 33. Extreme Wave Height Analysis from Clearwater CDN Gage (from Wang, et al., 1990).

Shallow water WIS wave data are summarized in Hubertz and Brooks (1989). The closest WIS station to the Clearwater CDN gage and Hurricane Pass is Sta. 39 (water depth = 11 m). A comparison of the CDN gage data and the WIS hindcast data (see Figure 34) shows a 0.4 to 0.6 m deviation; the WIS results consistently predict mean monthly wave heights higher than those measured at the CDN gage. However, mean monthly wave periods and monthly maximum wave heights seem to agree. These variations are thought to be due to location and water depth differences (Hubertz and Brooks, 1989). During the 20-year hindcast period (1956-1975), the WIS analysis predicted a maximum significant wave height of 3.1 m.

LEO data were collected near Honeymoon Island profile station HI-6 between December 1989 and November 1990. The data confirm the seasonal trends deduced from CDN and WIS data. Detailed LEO data are contained in the *Honeymoon Island Study, Phase Two* (Coastal Research Laboratory, 1991).

Wave refraction was investigated by the Coastal Research Laboratory (1991), Inglin (1991) and by Gibeaut and Inglin (1992). The results from the latter show that removal of sediment from the proposed Hurricane Pass ebb-tidal delta borrow site (see Figure 30) will not significantly impact refraction patterns.

H. Currents

Tidal currents have been measured at or near Hurricane Pass numerous times over the past 17 years. Figure 35 shows the locations of current measurements taken in the region since 1975. The figure does not include locations of spot measurements measured by ATM/USF in May 1992 (measurements were taken in Hurricane Pass, North Willy's Cut, the west opening of the Dunedin Causeway and in the flood channel between Hurricane Pass and North Willy's Cut).

The most comprehensive current measurements were carried out by USF in July and September 1991. Figures 36, 37 and 38 show the results of the measurements, when recording current meters were deployed in Hurricane Pass, North Willy's Cut and South Willy's Cut. The USF measurements are summarized in Table 9. The Table shows the highest velocities were observed during ebb at Hurricane Pass and South Willy's Cut, and during flood at North Willy's Cut. Velocities at South Willy's Cut were smaller than those at Hurricane Pass and North Willy's Cut.

