APPENDIX F. Brevard County Federal Projects and Surveys[35]

This appendix describes the Federal navigation project at Canaveral Harbor, Florida, and the Federal shore-protection project for Brevard County, Florida. Many surveys have been made by the U.S. Army Corps of Engineers (USACE) for the purposes of study, construction, and monitoring of these two projects. These survey data sets have not been accessed in previous studies of Harbor impacts on the adjacent shores of Brevard County. The USACE survey data are analyzed and the results presented in this appendix.

F.1. Canaveral Harbor, Florida, Navigation Project

The River and Harbor Act of March 2, 1945 (Public Law 79-14), authorized a 27-ft-deep entrance channel, jetties, a 27-ft-deep turning basin enclosed by a dike, and an 8-ft-deep barge canal lock. The project is described in House Document 367, 77th Congress, 1st Session, dated October 14, 1941. A location map with project features is shown in Figure F-1.

Harbor Construction. The work began in June 1950. During the first full year of dredging, almost 6 Mcy were moved from the turning basin and the barge and slip canals. The dredged material was constructed into a dike around the turning basin and the Merritt Island causeway. The pilot cut was made in October 1951. The entrance channel was about 90 % complete in March 1952 when dredging was suspended from lack of progress because of rapid shoaling of the channel. To stabilize the land points and reduce shoaling, construction of jetties and bank revetments were undertaken on an emergency basis in June 1953. A section of the south jetty about 813 ft in length and 445 ft of bank revetment (along the south bank of the land cut beginning at the shore end of the jetty) was constructed between June 2, 1953, and November 10, 1953. The revetment was added because erosion was occurring at the south shore adjacent to the channel. Between December 1953 and June 1954, the north jetty was constructed 1,150 ft long to the 12-ft contour, and a 300-ft-long revetment was placed along the north shore extending south from the landward end of the north jetty. By September 3, 1954, a 300-ft extension to the south jetty was constructed, and the south-shore revetment was extended landward an additional 1,200 ft.

The ocean entrance channel and turning basin were enlarged and deepened with military funds between November 1956 and May 1957 to 33 ft in the turning basin, 34 ft in the entrance channel through the land cut, and 36 ft in the approach channel. In 1958, the north revetment was extended 600 ft westward, and the south revetment was extended westward to the Port Authority wharf. In 1961, the channel was further deepened to 37 ft with military funds.

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[35] This appendix was prepared by Mr. David V. Schmidt, P.E., Supervisory Civil Engineer, USACE Jacksonville District, Jacksonville, Florida.

Between April 1974 and March 1975, the Harbor entrance channel was deepened from 37 to 44 ft and a new turning basin and access channel constructed to a depth of 41 ft for the Trident Missile Defense System. Approximately 4 Mcy were removed from the entrance channel, and 9 Mcy were removed from the turning basin and access channel. Local interests completed the deepening of the west access channel and west turning basin from the authorized 31 to 35 ft in May 1987.

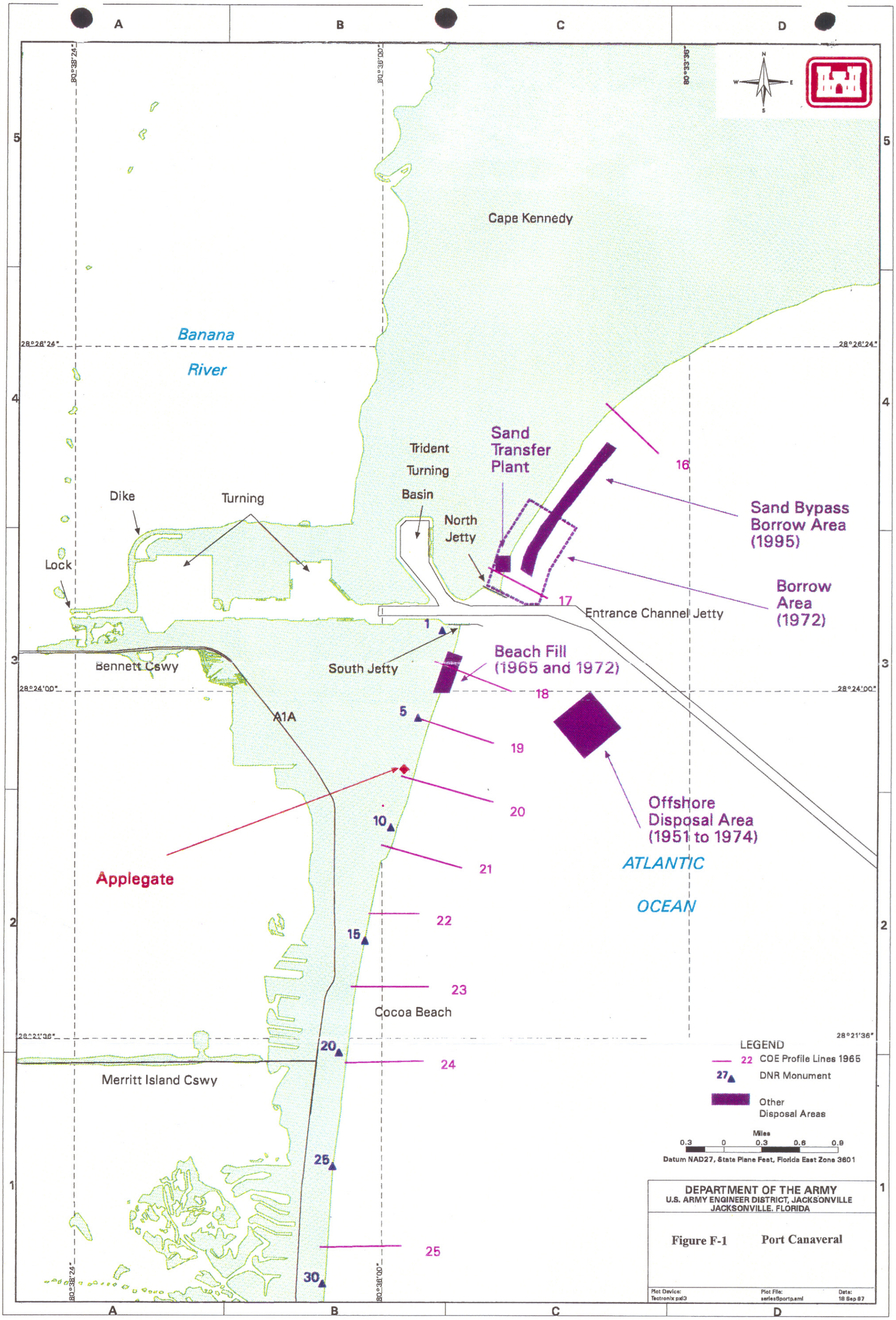
Deepening of the Harbor entrance channel from 37 to 41 ft, the inner channel from 36 to 40 ft and widening it to 400 ft, the middle turning basin from 35 to 39 ft to provide for a 1,200-ft-diameter turning area, and the north channel branch from 35 to 39 ft with a width of 350 ft, was started in August 1993 and completed in October 1994. Construction of the authorized fishing walkway, located on the south jetty, was coordinated with the jetty extension and sand-tightening project. The south jetty sand-tightening work was completed in September 1995. The first sand bypassing was completed in September 1995.

F.1.1. Harbor Project Modifications

1951 Project Review Study. The Senate Public Works Committee by resolution adopted April 26, 1951, directed the USACE to review the report of the Chief of Engineers on Canaveral Harbor (House Document 367/77/1) to determine if the project should be modified. The purpose of the study was to consider the advisability of maintaining the enlarged and deepened harbor with civil works funds, deepening and enlarging the existing barge channel, enlarging the dike-enclosed harbor area, modifying the requirements of local cooperation, and proceeding with construction of a barge lock. The USACE Jacksonville District Engineer's feasibility report in response to the Congressional resolution is dated October 30, 1961. The report of the Board of Engineers for Rivers and Harbors is dated March 23, 1962. The report of the Chief of Engineers is dated July 6, 1962. The Secretary of the Army transmitted the study results to Congress on September 24, 1962. The project was modified as follows.

1962 Sand Transfer Plant Authority. The River and Harbor Act of October 23, 1962 (Public Law 87-874), authorized maintenance of improved channel and turning basin. It also authorized enlarging a barge channel and lock, relocating the dike, constructing a channel and turning basin west of 35-ft turning basin, and constructing and operating of a sand-transfer plant. Project modifications are described in Senate Document 140, 87th Congress, 2nd Session dated September 24, 1962. The purpose of the sand-transfer plant, in combination with conventional dredging, was to maintain the navigation project entrance channel.

1990 Project Deepening Study. Title I, Section 101(7) of the 1992 Water Resources Development Act authorized modifications to the Canaveral Harbor, Florida, project. The authorization provides for increasing the depth of the entrance channel from 37 to 41 ft and



deepening of the inner channel from 36 to 40 ft and widening it to 400 ft. The middle turning basin would be deepened from 35 to 39 ft to provide for a 1,200-ft-diameter turning area. The north channel branch would be deepened from 35 to 39 ft with a width of 350 ft. A description of the project is contained in the report of the Chief of Engineers dated July 24, 1991, as modified by the letter of the Secretary of the Army dated October 10, 1991. Reference House Document 102-156, 102nd Congress, 1st Session, dated October 21, 1991, and the District feasibility report on deepening dated August 1990.

1993 Sand-Bypass Modification. General Re-evaluation Report, Sand-Bypass System, Canaveral Harbor, Florida, December 1992, Revised November 1993. The project modified the sand-bypass feature from a fixed sand-transfer plant at the north jetty to hydraulic dredging from a borrow site north of the jetty to the beach south of the inlet. The plan is to bypass 636,000 cy of sand every 6 years (106,000 cy/year). Another feature of the modified bypass system was to lengthen and sand-tighten the south jetty. The project modifications were approved by the Chief of Engineers in 1994.

F.1.2. Canaveral Harbor Dredged Material

Volumes of dredged material removed from Canaveral Harbor are listed in Table F-1. Prior to 1974, dredged material was placed either in the ocean disposal site (Figure F-1) or stockpiled in upland disposal areas, except for 120,000 cy in 1965 and 200,000 cy in 1972. Since 1974, a combination of upland, offshore, beach, and nearshore disposal locations have been used (Figure F-2).

Table F-1. Canaveral Harbor, Florida. Summary of dredging volumes (cy).