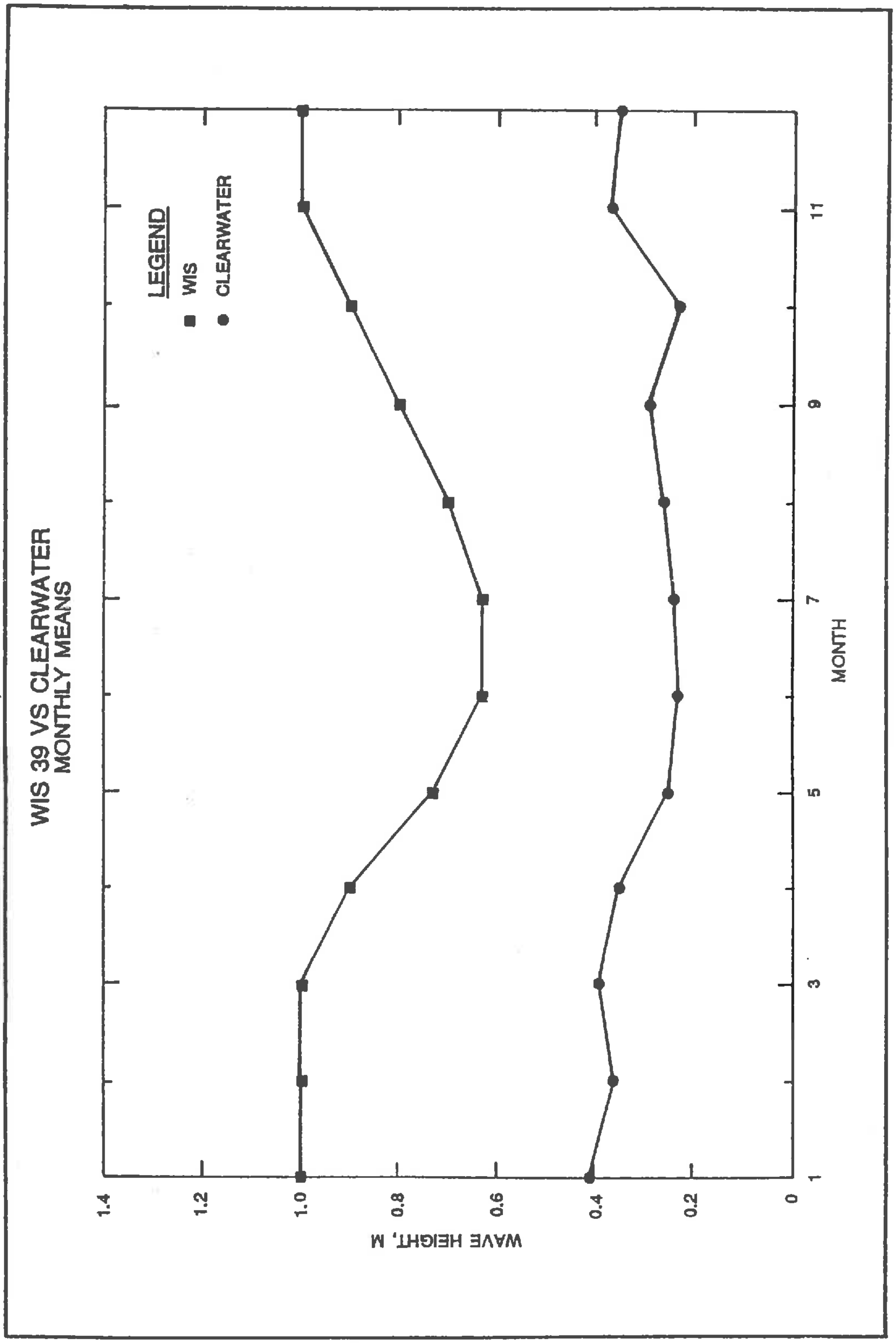

Figure 34. Comparison of Monthly Mean Wave Height Data, CDN Clearwater Gage and WIS Station 39 (from Hubertz and Brooks, 1989).

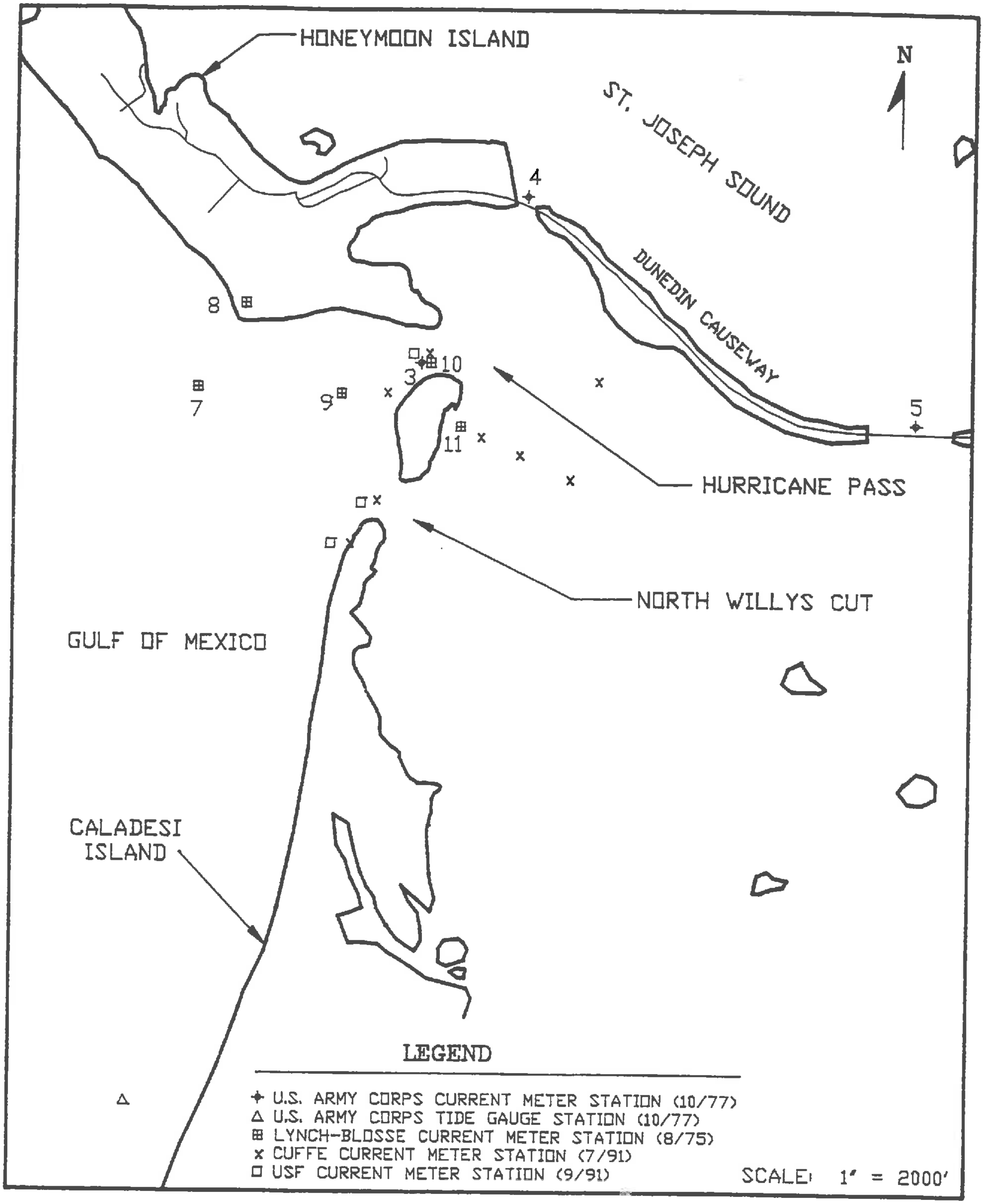

Figure 35. Locations of Current Measurements in the Vicinity of Hurricane Pass.

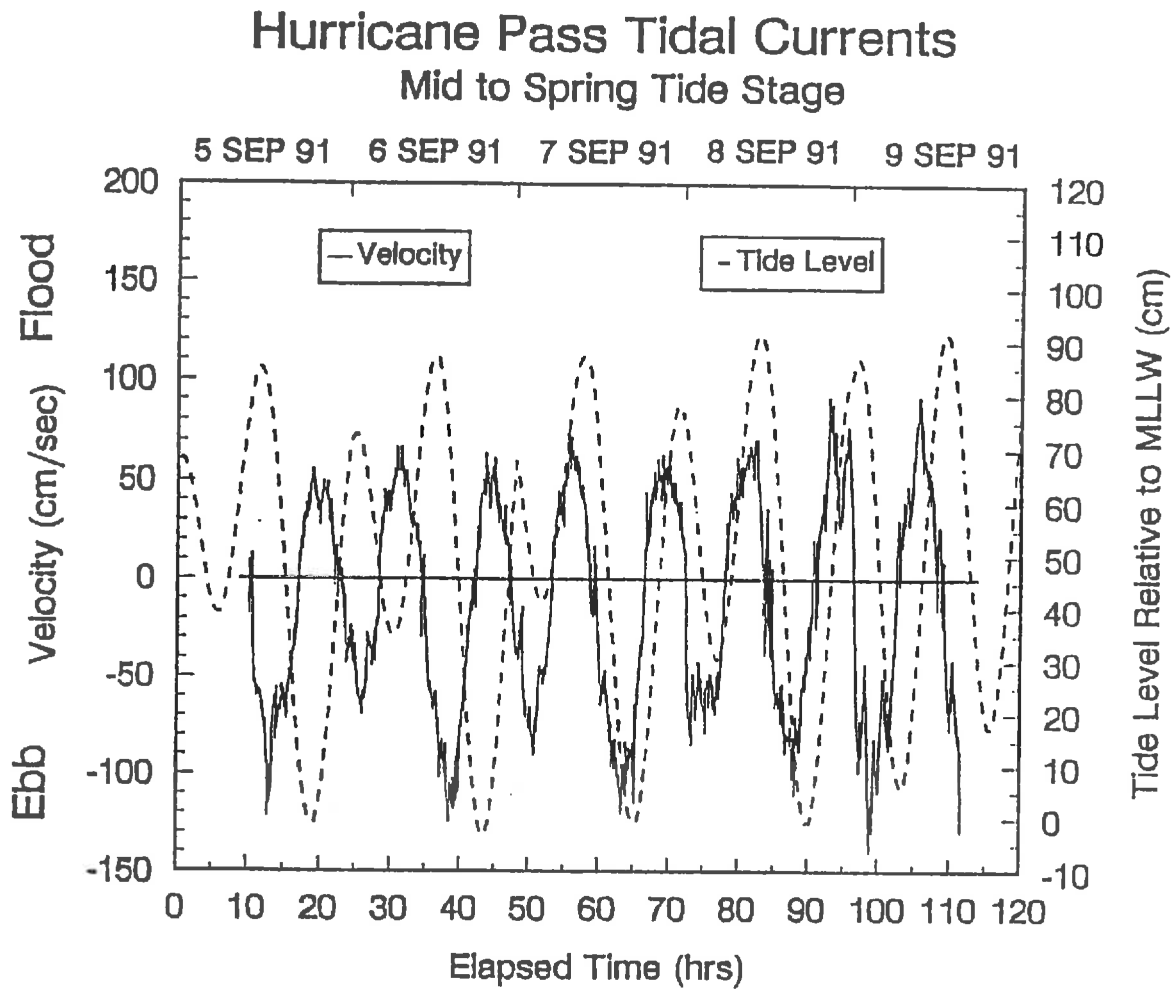

Figure 36. September 1991 Flow Measurements at Hurricane Pass (from Gibeaut and Inglin, 1992).