Location Placed	New Work Only	Pre-Trident 1951 to Apr-74	Post-Trident Apr-74 to 1997	Total
Upland	8,848,971	499,746	10,886,142	**11,385,888**
1952 to 1974 Offshore	3,317,098	13,234,838	0	**13,234,838**
1974 to 1997 ODMDS	7,361,388	0	20,999,196	**20,999,196**
Beach	2,966,963	320,000	3,598,605	**3,918,605**
Nearshore	0	0	893,560	**893,560**
TOTALS	**22,494,420**	**14,056,461**	**36,379,426**	**50,432,087**

Aproximately 50.2 Mcy of dredged material have been removed from Canaveral Harbor, as shown in Table F-1. Approximately 22 Mcy were removed as a result of new work (initial construction) and 28.2 Mcy were removed from maintenance of the Harbor. Prior to April 1974, approximately 13.2 Mcy of dredged material from Canaveral Harbor was placed in the offshore disposal site shown on Figure F-1. Another 499,700 cy were placed in upland disposal areas. Approximately 120,000 and 200,000 cy were placed in the beach disposal area shown on Figure F-1 in 1965 and 1972, respectively. Since April 1974, upland, offshore, beach, and nearshore (0.9 Mcy) disposal locations have been used. The total dredged-material disposal placed in these areas is shown on Figure F-2. In April 1974, the offshore disposal site was changed to an area further offshore. The area of this "interim" offshore disposal area was 3 square nautical miles. The interim offshore disposal area was increased in size to 4 square nautical miles and designated as an Offshore Dredged-Material Disposal Site (ODMDS) by the Environmental Protection Agency in 1990. A total of 21 Mcy have been placed in the ODMDS for Canaveral Harbor since April 1974.

F.2. Brevard County, Florida, Shore-Protection Project

The 1968 Rivers and Harbors Act (Public Law 90-483) authorized a beach-erosion control project for Brevard County, Florida. The project is described in House Document 352, 90th Congress, 2nd Session dated July 8, 1968. Five areas were identified as having erosion problems, two north of Canaveral Harbor and three south. These areas are shown in Figure F-3. The lengths of the problem areas are, in order from north to south, 4.9 miles at Kennedy Space Center, 4 miles at Cape Kennedy Air Force Station (AFS), 2.8 miles at the city of Cape Canaveral, 2.3 miles at Patrick AFB, and 2 miles at Indialantic and Melbourne Beach. Federal Civil Works participation was authorized for the City of Cape Canaveral and at Indialantic/Melbourne Beach. The three remaining areas are Federal property, and the Federal agencies involved would be responsible for constructing the projects recommended. Descriptions of the recommended project areas follows:

Kennedy Space Center. Restore 26,000 ft (4.9 miles) of beach at Kennedy Space Center without Federal (Civil Works) participation. Federal agencies owning property involved would be responsible for their own justification and funding for project construction. Volume needed for initial restoration was 2.5 Mcy. Approximately 195,000 cy would be needed annually for periodic nourishment (7.5 cy/ft).

Cape Kennedy AFS. Restore 21,200 ft (4.0 miles) of beach at Cape Kennedy AFS without Federal (Civil Works) participation. Federal agencies owning property involved would be responsible for their own justification and funding for project construction. Volume needed for initial restoration was 2.0 Mcy. Approximately 162,000 cy would be needed annually for periodic nourishment (7.6 cy/ft).

Titusville

Indian River

Banana River

Cape Kennedy

Canaveral Harbor

Applegate

Cocoa

Brevard County

Rockledge

Cocoa Beach

Canaveral Channel

Patrick AFB

Noro

Satellite Beach

Melbourne

Indialantic

Melbourne Beach

ATLANTIC OCEAN

Upland Disposal Areas
11,385,900 Cubic Yards
(1970 to Present)

Beach Disposal Area
3,918,600 Cubic Yards
(1965 to Present)

Offshore Disposal Area
13,234,800 Cubic Yards
(1951 to March 1974)

Offshore Disposal Area (ODMBS)
20,999,200 Cubic Yards
(April 1974 to Present)

Nearshore Disposal Area
873,600 Cubic Yards
(1992 to Present)

80°45'00"
80°30'00"
28°30'00"
28°15'00"
28°00'00"

LEGEND

22 COE Profile Lines 1965

27 DNR Monument

Harbor Construction Disposal Areas

Miles
1.75 0 1.75 3.5 5.25

Datum NAD27, State Plane Feet, Florida East Zone 3601

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, JACKSONVILLE
JACKSONVILLE, FLORIDA

Figure F-2

Operation and Maintenance Disposal Areas and Volumes

Plot Device:	Plot File:	Date:
Tectronix pxl3	series7.aml	18-Sep-97

Cape Canaveral. Restore 14,600 ft (2.8 miles) of beach at the city of Cape Canaveral. Volume needed for initial restoration was 988,000 cy. Approximately 240,000 cy would be needed annually for periodic nourishment (16.4 cy/ft). The sand-transfer plant was expected to transfer 315,000 cy of material across the inlet annually. Therefore, no periodic nourishment was authorized for the Cape Canaveral project segment.

Patrick AFB. Restore 10,600 ft (2.3 miles) of beach at Patrick AFB without Federal (Civil Works) participation. Federal agencies owning the property involved would be responsible for their own justification and funding for project construction. Volume needed for initial restoration was 700,000 cy. Approximately 82,000 cy would be needed annually for periodic nourishment (7.7 cy/ft).

Indialantic/Melbourne. Restore 10,600 ft (2.0 miles) of beach at Indialantic Beach and Melbourne Beach. Volume needed for initial restoration was 603,000 cy. Approximately 68,000 cy would be needed annually for periodic nourishment (6.4 cy/ft).

It is important to note that, with the exception of Cape Canaveral, all of the areas identified as having erosion problems were eroding at similar rates, between 6.4 and 7.7 cy/ft/year. Two of the eroding areas are located more than 9 miles north of Canaveral Harbor, to the north of Cape Kennedy, and are totally outside the zone of influence of the Harbor entrance.

Brevard County, Florida, Project Construction.

(*Cape Canaveral Segment*). About 2.0 of the 2.8-mile City of Cape Canaveral segment of the Brevard County, Florida, beach-erosion control project was completed in March 1975. Approximately 2.8 Mcy of sand were placed. In addition, about 1.3 Mcy were placed as part of the beach-erosion control project. The work was performed under an agreement dated April 26, 1973, and executed between the USACE and Brevard County Board of Commissioners (Contract No. DACW17-73-A-0009). The remaining 1.5 Mcy were placed on private property landward of the erosion control line (ECL) at Federal expense as a least-cost disposal site for new-work dredging as part of the deepening of the navigation entrance channel for the Trident. The southern 0.8 miles of the beach-erosion control project was not nourished as part of this work.

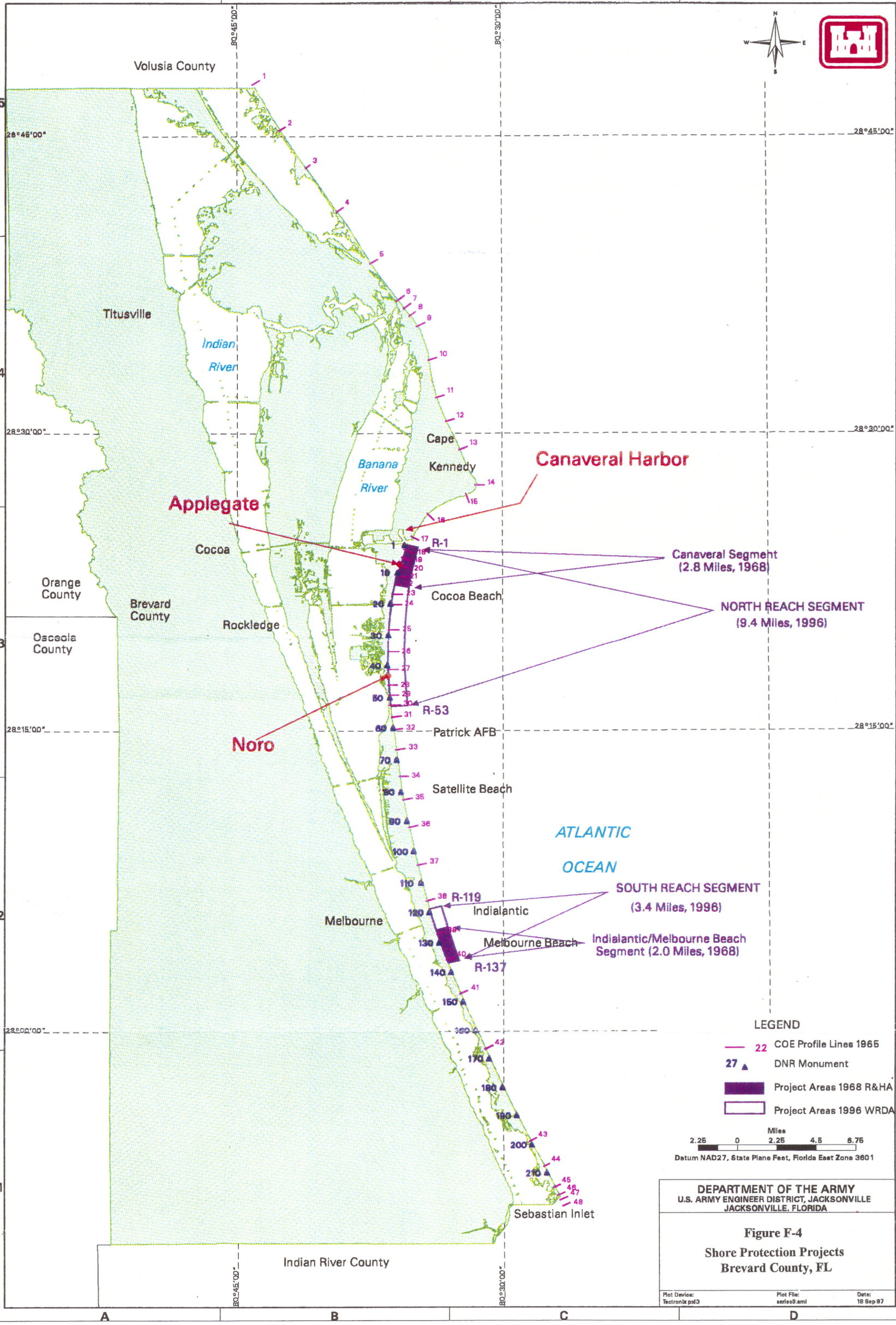
(*Indialantic/Melbourne Beach Segment*). The 2-mile Indialantic and Melbourne Beach Segment (R-122+500 ft to R-134+500 ft) of the Brevard County, Florida, beach-erosion control project was completed in 1981. About 540,000 cy were placed along 2 miles of beach. The contract above was amended in 1979 for this project segment. The project was authorized with a 50-year project life. Federal participation was limited by the authorizing act to 10 years from the completion of construction. Federal participation expired at the end of 1991.

F.3. Beach-Erosion Control Project Modifications

The House Public Works and Transportation Committee, by resolution adopted September 23, 1982, directed the USACE to review the report of the Chief of Engineers on Brevard County, Florida, published in House Document 352/90/2 to determine if the project should be modified. The purpose of the study was to consider the advisability of extending Federal participation in the Cape Canaveral and Indialantic and Melbourne Beach segments and the addition of other project segments if needed and justified. The study was completed and the report of the Chief of Engineers transmitted to the Secretary of the Army on December 23, 1996. Section 101(b)(7) of the 1996 Water Resources Development Act reauthorized the Brevard County, Florida, Shore-Protection Project based on the report of the Chief of Engineers. The City of Cape Canaveral segment was incorporated into a larger 9.4-mile segment. The Indialantic and Melbourne Beach segment was incorporated into a larger 3.4-miles segment. The locations of the existing and modified project segments are shown in Figure F-4. Beach restoration and periodic nourishment were authorized for both project segments at a 50-year total project cost estimated at $138,778,000.

F.4. Summary of Dredged-Material Placement

Approximately 4.8 Mcy of beach-quality dredged material from Canaveral Harbor have been placed on the beaches or in the nearshore littoral zone of Brevard County since April 1974. Another 792,700 cy have been placed at Patrick AFB by the Air Force. Non-Federal beach nourishment at the cities of Cape Canaveral and Cocoa Beach total 140,000 cy. The amounts, locations, authority, and other information on sand placed on Brevard County's beaches are shown in Figure F-5. In summary, 6.3 Mcy of beach-quality material have been placed on the beaches, or in the nearshore zone, south of Canaveral Harbor in Brevard County from 1965 through 1997. A summary of beach and nearshore disposal in Brevard County is given in Table F-2.



A B C D

Cape Kennedy

Banana River

Canaveral Harbor

Beach Placement
4,018,600 (total) Cubic Yards
1965 to 1997

Applegate

Cocoa Beach

Nearshore Placement
893,600 (total) Cubic Yards
1992 to 1997

Beach Placement
40,000 (total) Cubic Yards
1996

Noro

Patrick AFB

Beach Placement
792,700 (total) Cubic Yards
1980 to 1996

Satellite Beach

ATLANTIC OCEAN

Beach Placement
540,000 (total) Cubic Yards
1981

Indialantic

Melbourne

Melbourne Beach

28°21'00" 28°12'00" 28°03'00"

80°42'00" 80°33'00"

LEGEND
22 COE Profile Lines 1965
27 DNR Monument
Project Sand Disposal Areas

Miles
1 0 1 2 3

Datum NAD27, State Plane Feet, Florida East Zone 3601

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, JACKSONVILLE
JACKSONVILLE, FLORIDA

Figure F-5

Locations and Amounts of Beach Quality Dredged Material Disposal

Plot Device:	Plot File:	Date:
Tectronix pxlG	series8.aml	16 Sep 97

12/5/97

Table F-2. Summary of beach and nearshore disposal sites in Brevard County, Florida.						
Year	Location	Monument No. North Limit	Monument No. South Limit	Authority/Purpose	Start Date	Complete Date	Volume of Sand Placed (cy)
1965	Cape Canaveral	R-2	R-4	Federal Navigation Project O&M / Beach Disposal	1965	1965	120,000
1972	Cape Canaveral	R-2	R-4	Federal Navigation Project O&M / Beach Disposal	Mar-72	Sep-72	200,000 *
1974-1975	Cape Canaveral	South Jetty	R-11	Federal Shore Protection Project / Beach Restoration	Apr-74	Mar-75	1,250,000
1974-1975	Cape Canaveral	South Jetty	R-11	Federal (Navy) Trident New Work / Beach Disposal	Apr-74	Mar-75	1,515,963
1980-1981	Indialantic/ Melbourne Bch	R-124	R-135	Federal Shore Protection Project / Beach Restoration Adv Nourishment	Oct-80	Jan-81	540,000
	(3rd Avenue in Indialantic to 5th Avenue in Melbourne Beach)						
1992	Cocoa Beach	R-28	R-31	Federal Navigation Project O&M / Nearshore Disposal	Jun-92	Aug-92	229,000 **
1993	Cocoa Beach	R-28	R-31	Federal Navigation Project O&M / Nearshore Disposal	Jul-93	Nov-93	180,410
1994	Cape Canaveral	R-5	R-11	Local Beach Nourishment City/Port Authority Co-Sponsors	Feb-94	Apr-94	100,000 **
1994	Cocoa Beach	R-28	R-31	Federal Navigation Project O&M / Nearshore Disposal	Oct-94	Oct-94	91,310
1994	Cocoa Beach	R-28	R-31	Federal Navigation Project O&M / Nearshore Disposal	Oct-94	Nov-94	69,850
1995	Cape Canaveral	R-0	R-8	Federal Navigation Project Sand Bypass / Beach Disposal	Jan-95	May-95	831,642
1995	Cocoa Beach	R-28	R-31	Federal Navigation Project O&M / Nearshore Disposal	Aug-95	Dec-95	322,990
1996	Cocoa Beach	R-34	R-38	Local Beach Nourishment City/Port Authority Co-Sponsors	Feb-96	Mar-96	40,000
1980-1996	Patrick AFB	R-53	R-75	Military, Dune Restoration Ten Placements	1980	1996	792,698
						TOTAL	**6,284,863**

Notes: * From a total of 341,954 dredged from the turning basin.
** Best estimates from field observations. The 1993 volume ranges from 180,000 to 218,000 estimated.

F.5. Analysis of Volume Changes From 1951 To 1997

This section summarizes the location and analysis of available beach-profile survey data north and south of Canaveral Harbor in Brevard County, Florida. Comparisons are made between plaintiffs' claims of volume losses and estimates of volume losses based on survey data.

F.5.1. Survey Datum

Beach-profile survey data for Brevard County, Florida, have been acquired both by the Florida Department of Environmental Protection (FDEP) and by the USACE. The FDEP survey data are collected for the State's Coastal Construction Control Line (CCCL), erosion control, and inlet management programs. The USACE has acquired beach-profile surveys for the purposes of navigation, beach-erosion control, and shore protection. From March to June 1965, the USACE conducted a countywide beach-profile survey of Brevard County. The USACE Beach Profile Lines 1-17 are located north of the inlet. Profile Lines 18 to 48 are located from the south jetty to just south of Sebastian Inlet. The FDEP survey data are referenced to R-1, R-2, etc. The USACE and FDEP profile locations are shown in Figure 2-1 of the main text.

The FDEP survey data are referenced to the 1929 National Geodetic Vertical Datum (NGVD 29). All survey data acquired by the USACE (Jacksonville District) for Canaveral Harbor and Brevard County are referenced to a construction datum (mean low water (MLW)) which is -1.9 ft below NGVD 29. The National Ocean Service (NOS) datum in the main text of this report is based upon a specific tidal epoch. Therefore, NOS datums are subject to change throughout time. The USACE has adopted the -1.9-ft offset to define an invariant construction datum. The survey data and analysis described in this appendix are referenced to NGVD 29.

F.5.2. Canaveral Harbor Monitoring Surveys

Numerous hydrographic surveys of the Harbor channel, turning basins, and adjacent areas have been performed over the years as part of the operation and maintenance (O&M) of the Harbor. The purpose of these hydrographic surveys is to monitor shoaling in the entrance channel, inner channel, access channels and turning basins, and determine pre-dredging and post-dredging conditions. The O&M hydrographic surveys are generally limited in scope to the Harbor project dimensions and cannot be used to determine changes to the adjacent beaches.

The USACE established monitoring surveys as part of the Canaveral Harbor project. The Jacksonville District Office (D.O.) File Numbers for beach-profile surveys for the Harbor project are listed in Table F-3. The first survey was performed from September to October 1951, prior to the pilot cut through the Barrier Island. The 1951 survey extended 10,500 ft north and south of the Harbor. These distances are referred to as Station 105+00N and 105+00S, respectively. The stationing for the October 1951, survey is shown on Plate F-1. Monitoring surveys were taken in

April and August 1952, but these surveys were limited to the area between 20+00N and 25+00S. In April 1953, a limited number of beach profiles were taken from 20+00N to 30+00S.

Table F-3. Canaveral Harbor, Florida, Federal Navigation Project monitoring surveys.

D.O. File No.	No. of Sheets	Survey Dates	Description
11-20, 193 Ocean Shoreline and Beach Profiles	3	Oct-51	Baseline control and beach-profile surveys, 23 lines from 105+00N to 105+00S. Offshore surveys extend to -18 ft (MLW).
11-21, 091 Erosion/Accretion, April-Aug 1952	1	Apr-52 to Aug-52	Volume contours plotted for surveys. Coverage limited to 20+00N to 25+00S.
11-21, 964	1	Jan-52	Layout of north and south jetties, MHW shorelines for limited area north and south.
11-22, 041 Periodic Survey of Channel and Beaches	3	Apr-53	Beach-profile surveys, 22 lines from 50+00N to 105+00S. Offshore surveys extend to -18 ft (MLW). Profile Lines 13+00N to Rgs. -600 have limited offshore coverage.
11-22, 654 Periodic Survey of Channel and Beaches	5	May-54 to Oct-56	Baseline control and beach-profile surveys, 32 lines from 210+00N to 343+99S. Offshore surveys extend to -20 ft (MLW).
11-22, 726 MHW Shoreline Changes	1	Oct-51 to May-54	Plan view of MHW shoreline changes for 105+00N to 105+00S.
11-23, 442 Erosion and Accretion	4	Apr-52, Aug-52 Apr-53, May-54 Jun-55	Limited survey coverage in immediate vicinity of entrance channel.
11-23, 992 Canaveral Harbor Shoreline Vicinity of the North Jetty	2	Apr-56 Jul-56	Beach-profile surveys from Sta. 4+00N to Sta. 2+00N.
11-24, 397 High-Water Shoreline Changes 1878-1958	5	1878 to 1901 1928 to 1930 1952 to 1954 1955 to 1956 1957 to 1958	High-water shorelines from surveys listed, in plan view. High-water shoreline comparisons for 16 miles north of Harbor to 19 miles south of Canaveral Harbor.
11-24, 653 MHW Shoreline Changes	1	May-54 Oct-56 Nov-58	Limited MHW shoreline changes from south jetty to 1,000 ft
11-25, 726 Beach-Profile Surveys of 1954, 1956, 1958	8	May-54 Oct-56 Nov-58	Beach-profile surveys 32 lines fr 210+00N to 343+99S. 1954, 1956 offshore surveys extend to -20 ft (MLW). 1958 offshore survey extends to -30 ft (MLW).
11-31, 614 Canaveral Beach Nourishment Study	4	Feb-72 Sep-72	Profile control and layout for Profile Lines 3 to 29.
11-31, 661 P&S Survey, First Sand Bypass	34	Feb-94 to Apr-94	Surveys CCAFS-29 to CCAFS-42 north of Harbor, R-0 to R-15 south of the Harbor. Beach-profile surveys.
11-36, 999	29	Jun-95	Surveys CCAFS-29 to CCAFS-42 north of Harbor, R-0 to R-15 south of Harbor. Beach-profile surveys.
11-37, 018 Sand Bypass System, Phase II	14	Jan-95 to Feb-95	Surveys CCAFS-29 to CCAFS-42 north of Harbor, R-0 to R-15 south of Harbor. Beach surveys.
11-37, 059 Monitoring Survey	29	Oct-95	Surveys CCAFS-29 to CCAFS-42 north of Harbor, R-0 to R-15 October Monitoring Survey
11-37, 146 Monitoring Survey	29	Jan-96 to Feb-96	Surveys CCAFS-29 to CCAFS-42 north of Harbor, R-0 to R-15 south of Harbor. Beach-profile surveys.
11-37, 296 Monitoring Survey	24	May-96	Surveys CCAFS-29 to CCAFS-42 north of Harbor, R-0 to R-15 south of Harbor. Beach surveys.
11-37, 442 Monitoring Survey	27	May-97	Surveys CCAFS-29 to CCAFS-42 north of Harbor, R-0 to R-15 south of Harbor. Beach-profile surveys.