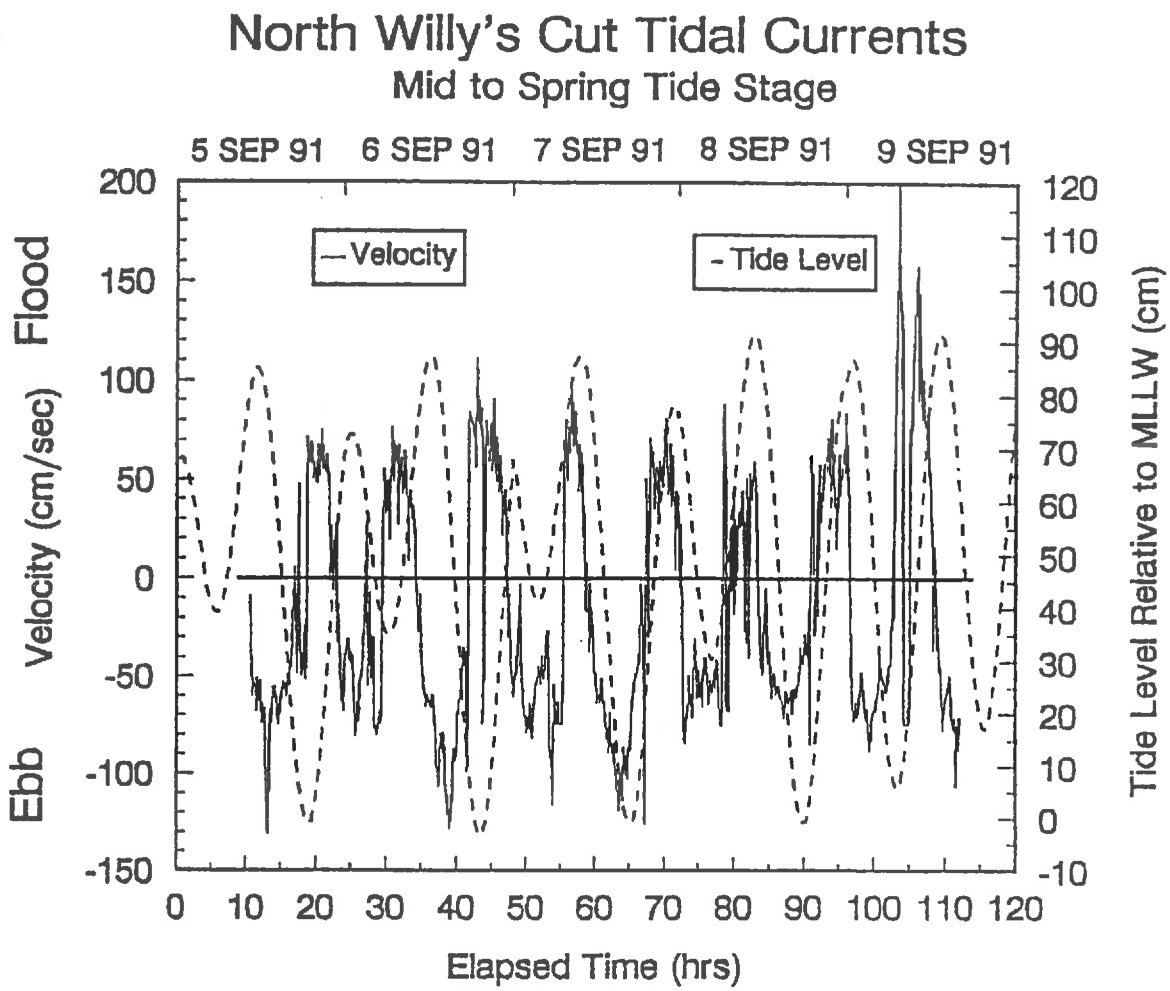

Figure 37. September 1991 Flow Measurements at North Willy's Cut (from Gibeaut and Inglin, 1992).

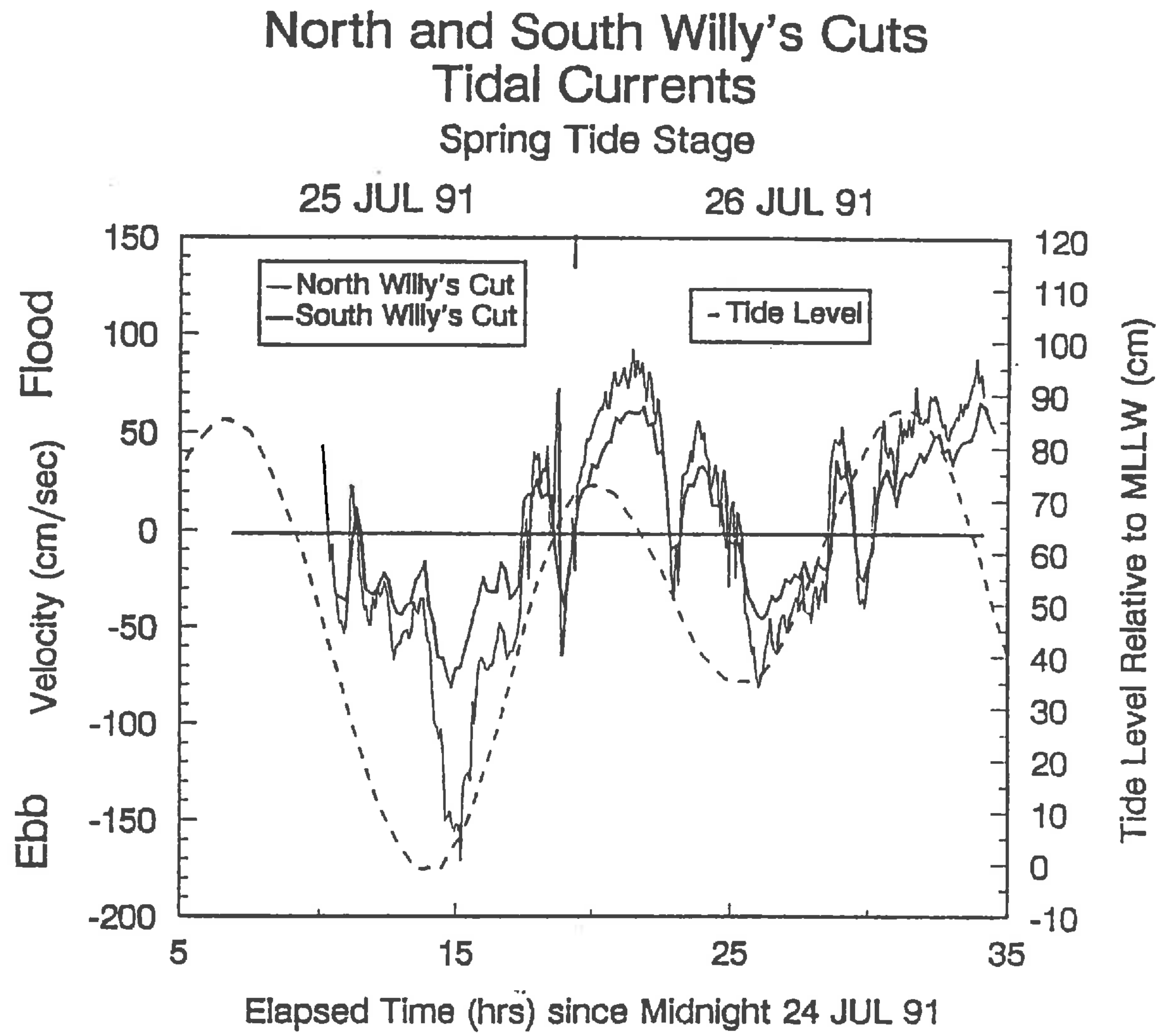

Figure 38. July 1991 Flow Measurements at South Willy's Cut and North Willy's Cut (from Gibeaut and Inglin, 1992).