In May 1954, the October 1951 survey was repeated and expanded. Coverage was extended north (105+00N to 210+00N) and south (105+00S to 343+98S) of the Harbor. From October to November 1956, the monitoring surveys were repeated from 210+00N to 165+03S. Between November 1958 and January 1959 (referred to as the 1958 survey), the 1954 monitoring surveys were repeated (210+00N to 343+98S).

In March 1972, pre-dredging surveys were taken for the area 4+00N through 23+00S, in 100-ft increments. The March 1972 survey coverage offshore was limited to about -12 ft MLW. In September 1973; July, August, and November 1974; and in January, February, and May 1975, surveys were taken as part of the Trident work. The September 1973 and the July, August, and November 1974 surveys extended from 20+00N to 60+00S (R-6). The January and February 1975 surveys extended from 20+00N to 90+00S (R-9). The May 1975 survey extends from 20+00N to R-12.

The USACE conducted sand-bypassing monitoring surveys in January 1995 (pre-), June 1995 (post-), October 1995, January 1996, May 1996, May 1997, and December 1997. The surveys extend from the south jetty to R-15, south of the Harbor, and from the north jetty to CCAFS-42 (approximately 135+00N) north of the Harbor. Figure F-6 shows the extent of the survey coverage for the sand-bypass monitoring profiles. These survey lines are shown relative to other survey lines in Table F-4 for the area north of the Harbor and in Tables F-5 and F-6 for the area south of the Harbor.

F.5.3. Brevard County Beach-Erosion Control Surveys

Numerous beach-profile surveys of the beaches of Brevard County have been performed by the USACE. These surveys were made for shore-protection studies, and for pre- and post-project construction and project monitoring. The Jacksonville District Office (D.O.) File Nos. for USACE beach-profile surveys for the Brevard County, Florida, shore protection project and related studies are listed in Table F-7. Unlike the USACE surveys taken for Canaveral Harbor project which start with a D.O. File No. 11 (Table F-3), the surveys taken for the Brevard County shore protection project start with D.O. File No. 24.

Between March and June 1965, the USACE conducted a countywide beach-profile survey of Brevard County for the feasibility study. USACE Beach Profiles 1-17 are located north of the inlet. Profile Lines 18 to 48 are located from the south jetty to just south of Sebastian Inlet. From May to June 1971, a limited number of USACE beach-profile lines (8) were surveyed from 5,000 ft north and south of the Harbor. In February and August 1972, 29 beach-profile surveys were taken for an area 5,000 ft north to 14,800 ft south of the Harbor. In November 1974, USACE Profile Lines 30, 31, 32, 33, and 43 were surveyed; however, the lines only extend offshore to the -10-ft contour. These lines are located on or near Patrick AFB.

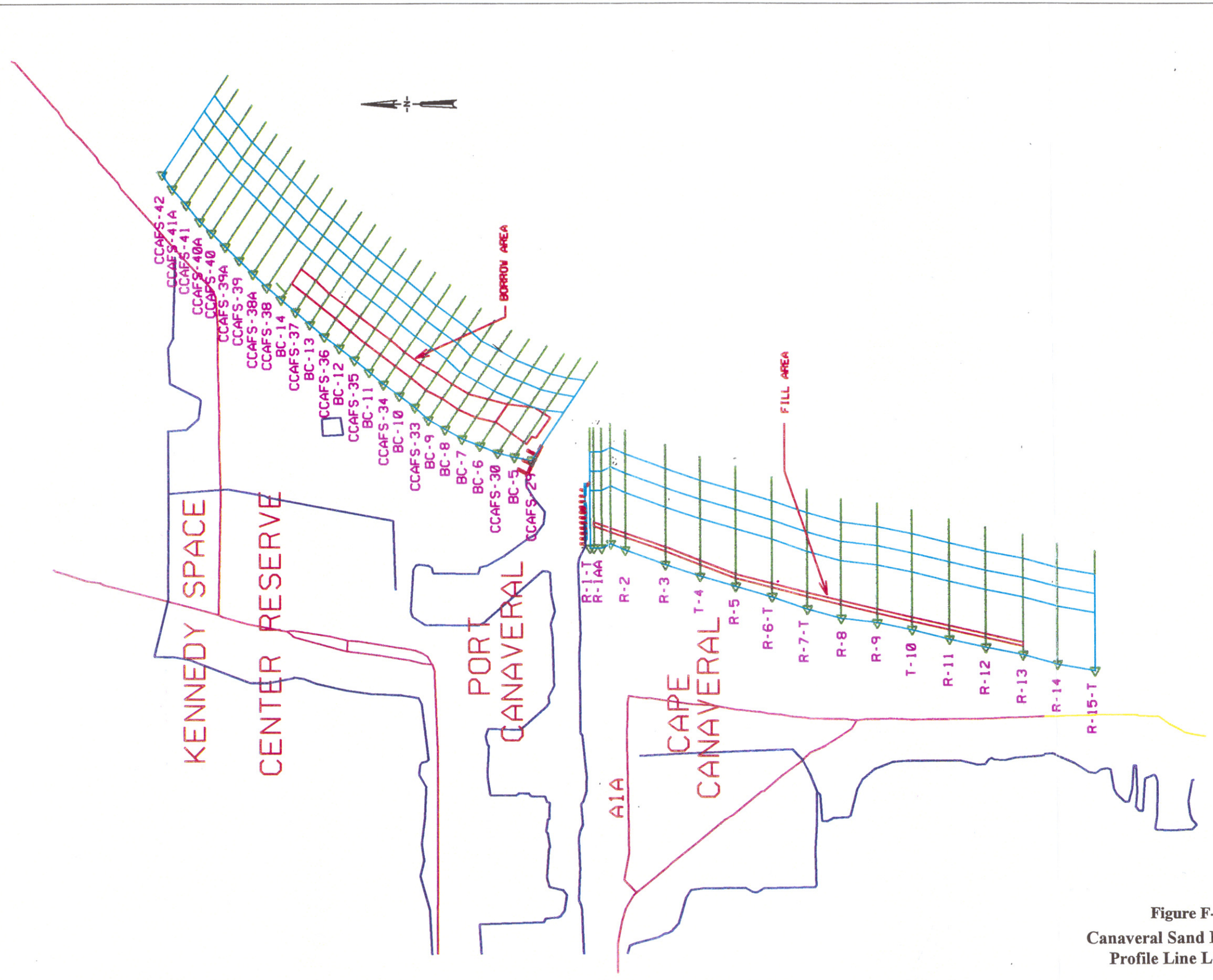


Figure F-6
Canaveral Sand By-Passing Profile Line Locations

Table F-4. Beach-profile surveys north of Canaveral Harbor.

USACE Canaveral Harbor Beach-Profile Survey Line Number		USACE Beach-Erosion Control Profile Line No.		Distance from Harbor Channel Centerline, ft	USACE Canaveral Harbor Monitoring Surveys				USACE BEC Survey	USACE Canaveral Harbor Sand-Bypassing Monitoring Surveys						
					Oct-51	May-54	Oct-56	Nov-58	Mar-65 to Jan-66	Feb to Apr-94	Jan-95 to Feb-95	Jun-95	Oct-95	Jan-96	May-96	May-97
CAPE CANAVERAL																
			(7) P-15						X							
210+00N				21,000		X	X	X								
165+00N				16,500		X	X	X								
	CCAFS-42									X	X	X	X	X	X	X
135+00N				13,500		X	X	X								
	CCAFS-41A									X	X	X	X	X	X	X
	CCAFS-41									X	X	X	X	X	X	X
	CCAFS-40A									X	X	X	X	X	X	X
	CCAFS-40									X	X	X	X	X	X	X
	CCAFS-39A									X	X	X	X	X	X	X
	CCAFS-39									X	X	X	X	X	X	X
105+00N			(8) P-16	10,500	X	X	X	X	X							
	CCAFS-38A									X	X	X	X	X	X	X
	CCAFS-38									X	X	X	X	X	X	X
	BC-14									X	X	X	X	X	X	X
90+00N				9,000	X											
	CCAFS-37									X	X	X	X	X	X	X
	BC-13									X	X	X	X	X	X	X
	CCAFS-36									X	X	X	X	X	X	X
75+00N				75,000	X	X	X	X								
	BC-12									X	X	X	X	X	X	X
	CCAFS-35									X	X	X	X	X	X	X
	BC-11									X	X	X	X	X	X	X
60+00N				6,000	X											
	CCAFS-34									X	X	X	X	X	X	X
	BC-10									X	X	X	X	X	X	X
50+00N		Line 3		5,000	X	X	X	X								
			P-16C													
	CCAFS-33									X	X	X	X	X	X	X
	BC-9									X	X	X	X	X	X	X
40+00N				4,000	X											
	BC-8	Line 4								X	X	X	X	X	X	X
	BC-7	Line 5								X	X	X	X	X	X	X
30+00N				3,000	X	X	X	X								
	BC-6	Line 6								X	X	X	X	X	X	X
	CCAFS-30	Line 7								X	X	X	X	X	X	X
20+00N			(9) P-17	2,000	X	X	X	X	X							
	BC-5									X	X	X	X	X	X	X
17+00N		Line 8		1,700												
15+00N				1,500	X	X	X	X								
13+00N				1,300		X	X	X								
	CCAFS-29									X	X	X	X	X	X	X
12+00N	**Centerline of North Jetty**															

Note: Columns with shading denote surveys that were used in the volume analysis and plotted on the plates at the end of Appendix F.

Table F-5. Beach-profile surveys south of Canaveral Harbor from south jetty to R-53, October 1951 to May 1975.

DEP Survey Mon. Number	USACE Canaveral Harbor Beach Profile Survey Line Number	USACE Beach-Erosion Control Profile Line No.		Distance from Harbor Channel Centerline, ft	USACE Canaveral Harbor Monitoring Surveys Month/Year of Survey				USACE BEC Survey	USACE Beach-Erosion Control Surveys		DEP CCCL Survey	USACE Trident Survey
					Oct-51	May-54	Oct-56	Nov-58	Mar-65 to Jan-66	May, Jun, Sep-71	Feb, Aug, Sep-72	Sep-72 to Nov-72	May-75
Range 400, Centerline of South Jetty													
	Range 550			700		X							
R-0													
	Range 600			750		X	X	X					
		P-17A								X			X
	Range 800			950		X	WD	X					X
	CDA-B, P9	Line 9	P-17A1								X		X
	10+OOS			1,000	X								
R-1												X	
	CDA-B, P9A												X
R-1AA													
	CDA-B,P10	Line 10									X		X
	Range 1000			1,150		X	WD	X					
R-1A													
	15+00S			1,500	X	X	X	X					
	Range 1200			1,350		X	X	X					
	Range 1400			1,550		X	WD	X					
	CDA-B, P10A												X
		P-17B								X	X		X
R-2	CDA-B, P11	Line 11									X	X	
	20+00S			2,000	X								
	CDA-B,P11A												X
	CDA-B, P12	Line 12									X		X
	25+00S	P-18 Alt	PL-18	2,500		X	X	X	X	X	X		X
	CDA-B, P12A												X
	CDA-B, P13	Line 13									X		X
	30+00S			3,000	X								
R-3												X	
	CDA-B, P13A												X
	CDA-B, P14	Line 14									X		
		P-18A	PL-18							X	X		X
	CDA-B, P14A												X
R-4												WD	
	40+00S			4,000	X								
	CDA-B, P-15	Line 15									X		
		P-18B								X			
	CDA-B, P15A												X
	CDA-B, P16	Line 16									X		
R-6	50+00S	P-19	PL-19	5,000	X	X	X	X	X	X		WD	
	CDA-B, P17	Line 17									X		
	CDA-B, P17A												
	CDA-B, P18	Line 18									X		
R-6	CDA-B, P18A											X	
	60+00S	P-19A		6,000	X					X			
	CDA-B, P19	Line 19									X		
	CDA-B, P19A												X
	CDA-B, P20	Line 20									X		

Table F-5. Beach-profile surveys south of Canaveral Harbor from south jetty to R-53, October 1951 to May 1975.

DEP Survey Mon. Number	USACE Canaveral Harbor Beach Profile Survey Line Number	USACE Beach-Erosion Control Profile Line No.		Distance from Harbor Channel Centerline, ft	USACE Canaveral Harbor Monitoring Surveys Month/Year of Survey				USACE BEC Survey	USACE Beach-Erosion Control Surveys		DEP CCCL Survey	USACE Trident Survey
					Oct-51	May-54	Oct-56	Nov-58	Mar-65 to Jan-66	May, Jun, Sep-71	Feb, Aug, Sep-72	Sep-72 to Nov-72	May-75
R-7				6,698						X		WD	
	CDA-B, P20A			**Applegate**									X
		P-20B											
	75+00S		PL-20	7,500	X	X	X	X	X				
	CDA-B, P21	Line 21									X		
R-8	CDA-B, P21A											WD	X
	CDA-B, P21B												X
	CDA-B, P21C												X
			20A							X			
R-9	CDA-B, P22	Line 22									X	X	
	90+00S			9,000	X								
	CDA-B, P22A												X
	CDA-B, P22B												X
			20B							X			
R-10	CDA-B, P23	Line 23									X	WD	X
	CDA-B, P23A												X
	CDA-B, P23B												X
	105+00S		PL-21	10,500	X	X	X	X	X	X			
R-11	**South limit of Trident Fill**											WD	
	CDA-B, P24	Line 24									X		X
	CDA-B, P24A												
	CDA-B, P24B												X
	CDA-B, P24C												X
R-12												X	
		Line 25	21A							X	X		
R-13												WD	
		Line 26									X		
	133+84S		PL-22	13,384		X	X	X	X	X			
R-14												WD	
		Line 27									X		
		Line 28	22B							X	X		
R-15				14,784	2.8 mi							X	
		Line 29	22C							X	X		
R-16				15,500								WD	
R-17	165+03S		PL-23	16,503		X	X	X	X	X		WD	
R-18												X	
R-19												WD	
R-20												WD	
	197+43S		PL-24	19,743		X		X	X	X			
R-21												X	
R-22												WD	
R-23												WD	
R-24												X	
R-25	239+80S			23,980		X		X				WD	
R-26												WD	
R-27												X	

Table F-5. Beach-profile surveys south of Canaveral Harbor from south jetty to R-53, October 1951 to May 1975.

DEP Survey Mon. Number	USACE Canaveral Harbor Beach Profile Survey Line Number	USACE Beach-Erosion Control Profile Line No.		Distance from Harbor Channel Centerline, ft	USACE Canaveral Harbor Monitoring Surveys Month/Year of Survey				USACE BEC Survey	USACE Beach-Erosion Control Surveys		DEP CCCL Survey	USACE Trident Survey
					Oct-51	May-54	Oct-56	Nov-58	Mar-65 to Jan-66	May, Jun, Sep-71	Feb, Aug, Sep-72	Sep-72 to Nov-72	May-75
R-28												WD	
	290+14S		PL-25	29,014		X		X	X	X			
R-29												WD	
R-30												X	
R-31												WD	
R-32	**Ocean Pines**											WD	
R-33												X	
R-34												WD	
R-35												WD	
	343+98S		PL-26	34,398		X		X	X				
R-36												X	
R-37												WD	
R-38												WD	
R-39												X	
R-40												WD	
R-41												WD	
			PL-27						X				
R-42												X	
R-43												WD	
	Noro property												
R-44												WD	
R-45												X	
R-46												WD	
			PL-28						X				
R-47												WD	
R-48												X	
R-49												WD	
			PL-29						X				
R-50												WD	
R-51												X	
R-52												WD	
	508+51S		PL-30						X				
R-53												WD	
PATRICK AIR FORCE BASE													

Note: Columns with shading denote surveys that were used in the volume analysis and plotted on the plates at the end of Appendix F.

Table F-6. Beach-profile surveys south of Canaveral Harbor from south jetty to R-53, March 1979 to January 1997.

DEP Survey Mon. NO.	USACE Canaveral Harbor Beach Profile Survey Line No.	USACE Beach-Erosion Control Profile Line No.		Distance from Harbor Channel Centerline, ft	USACE Trident Mon. Surveys		USACE BEC Survey	DEP CCCL Survey	USACE BEC Survey	USACE BEC Survey	USACE Sand-Bypassing Monitoring Surveys			
					Mar-79	Dec-79	May-85 to Jun-85	Aug-85 to May-86	Sep-88	Jan-94	Feb-94 to Apr-94	Jan-95 to Feb-95	Jan-96	May-97**
Range 400, Centerline of South Jetty														
	Rge 550			700										
R-0											X	X	X	X
	Rge 600			750										
		P-17A			X									
	Rge 800			950	X									
	CDA-B, P9	Line 9	P-17A1											
	10+OOS			1,000										
R-1					X	X	X	X	X	X	X	X	X	X
	CDA-B, P9A													
R-1AA														
	CDA-B,P10	Line 10												
	Rge 1000			1,150										
R-1A														
	15+00S			1,500										
	Rge 1200			1,350										
	Rge 1400			1,550										
	CDA-B, P10A													
		P-17B												
R-2	CDA-B, P11	Line 11			X	X	WD	WD	X	WD	X	X	X	X
	20+00S			2,000										
	CDA-B,P11A													
	CDA-B, P12	Line 12			X									
	25+00S	P-18 Alt	PL-18	2,500	X									
	CDA-B, P12A													
	CDA-B, P13	Line 13												
	30+00S			3,000										
R-3					X	X	X	X	X	WD	X	X	X	X
	CDA-B, P13A													
	CDA-B, P14	Line 14												
		P-18A	PL-18											
	CDA-B, P14A													
R-4					X	X	WD	WD	X	X	X	X	X	X
	40+00S			4,000										
	CDA-B, P-15	Line 15												
		P-18B												
	CDA-B, P15A													
	CDA-B, P16	Line 16												
R-5	50+00S	P-19	PL-19	5,000	X	X	WD	WD	X	WD	X	X	X	X
	CDA-B, P17	Line 17												
	CDA-B, P17A				X									
	CDA-B, P18	Line 18												
R-6	CDA-B, P18A				X	X	X	X	X	WD	X	X	X	X
	60+00S	P-19A		6,000										
	CDA-B, P19	Line 19												
	CDA-B, P19A													
	CDA-B, P20	Line 20												

Table F-6. Beach-profile surveys south of Canaveral Harbor from south jetty to R-53, March 1979 to January 1997.

DEP Survey Mon. N0.	USACE Canaveral Harbor Beach Profile Survey Line No.	USACE Beach-Erosion Control Profile Line No.		Distance from Harbor Channel Centerline, ft	USACE Trident Mon. Surveys		USACE BEC Survey	DEP CCCL Survey	USACE BEC Survey	USACE BEC Survey	USACE Sand-Bypassing Monitoring Surveys			
					Mar-79	Dec-79	May-85 to Jun-85	Aug-85 to May-86	Sep-88	Jan-94	Feb-94 to Apr-94	Jan-95 to Feb-95	Jan-96	May-97**
R-7				6,698	X	X	WD	WD	X	X	X	X	X	X
	CDA-B, P20A			**Applegate**										
		P-20B												
	75+00S		PL-20	7,500										
	CDA-B, P21	Line 21												
R-8	CDA-B, P21A				X	X	WD	WD	X	WD	X	X	X	X
	CDA-B, P21B													
	CDA-B, P21C													
			20A											
R-9	CDA-B, P22	Line 22			X	X	X	X	X	WD	X	X	X	X
	90+00S			9,000										
	CDA-B, P22A													
	CDA-B, P22B													
			20B											
R-10	CDA-B, P23	Line 23			X	X	WD	WD	X	X	X	X	X	X
	CDA-B, P23A													
	CDA-B, P23B													
	105+00S		PL-21	10,500										
R-11	**South limit of Trident Fill**				X	X	WD	WD	X	WD	X	X	X	X
	CDA-B, P24	Line 24												
	CDA-B, P24A													
	CDA-B, P24B													
	CDA-B, P24C				X	X								
R-12					X	X	X	X	X	WD	X	X	X	X
		Line 25	21A											
R-13					X		WD	WD	X	X	X	X	X	X
		Line 26												
	133+84S		PL-22	13,384										
R-14					X		WD	WD	X	WD	X	X	X	X
		Line 27												
		Line 28	22B											
R-15	**South limit of 2.8-mile project**			14,784	X		X	X	X	WD	X	X	X	X
		Line 29	22C											
R-16				15,500	X		WD	WD		X				
R-17	165+03S		PL-23	16,503			WD	WD		WD				
R-18							X	X		WD				
R-19							WD	WD		X				
R-20							WD	WD		WD				
	197+43S		PL-24	19,743										
R-21							X	X		WD				
R-22							WD	WD		X				
R-23							WD	WD		WD				
R-24							X	X		WD				
R-25	239+80S			23,980			WD	WD		X				
R-26							WD	WD		WD				
R-27							X	X		WD				
R-28							WD	WD		X				
	290+14S		PL-25	29,014										
R-29							WD	WD		WD				

Table F-6. Beach-profile surveys south of Canaveral Harbor from south jetty to R-53, March 1979 to January 1997.