Table 9. Results of July and September 1991 USF Flow Measurements at Hurricane Pass, North Willy's Cut and South Willy's Cut (all velocities are in ft/sec).

Flow Parameter	Hurricane Pass	N. Willy's Cut	S. Willy's Cut
mean ebb velocity	2.6	2.5	-
mean flood velocity	1.9	2.7	-
spring max. ebb velocity	3.4	2.6	2.3
spring max. flood Velocity	2.5	3.1	1.9

note: the results of ATM/USF spot flow measurements on May 20, 1992 (mid-tide, flood) are consistent with the results shown above:

2.0 ft/sec at Hurricane Pass

2.4 ft/sec at North Willy's Cut

Based on these data alone, it appears that Hurricane Pass is ebb dominant and North Willy's Cut is flood dominant. However, tidal prism calculations by Gibeaut and Inglin (1992) show both passes to be ebb dominant, with ebb tidal prisms from 1.7 to 1.9 times flood tidal prisms.

I. Structures

The only structures occurring along the shoreline within the area influenced by the inlet lie on Honeymoon Island -- two short concrete bag groins and a rock terminal groin. These structures were constructed in 1970 to halt erosion of the 1969 beachfill. The structures are largely ineffective.

A preliminary analysis of structural measures to enhance Honeymoon Island beachfill retention (Jones, 1991 [contained in Coastal Research Laboratory, 1991]) concluded that detached breakwaters or additional groins would help to reduce future beachfill losses. Further consideration will be included in the alternatives analysis of this inlet management plan study.

III. NATURAL RESOURCES

A. General

With the exception of the highly modified beachface and upland area along central Honeymoon Island, the Hurricane Pass region is typical of a natural west central Florida barrier system:

- beaches and nearshore areas are inhabited by fauna adapted to living along high energy shorelines,
- seagrasses colonize much of the flood-tidal delta complex and other protected shallow water areas landward of the barriers,
- uplands are characterized by typical dune and maritime forest communities.

Given the fact that both Honeymoon Island and Caladesi Island are State parks, this natural setting is likely to remain intact into the future.

Prior to the inlet management plan field work, biological investigations concentrated on identifying natural communities associated with potential borrow sources in and around Hurricane Pass. Figure 39 shows the locations of December 1989 and May 1991 USF biological sampling stations.

B. Beach and Dune System and Upland

Beaches and dunes in the vicinity of Hurricane Pass are largely natural, with the exception of the modified portion of Honeymoon Island mentioned previously. Dunes are colonized by typical Florida dune vegetation (e.g., sea oats, panic grass, native ground covers, etc.). Spartina patens occupies wetter regions of the dune community and upper portions of the back barrier marsh. Black mangroves occupy much of the low elevation upland areas on northern Caladesi Island.

C. Estuarine Wetlands

Wetland areas near the pass are dominated by seagrasses and associated communities. Figure 40, based on March 1992 aerial photographs and May 1992 ground trotting, shows the extent of seagrass communities near Hurricane Pass. This figure should be compared with 1982 and 1950 seagrass communities mapped by Florida DNR (see Figure 41 and 42).