DEP Survey Mon. NO.	USACE Canaveral Harbor Beach Profile Survey Line No.	USACE Beach-Erosion Control Profile Line No.		Distance from Harbor Channel Centerline, ft	USACE Trident Mon. Surveys		USACE BEC Survey	DEP CCCL Survey	USACE BEC Survey	USACE BEC Survey	USACE Sand-Bypassing Monitoring Surveys			
					Mar-79	Dec-79	May-85 to Jun-85	Aug-85 to May-86	Sep-88	Jan-94	Feb-94 to Apr-94	Jan-95 to Feb-95	Jan-96	May-97**
R-30							X	X		WD				
R-31							WD	WD		X				
R-32	**Ocean Pines**						WD	WD		WD				
R-33							X	X		WD				
R-34							WD	WD		X				
R-35							WD	WD		WD				
	343+98S		PL-26	34,398										
R-36							X	X		WD				
R-37							WD	WD		X				
R-38							WD	WD		WD				
R-39							X	X		WD				
R-40							WD	WD		X				
R-41							WD	WD		WD				
			PL-27											
R-42							X	X		WD				
R-43							WD	WD		X				
	Noro Property													
R-44							WD	WD		WD				
R-45							X	X		WD				
R-46							WD	WD		X				
			PL-28											
R-47							WD	WD		WD				
R-48							X	X		WD				
R-49							WD	WD		X				
			PL-29											
R-50							WD	WD		WD				
R-51							X	X		WD				
R-52							WD	WD		X				
	508+51S		PL-30											
R-53							WD	WD		WD				
PATRICK AIR FORCE BASE														

Note: Columns with shading denote surveys that were used in the volume analysis and plotted on the plates at the end of Appendix F.
** The May 1996 survey column was omitted for clarity, but was included in the volume analysis.

Table F-7. Brevard County, Florida, Shore Protection Project beach-profile surveys.			
D.O. File No.	No. of Sheets	Survey Dates	Description
24-29, 128 Beach-Erosion Control Study	35	1928 1965 1958 Jun-71	Baseline control and beach-profile surveys, 47 lines from the north county line to just south of Sebastian Inlet.
24-31, 322 Canaveral Harbor, FL Interim Beach Nourishment for Downdrift Shore	9	May-71 to Jun-71	Baseline control and beach-profile surveys, 8 lines from 5,000 ft north to 5,000 ft south of Harbor, PL-16C, PL-17, PL-17A, PL-17B, PL-18, PL-18A, PL-18B, PL-19; logs of core borings and grain size curves.
24-31, 488 Beach-Erosion Control Project Survey Control and Layout	4	-	Survey control and layout for survey in D.O. File 24-32, 002.
24-31, 727 Beach-Erosion Control Study Profile Lines	1	1958 May-65 Jun-71 Sep-73	Beach-profile survey comparisons for Profile Lines 20, 21, 22, 23. Sep-71 offshore profiles limited to between -12 and -15 ft.
24-31, 847 Canaveral Monitoring Surveys	4	Sep-71 Feb-72 Aug-73 Dec-73 Jul-74	Beach-profile survey comparisons for Profile Lines P-17, Cut 2, PL-17A, PL-17A-1, PL-17B, PL-18Alt, PL-18A. Many surveys are limited to wading depth.
24-31, 849 Canaveral Nourishment Study	11	Feb-72 Aug-72 Sep-72	Beach-profile surveys, 29 lines taken in area from 5,000 ft north to 14,800 ft south of Harbor, PL-1 to PL-29.
24-31, 851 Canaveral Harbor, FL Pre-dredging Survey for Interim Beach Nourishment	5	Mar-72	Sta. -4+00 to Sta. 23+00, 28 profile lines. Surveys extend to -12 ft.
24-31, 990 Canaveral Monitoring Surveys	1-6 of 23	Jul-74 Aug-74 Nov-74	Survey control and layout, beach-profile cross sections for 9 lines, P-17, Cut 2, PL-8, PL-17A, PL-17A-1, PL-17B, PL-18Alt, PL-18A, PL-19A.
	7-11 of 23	Jan-75 Feb-75 May-75	Beach-profile surveys for 9 lines, P-17, Cut 2, PL-8, PL-17A, PL-17A-1, PL-17B, PL-18Alt, PL-18A, PL-19A.
	12-23 of 23	Jan-75 Feb-75 May-75	Beach-profile surveys for 26 lines for the Trident beach disposal area (CDA-B series beach-profile lines).
24-31, 998 1965 Beach-Erosion Control Study Update	4	1928 1965 Nov-74	Five 1965 profile lines (30, 31, 32, 33, and 34) were resurveyed in Nov-74. The lines are located in or near Patrick AFB. The Nov-74 offshore survey is limited to -10 ft.
24-32, 002 Beach-Erosion Control Project Exam Survey	7	May-71 to Jun-71	Survey for the G&DDM dated Sep-72. 17 profile lines were taken over the 2.8-mile Canaveral project segment. 16 profile lines were taken over the 2-mile Indialantic and Melbourne Beach project segment.
24-32, 608 Beach-Erosion Control Project G&DDM Addendum	7	1928 1965 May-71 1972 Sep-77	Comparative beach-profile surveys. Surveys extend to -20 to -25 ft. Profile Lines PL-38, PL-39, PL-40, PL-41, R-120, R-123, R-126, R-129, R-132, R-135, R-138 survey in the area of 2-mile Indialantic and Melbourne Beach project segment
24-32, 851 Indialantic and Melbourne Beach Plans and Specifications	24	-	P&S sheets, file is dated Sep-78. These sheets are missing from the D.O. File drawer.

Table F-7. Brevard County, Florida, Shore Protection Project beach-profile surveys.			
D.O. File No.	No. of Sheets	Survey Dates	Description
24-33, 100 Beach-Erosion Control Project Comparative Profiles, Canaveral Harbor Sections	6	May-75 Mar-79	Mar-79 beach-profile lines extend to -20 to -25 ft. 23 profile lines were surveyed and extend from the south jetty to R-16.
24-33, 759 Indialantic and Melbourne Beach Plans and Specifications As-Builts	-	-	P&S sheets, file is dated Sep-81. These sheets are missing from the D.O. File drawer.
24-33, 776 Indialantic and Melbourne Beach Comparative Profiles	10	Sep-81	Survey control and beach-profile surveys. 27 lines were surveyed from R-122+451 to R-127.
24-33, 824 Canaveral Harbor Sections Comparative Profiles	6	Mar-79 Dec-79	Comparative beach-profile cross sections for R-1 through R-12. Profiles extend to -25 ft.
24-34, 594 Beach-Erosion Comparative Profiles	34	May-85 to Jun-85	R-1, R-3, R-6,,,R-219 surveyed to -25-ft contour. R-2, R-4, R-7, R-8, R-10, R-11, R-13, R-14, R-16, and R-17 were surveyed to wading depth only.
24-35, 379 City of Canaveral Monitoring Survey	12	Sep-88	R-1 through R-15 surveyed. Profiles extend to -15 to -20 ft.
24-36, 564 Shore Protection Project Feasibility Survey Beach Profiles	29	Dec-93	R-1, R-4, R-7, R-10...R-52 were surveyed to -20 ft. R-2, R-3, R-5, R-6...R-51 were surveyed to wading depth. R-56, R-59, R-62, R-65, R-68, R-71, and R-74 at Patrick AFB were surveyed to wading depth. R-76, R-79, R-81...R-136 were surveyed to -20 ft. R-77, R-78, R-80, R-81, R-83, R-84...R-137 were surveyed to wading depth.
24-37, 570 Brevard County, FL, Shore Protection Project Plans and Specifications Surveys, North Reach	23	Nov-97 to Feb-98	Profile Lines R-1 through R-53, and intermediate lines at 500-ft intervals.
24-37, 565 Brevard County, FL, Shore Protection Project Plans and Specifications Surveys, South Reach	10	Dec-97 to Jan-98	Profile Lines R-117 through R-139, and intermediate lines at 500-ft intervals.

From May to June 1971, beach profiles used in the USACE G&DDM dated September 1972 were surveyed. Seventeen profile lines were taken along the 2.8-mile Canaveral Beach project segment. Sixteen profile lines were taken along the 2.0-mile Indialantic and Melbourne Beach Project segment. In March 1979, the USACE surveyed FDEP Beach Profiles R-1 to R-16. The March 1979 data extends to between the -20 to -25-ft contour. FDEP Profile Lines R-1 through R-12 were resurveyed by the USACE in December 1979. The December 1979 data extends to the -25-ft contour. In September 1981, 27 profile lines between R-122+451 to R-127 were surveyed by the USACE.

The USACE surveyed R-1, R-3, R-6, R-9...R-219 to the 30-ft contour, and R-2, R-4, R-5, R-7, R-8...R-218 to wading depth in May and June 1985. In September 1988, the USACE resurveyed R-1 through R-15. The 1988 survey extended offshore to the -15 to -20-ft contour. In January 1994, the USACE completed a survey of every third FDEP beach profile in Brevard County from the south jetty to the south county line, excluding Patrick AFB. The beach-profile

surveys for the contract plans for the Brevard County shore protection project were taken from November 1997 through February 1998.