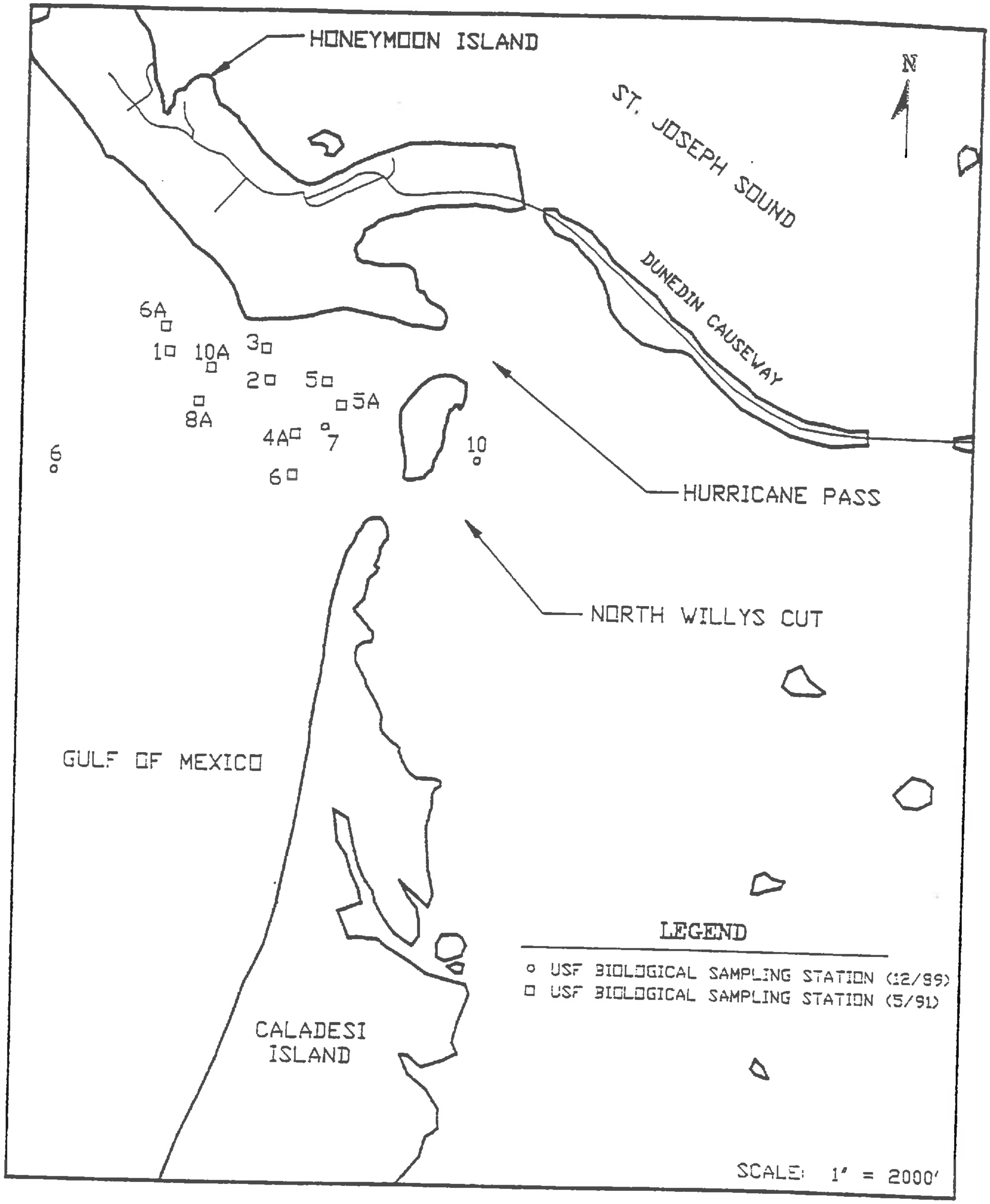

Figure 39. Locations of December 1989 and May 1991 Biological Sampling Stations.

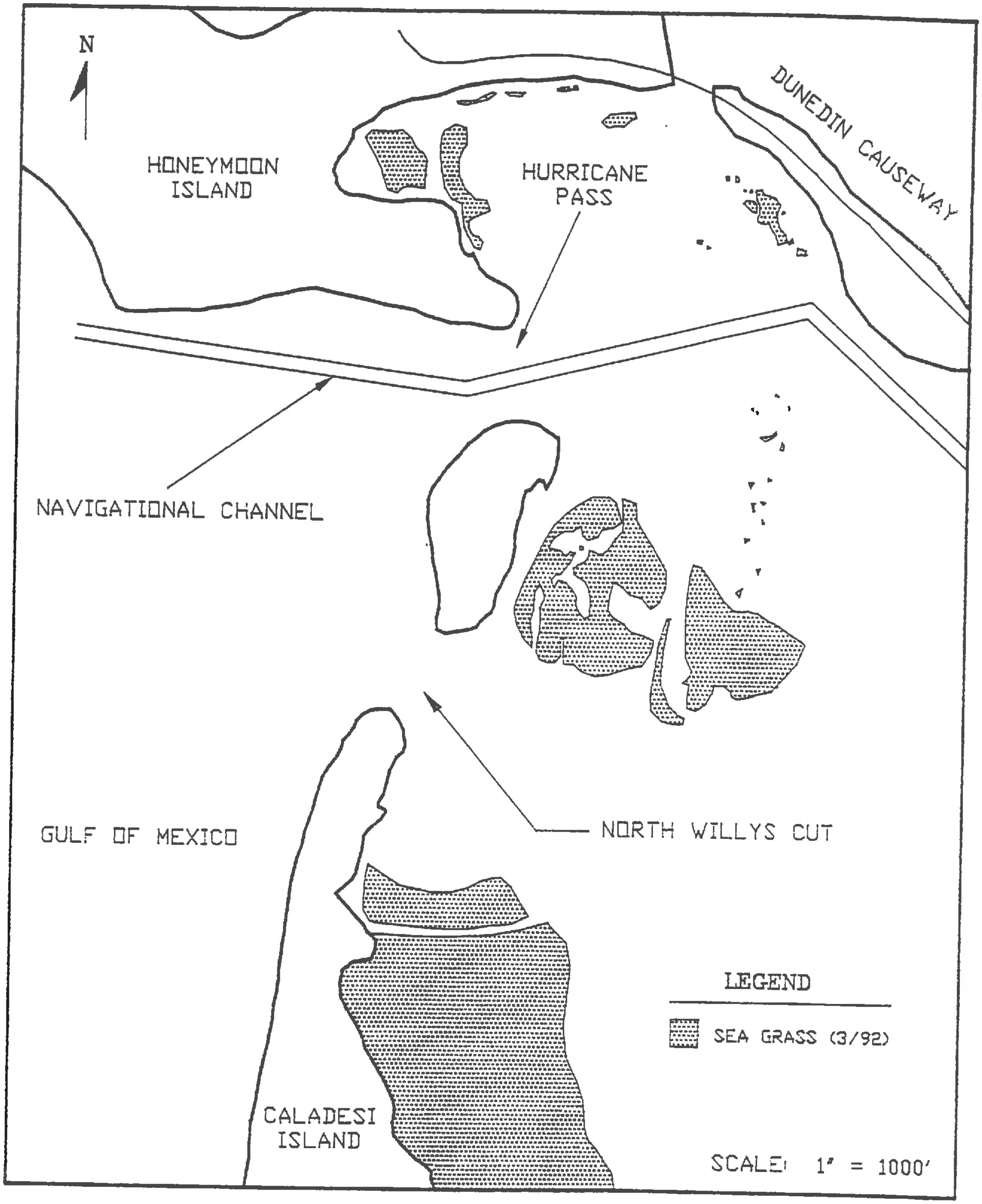

Figure 40. Distribution of March 1992 Seagrass Communities in the Vicinity of Hurricane Pass.

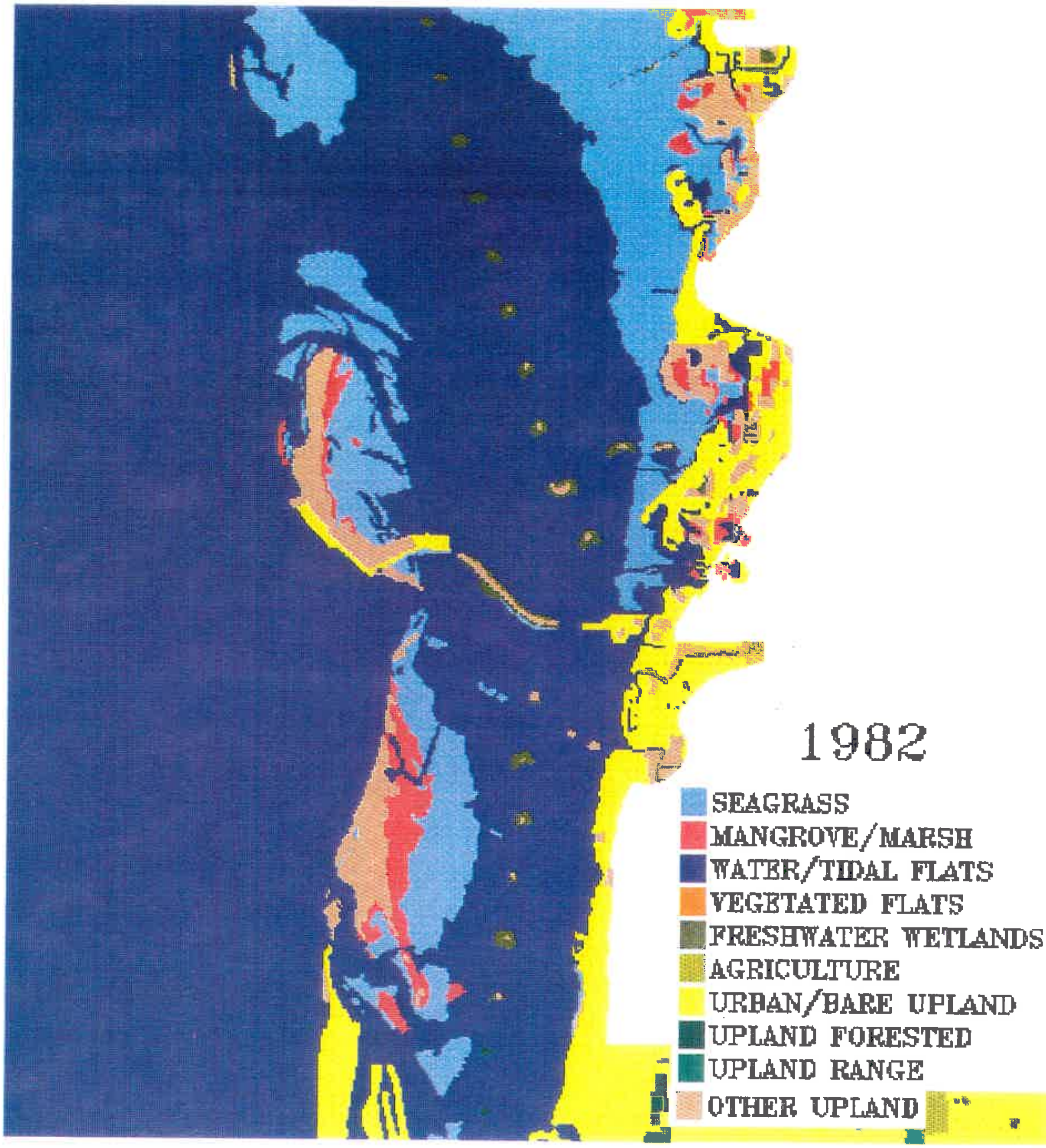

Figure 41. 1982 Seagrass Map (FDNR).