F.5.4. FDEP Surveys

The FDEP establishes CCCLs on a countywide basis. Surveys of the beach and offshore areas are an integral part of studies performed by the FDEP for its control line program. The FDEP surveyed R-1, R-3, R-6, R-9,..R-219 to the 30-ft depth contour and R-2, R-4, R-6, R-7, R-8, ... R-218 to wading depth for the purpose of establishing a CCCL for Brevard County in September through November 1972. FDEP resurveyed the same profile lines for reestablishment of the CCCL in Brevard County from August 1985 to May 1986. Because the State does not establish CCCLs for Federal property, the Brevard County CCCL does not extend north of Canaveral Harbor. The FDEP has also performed ten post-storm or conditional surveys of the beaches in Brevard County since 1972. Post-storm and condition surveys do not extend seaward beyond wading depth (-5 ft MLW) and are taken for a limited number of profile lines. Table F-8 lists the FDEP surveys, including the number of offshore and onshore profiles, the total number of points (elevation data) taken, the survey type, and survey dates.

Table F-8. Brevard County, Florida, beach-profile survey inventory from the FDEP.

Survey Dates	Number of Offshore Profiles	Number of Onshore Profiles	Total Number of Points	Survey Type
Sep to Nov-72	74	219	4,807	Control Line
Nov-73	0	32	361	Post Storm
Oct-74	0	59	723	Post Storm
Oct-74	0	- 5	55	Post Storm
Sep-79	0	14	178	Post Storm
Nov-81	0	15	162	Post Storm
May-82	0	30	520	Post Storm
Jul-83	0	74	1,414	Condition
Feb-85	0	193	5,429	Post Storm
May to Jun-85	74	93	4,161	Special
Aug-85 to May-86	74	219	5,848	Control Line
Apr-86	0	21	391	Special
Apr-86	0	21	239	Special
May-86	0	21	177	Special
Jun-86	0	21	239	Special

F.6. Volume Computations

As noted in the earlier sections of this appendix, there is a wealth of survey data for the beaches of Brevard County. Many of the surveys were taken for limited areas, such as the condition surveys taken by FDEP, or have been taken once, such as the USACE survey in 1965-1966 for Brevard County from Cape Canaveral to the north county line. The USACE completed a survey for the area 2 miles north and south of the Harbor just prior to the pilot cut through the barrier island in October 1951. In May 1954, the USACE expanded the October 1951 survey to extend 4 miles north and 6.5 miles south of the Harbor. The 1951 and 1954 surveys serve as the basis for examining volume changes to the shores adjacent to Canaveral Harbor since its construction.

Table F-4 shows the extent of survey data north of Canaveral Harbor. Beach-profile data north of the Harbor for October 1951, May 1954, November 1958, March 1965 - January 1966, February - April 1994, January 1996, May 1996, and May 1997 were digitized for analysis. These surveys are shaded in Table F-4. Tables F-5 and F-6 show the extent of survey data from the south jetty to R-53, near the north boundary of Patrick AFB. Beach-profile data south of the Harbor for October 1951, May 1954, November 1958, March 1965 to January 1966, September to November 1972, May 1975, March 1979, December 1979, August 1985 to May 1986, January 1994, January 1996, May 1996, and May 1997 were digitized for analysis. These surveys are shaded in Tables F-5 and F-6. The location and extent of survey data from R-53 to the south county line have been compiled, but were excluded from this report since the focus is on the test Plaintiffs (test Plaintiffs are located north of R-53). Therefore, surveys south of R-53 were not listed in Tables F-5 and F-6.

Beach-profile data were digitized from the USACE D.O. map file mylar media, or obtained electronically from FDEP, in order to compare volume changes using the computer-aided design and drafting (CADD) software program. The software program MicroStation in conjunction with the support package InRoads was used to define the survey baseline data, beach-profile survey data, and conversion of data into surfaces (Digital Terrain Models (DTMs)) for each survey. Volume difference between the surfaces was then generated for each survey. The onshore limit of the volumetric analysis was the FDEP monuments. The offshore limit of the volumetric analysis is the 17-ft depth contour relative to NGVD (+1.7 ft MLW). An average-end area analysis was used to determine volume changes between each beach-profile survey line. The CADD software determined the cut, fill, and net area changes at each of the profile lines. The average net area change between adjacent long-line beach profiles was multiplied by the distance between each survey monument to define volume change.

The surveys listed above from 1951 through 1997 were digitized with CADD software. InRoads converted the digital survey data into DTMs. Much of the USACE survey data were

referenced to MLW; therefore, the elevation data were lowered -1.9 ft to convert to the NGVD 1929 reference. FDEP survey data for 1972, 1986, and USACE surveys for 1994 through 1997 were surveyed to NGVD datum and did not require elevation datum conversion.

F.6.1. Volume Analysis North of Canaveral Harbor

The pre-Harbor October 1951 survey was completed by the USACE just prior to the cut through the barrier island for the first 10,500 ft of shore north of the Harbor. The October 1951 survey was compared with the May 1954, December 1958, March 1965 to January 1966, February to April 1994, January 1996, May 1996, and May 1997 surveys to determine volume changes. The computed volume changes are listed in Table F-9. The volume changes were computed for the beach profile from the landward limit of the survey data seaward to the -17-ft contour of the October 1951 survey. The 1994 through 1997 survey data were extended landward to the limit of the October 1951 profile data in order to perform the volume comparisons. Some of the available survey data (Table F-4) were not included in the volume computations, such as the October 1956 and January, June, and October 1995 surveys, as there were sufficient surveys for comparison purposes for these time frames. Other surveys (refer to Tables F-3 and F-7) were excluded from the volume analysis because of their limited lineal extent.

The May 1954 survey repeated and expanded the October 1951 survey. The May 1954 coverage extends from 210+00N to 343+98S. The Harbor impact was fairly limited in 1954 as evidenced by volume changes to the -17-ft contour for 10,500 ft of shore north and south of the Harbor of +286,800 and -148,600 cy, respectively (refer to Tables F-9 and F-12). Therefore, the May 1954 survey is better suited as the baseline for pre-project conditions since its lineal extent is twice as great north of the Harbor, and three times longer south of the Harbor as compared with the October 1951 survey. Therefore, volume changes were also computed using the May 1954 survey as a pre-Harbor survey. The May 1954 survey was compared with the November 1958, March 1965 to January 1966, January 1996, May 1996, and May 1997 surveys for the first 13,500 ft of shore north of the Harbor. The computed volume changes are listed in Table F-10. The volume changes were computed for the beach profile from the landward limit of the survey data seaward to the -17-ft contour of the May 1954 survey. The 1994 through 1997 survey data were extended landward at the berm elevation (+8.1 ft NGVD) to the limit of the May 1954 profile data in order to perform the volume comparisons.

The May 1954 survey was compared with the November 1958 and the March 1965 to January 1966 surveys for the first 21,000 ft of shore north of the Harbor. The computed volume changes are listed in Table F-11. The volume changes were computed for the beach profile from the landward limit of the survey data seaward to the -17-ft contour of the May 1954 survey. The

1994 to 1997 survey data does not extend beyond 13,500 ft north of the Harbor, and, therefore, could not be used to compute volumes beyond 13,500 ft.

Table F-9. Volume changes north of the north jetty 10,500 ft, seaward to the -17-ft contour.

Survey Date	May-54	Nov-58	Mar-65 to Jan-66	Feb-94 to Apr-94	Jan-96	May-96	May-97
Oct-51	286,800	1,124,100	1,947,400	4,868,500	4,229,300	4,264,300	4,434,400
May-54		837,700	1,714,900	4,563,700	3,923,900	3,958,700	4,128,600
Nov-58			1,053,900	3,726,400	3,086,200	3,121,000	3,290,900
Mar-65 to Jan-66				3,534,500	2,592,900	2,953,900	3,109,400
Feb-94 to Apr-94					-639,500	-604,900	-434,700
Jan-96						35,000	205,100
May-96							170,100

Note: The 1965 data for the area north of the inlet are based on two profile lines. See Plates F-1, F-2, F-3, F-7, and F-8 for a graphical display of volume changes. The May 1954 MHW is depicted on the plates.

Table F-10. Volume changes north of the inlet 13,500 ft, seaward to the 1954 -17-ft contour.

Survey Date	Nov-58	Mar-65 to Jan-66	Feb-94 to Apr-94	Jan-96	May-96	May-97
May-54	759,900	1,445,100	6,053,400	5,468,800	5,510,300	5,732,100
Nov-58		863,200	4,689,900	4,104,000	4,145,600	4,371,800
Mar-65 to Jan-66			4,666,600	4,117,100	4,151,700	4,359,000
Feb-94 to Apr-94				-585,600	-545,100	-322,800
Jan-96					41,500	263,300
May-96						221,800

Table F-11. Volume changes north of the inlet 21,000 ft, seaward to the 1954 -17-ft contour.

Survey Date	Nov-58	Mar-65 to Jan-66
May-54	1,312,900	2,594,700
Nov-58		1,549,900
Jan-66		

Note: The 1965 data for the area north of the inlet are based on three profile lines. See Plates F-1 to F-9 for a graphical display of volume changes. The 1954 MHW line is noted on the Plates.

F.6.2. Volume Analysis South of Canaveral Harbor

The pre-Harbor, October 1951 survey was completed by the USACE just prior to the cut through the barrier island for the first 10,500 ft of shore south of the Harbor. The October 1951 survey was compared with the May 1954, December 1958, March 1965 to January 1966, May 1975, March and December 1979, August 1985 to May 1986, January 1994, January and May 1996, and May 1997 surveys to determine volume changes. These volume changes were computed for the beach profile from the landward limit of the survey data seaward to the -17-ft contour of the October 1951 survey and are listed in Table F-12. Similarly, volume changes were computed for the beach profile from the landward limit of the survey data seaward to the October 1951 MHWL (Table F-13). Some of the available survey data (see Tables F-4, F-5 and F-6) were not included in the volume computations (such as the October 1956 and the January, June, and October 1995 surveys), as there were sufficient surveys for comparison purposes for these time frames. Other surveys (refer to Tables F-3 and F-7) were excluded from the volume analysis because of their limited lineal extent.

The May 1954 survey repeated and expanded the October 1951 survey. The May 1954 coverage extends from 210+00N to 343+98S. The Harbor impact was fairly limited in 1954 as evidenced by volume changes to the -17-ft contour for 10,500 ft of shore north and south of the Harbor of +286,800 and -148,600 cy, respectively (refer to Tables F-9 and F-12). Therefore, the May 1954 survey is better suited as the baseline for pre-project conditions since its lineal extent is twice as great north of the Harbor and three times longer south of the Harbor as compared with the October 1951 survey and is more suitable as a pre-Harbor survey.