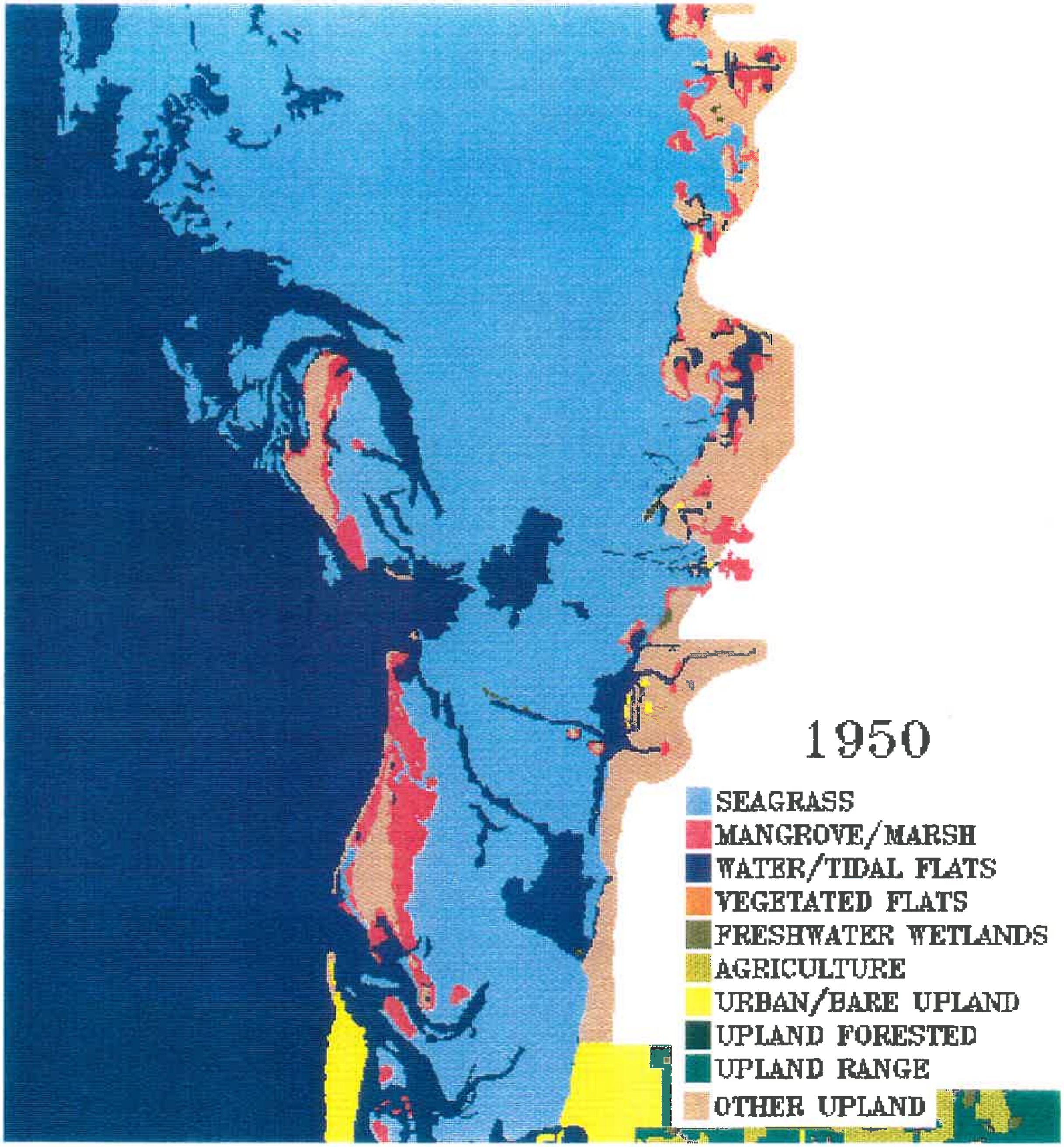

Figure 42. 1950 Seagrass Map (FDNR).

Field investigations by ATM during May 1992 revealed the dominant seagrass species in the area to be *Halodule wrightii*; small patches of other seagrasses (e.g., *Halophila engelmanii* and *Thalassia testudinum*) were also observed. Several species of algae covered the large grassbed east of Caladesi Island and south of North Willy's Cut. These included *Rosenvingea* sp., *Jania* sp., *Halymenia* sp. and *Hypnea* sp. Algal coverage of the grassbed between Hurricane Pass and North Willy's Cut was less than 1 percent, indicating an area that is better flushed and less susceptible to algal trapping by wind.

ATM observed Crustaceans (*Pagurus* sp. and *Libinia* sp.), Annelids (*Diopatra* sp. and *Chaetopterus* sp.) and Bryozoans inhabiting the grassbeds in the area.

D. Nearshore Area

Nearshore areas were previously investigated by USF during Phase one and Phase three of the *Honeymoon Island Study*. The conclusions of the Phase one study were as follows (Bell, 1990):

- polychaetes numerically dominated all taxa recovered from cores,

- significant variations in species richness and species diversity were observed throughout the study area (Anclote Key to Hurricane Pass) but could not be explained, given the limited data collection,

The Phase three study include additional macro benthic faunal sampling and analysis during spring 1991. This study concluded that:

- species encountered were typical of high-energy beaches,

- Amphipods dominated in all but one sample,

- Bivalva and Polychaeta ranked second and third in overall abundance,

- a total of 19 species from all taxa were recorded at the 10 sample sites,

- overall abundance was low and variability was high; species richness was relatively low,

- like the earlier study, data were insufficient to assess temporal patterns of abundance and community composition.

The reader is referred to Davis and Klay (1990) and Gibeaut and Inglin (1992) for more detail.

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