The May 1954 survey was compared with the December 1958, March 1965 to January 1966, May 1975, March and December 1979, August 1985 to May 1986, January 1994, January and May 1996, and May 1997 surveys for the shore 34,398 ft (6.5 miles) south of the Harbor. Volume changes were computed for the beach profile from the landward limit of the survey data seaward to the -17-ft contour of the May 1954 survey, (Table F-14). Similarly, volume changes were computed from the landward limit of the survey data seaward to the May 1954 MHWL and the results displayed in Table F-15 and shown on Plates F-1 through F-8. Since the May 1975, March and December 1979, January and May 1996, and May 1997 surveys only extend to 2.8 miles south of the Harbor, they could not be used to compute volumes for 6.5 miles of shore.

Table F-12. Volume changes south of the Inlet 2,500 to 10,500 ft, seaward to the -17-ft contour.

	May-54	Nov-58	Mar-65 to Jan-66	May-75	Mar-79	Dec-79	Aug-85 to May-86	Jan-94	Jan-96	May-96	May-97
Oct-51	-148,600	-494,100	-999,100	1,140,300	793,100	126,800	-109,600	-808,700	-618,800	-581,000	-701,600
May-54		-345,500	-853,900	1,284,100	931,500	1,407,700	35,500	-632,800	-470,400	-433,400	-553,300
Nov-58			-509,400	1,628,700	1,277,800	1,753,100	380,000	-325,800	-125,200	-88,600	-208,100
Mar-65 to Jan-66				2,129,800	1,777,500	2,252,300	889,400	185,500	379,600	416,400	297,700
Sep-72 Nov-72				-	-	-	-	-	-	-	-
May-75					-342,700	121,440	-1,252,300	-1,947,300	-1,751,100	-1,722,100	-1,845,300
Mar-79						465,700	-895,500	-1,597,800	-1,390,400	-1,363,800	-1,490,500
Dec-79							-1,372,500	-2,072,500	-1,872,200	-1,839,500	-1,966,900
Aug-85 to May-86								-703,160	-505,100	-468,000	-589,200
Jan-94									204,800	232,100	108,100
Jan-96										34,500	-84,300
May-96											-123,000
May-97											

Note: See Plates F-1 through F-7 for graphical display of volume changes. The May 1954 MHWL is noted on the Plates. The hydrographic data for the 1972 FDEP survey were omitted in this analysis because of irregularities in the offshore portions of the data set.

Table F-13. Volume changes south of the inlet 2,500 to 10,500 ft, seaward to the 1951 MHW.

	May-54	Nov-58	Mar-65 to Jan-66	Sep-72 to Nov-72	May-75	Mar-79	Dec-79	Aug-85 to May-86	Jan-94	Jan-96	May-96	May-97
Oct-51	-19,900	-71,700	-190,200	-361,000	117,600	66,000	74,500	-163,600	-305,200	-332,900	-295,100	-261,600
May-54		-51,900	-170,700	-341,400	132,700	75,800	89,700	-144,100	-296,500	-313,100	-276,200	-241,900
Nov-58			-119,000	-290,300	183,700	128,500	141,400	-92,400	-245,000	-261,600	-224,900	-190,300
Mar-65 to Jan-66				-171,700	298,300	240,800	256,300	26,600	-125,900	-143,000	-106,800	-71,700
Sep-72 to Nov-72					479,400	411,500	432,300	197,681	48,200	29,900	68,700	100,500
May-75						-46,300	-33,500	-281,400	-420,900	-442,700	-413,600	-382,600
Mar-79							16,323	-220,300	-367,100	-377,400	-350,900	-323,500
Dec-79								-234,900	-379,500	-396,900	-368,800	-337,600
Aug-85 to May-86									-147,700	-167,300	-130,300	-97,400
Jan-94										12,900	13,900	44,400
Jan-96											34,900	69,800
May-96												31,100
May-97												

Note: See Plates F-1 through F-7 for graphical display of volume changes. The May 1954 MHWL is noted on the Plates. The hydrographic data for the 1972 FDEP survey were omitted in this analysis because of irregularities in the offshore portions of the data set.

Table F-14. Volume changes south of the inlet from 2,500 to 34,400 ft, seaward to the -17-ft contour.					
	Nov-58	Mar-65 to Jan-66	Sep-72 to Nov-72	Aug-85 to May-86	Jan-94
May-54	-1,687,500	-1,497,700	-	-250,600	-1,304,400
Nov-58		190,100	-	1,437,300	386,400
Mar-65 to Jan-66			-	1,247,100	196,800
Sep-72 to Nov-72				-	-
Aug-85 to May-86					-1,050,300
Jan-94					
Note: See Plates F-1 through F-7 for graphical display of volume changes. The May 1954 MHW line is noted on the Plates. The hydrographic data for the 1972 FDEP survey were omitted in this analysis because of irregularities in the offshore portions of the data set.					

Table F-15. Volume changes south of the inlet from 2,500 to 34,400 ft, seaward to the 1954 MHW.					
	Nov-58	Mar-65 to Jan-66	Sep-72 to Nov-72	Aug-85 to May-86	Jan-94
May-54	-574,000	-193,100	-932,800	-481,600	-496,600
Nov-58		381,200	-357,700	92,800	80,700
Mar-65 to Jan-66			-739,700	-288,500	-300,000
Sep-72 to Nov-72				451,100	438,700
Aug-85 to May-86		-			-11,500
Jan-94					
Note: See Plates F-1 through F-7 for graphical display of volume changes. The May 1954 MHW line is noted on the Plates.					

F.7. Plaintiffs' Claims of Volume Loss

A comparison has been made of the USACE October 1951 Canaveral Harbor pre-construction survey (D.O. File 11-20, 193; three sheets, a copy of which is in Plaintiffs' possession) and the USACE January 1994 beach-profile surveys (1996 Feasibility report). The 1951 survey coverage was limited to 10,500 ft south of the south jetty. The volume difference in cubic yards was computed between the two surveys for the area bounded to the north by the inlet to a point 10,500 ft south of the inlet, to the minimum landward extent of the surveys and seaward to the October 1951 MHW shoreline (elevation +1.7 ft NGVD). The total volume change for this shore was 305,200 cy of erosion from 1951 to 1994 above and landward of the October 1951 MHW (see Table F-13).

F.7.1. Plaintiffs' First Claim of Volume Loss

In 1995, plaintiffs claimed total volumetric losses of 4.8 Mcy (claimed dune loss of 1.8 Mcy[36] and other volumetric loss of 3.0 Mcy[37]) for the first 10,500 ft south of the south jetty at Canaveral Harbor for the period 1951 to 1995. These claims of volume loss, presumably above and landward of the 1951 MHWL, are 16 times higher than those estimated from beach-profile surveys for the period 1951-1994. It is important to note that within the first 10,500 ft south of Canaveral Harbor, the Defendant estimates that 43 shorefront parcels owned by Plaintiffs sums to 5,880 ft. Because Plaintiffs shorefront parcels are 5,880 ft of the first 10,500 ft, it could be expected that erosion losses would be similarly reduced from a computed total.

Alleged volume losses from the Applegate property, which is located within the 10,500 ft south of Canaveral Harbor, totaled 42,550 cy (21,340 cy of dune and bluff erosion,[36] 21,210 cy of other volumetric loss.[37] Applegate's claim of volume losses in 1995 amounts to 13.9 % of actual loss (305,200 cy), yet Applegate's property width of 100 ft is only 0.9 % of 10,500 ft.

F.7.2. Plaintiffs' Second Claim of Volume Loss

Plaintiffs provided the Defendant a second estimate of dune and bluff volume losses from the time of purchase to 1995 on or about June 28, 1996. Summing the information provided by Plaintiffs second submission for claims within 10,500 ft south of Canaveral Harbor yields 464,710 cy of alleged losses from time of purchase to 1995. This is 1.5 times the amount of erosion from 1951 to 1994 (305,200 cy) above and landward of the 1951 MHW for the 10,500 ft of shoreline south of Canaveral Harbor. It is important to note the following: (1) Defendant estimates that Plaintiffs own 43 shorefront parcels totaling 5,880 ft within the first 10,500 ft south of Canaveral Harbor. Since Plaintiffs' shorefront parcels are 5,880 ft of the first 10,500 ft, it could be expected that erosion losses would be similarly reduced from a computed total; and (2) Plaintiffs' claims are alleged to have been made from time of purchase, and yet they exceed the estimate of loss based on survey data for the period 1951 to 1994.

The volumes losses from 1965 to 1995 have been estimated to be 125,900 cy above the 1951 MHW line for the area 10,500 ft south of Canaveral Harbor (see Table F-13). These comparisons were made based on the USACE October 1951 Canaveral Harbor pre-construction survey, the USACE 1965 survey (D.O. File 24-29, 128; thirty-five sheets, a copy of which is in Plaintiffs' possession) and the USACE January 1994 survey.

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[36] Based on information in Exhibit "A," November 16, 1995, Plaintiffs' Response to Defendant's Request for Information in Accordance with Court Order Dated August 18, 1995. Volume is summed for the first 62 Plaintiffs (to R10+850).

[37] Based on information in table enclosed to 30 June 1995 Plaintiffs' Answer to Defendant's Interrogatory No. 10 and Request for Production. Volume is summed for the first 62 Plaintiffs (to R10+850).

Beside the City of Cape Canaveral (#176, 12 parcels totaling 465 ft), only two Plaintiffs (Pittman, #131, 350 ft and Eberwein, #8, 230 ft) own parcels in the first 10,500 ft of shore, and their claims of loss total 172,663 cy. Recognizing that an indefinable portion of this volume loss occurred after 1965, an estimate of Plaintiffs' volume losses after 1965 within the first 10,500 ft south of Canaveral Harbor was made by subtracting 172,663 cy from 464,710 cy. This yields 292,047 cy of alleged volume losses after 1965, which is 2.3 times the amount of erosion (125,900 cy) computed from 1965 to 1994 surveys above and landward of the 1951 MHW.

F.7.3. Other Issues Related to Plaintiffs' Volume Claims

Names of plaintiffs and associated frontage (in ft) were provided to the Defendant in 1995. Summing this frontage for the first 10,500 ft south of Canaveral Harbor yields a total of 11,845 ft of ocean frontage (for Plaintiffs north of R10+850), a physical impossibility. Defendant estimates that Plaintiffs own 43 shorefront parcels totaling only 5,880 ft of ocean frontage in the first 10,500 ft south of Canaveral Harbor. This appears in large part to be duplication by Plaintiffs for condominium properties. As an example, Canaveral Sands Condominium Association (Plaintiff No. 5) claims 700 ft of frontage and 149,380 cy of dune and bluff loss, yet three additional Plaintiffs (Nos. 242, 108, and 130) appear to be claiming the same frontage and a portion of the dune and bluff loss claimed by Plaintiff No. 5. Similar discrepancies exist in Plaintiffs' Answer to Defendant's Interrogatory No. 10 and Request for Production dated June 30, 1995, and Plaintiffs' second estimate of dune and bluff volume losses dated June 28, 1996.