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Beach Erosion Control Study on Duval County, Fla

U.S. Army Engineer District, Jacksonville Corps of Engineers

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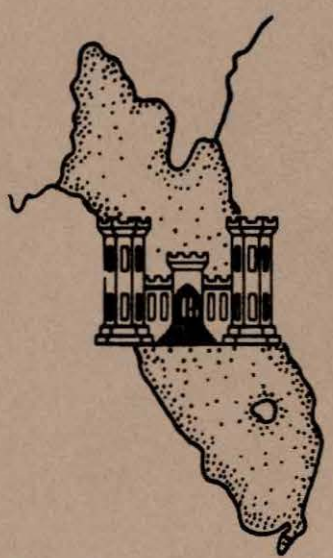
BEACH EROSION CONTROL STUDY

ON

DUVAL COUNTY, FLA.



U.S. ARMY ENGINEER DISTRICT, JACKSONVILLE
CORPS OF ENGINEERS
JACKSONVILLE, FLA.

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BEACH EROSION CONTROL STUDY
DUVAL COUNTY, FLORIDA

SYLLABUS

The purpose of this study was to define the beach erosion and the hurricane-induced flooding problems in Duval County, to determine the most economical methods of alleviating those problems, and to determine the division of costs between the Federal Government and local interests.

The District Engineer finds that most of the shore of Duval County south of the ocean entrance to St. Johns River has been eroded by wave action and ocean currents, and that severe damages have been sustained as a result of that erosion. He finds that hurricane-induced flooding is not a significant problem. Improvement of the eroded shore is needed to provide adequate erosion control and to satisfy future recreational bathing needs.

The study determines that the most practicable plan of improvement would involve artificial placement of fill to form a protective and recreational beach for about 10 miles of shore in the reach between St. Johns River and the Duval County - St. Johns County line, and periodic nourishment of the restored beach when needed. The improved beach would provide a level berm 60 feet wide at elevation 11 feet, mean low water. The expected seaward slopes, as shaped by wave action, would be about 1 on 20 from the seaward crest of the berm to mean high water, thence 1 on 30 to mean low water, and thence 1 on 45 to intersection with the existing bottom. Placement of 3.75 million cubic yards of material would be required. Stability of the restored beach would be accomplished by periodic replenishment of losses. Material for initial improvement would be pumped from inland sources by hydraulic dredge. Material for period nourishment would be obtained partly from those inland sources and partly from shoal areas near the mouth of St. Johns River. The estimated first cost, exclusive of preauthorization study costs, and including costs of lands, easements, and rights-of-way is $4,140,000. The estimated annual costs for interest and amortization and periodic nourishment equal $565,000. It is determined that the improvement is economically justified and adoption of a Federal project is warranted.

The District Engineer therefore recommends, subject to certain conditions of local cooperation outlined in paragraph 65, adoption of the plan of improvement as a Federal project at a first cost to the United States presently estimated at $2,266,000 (55.4 percent of the first cost of the project exclusive of lands, easements, and rights-of-way), plus $231,000 (57.7 percent of the total nourishment cost of the project) annually for periodic nourishment for a period of 10 years.

BEACH EROSION CONTROL STUDY
DUVAL COUNTY, FLA.

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U. S. ARMY ENGINEER DISTRICT, JACKSONVILLE
OFFICE OF THE DISTRICT ENGINEER
CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

SAJWR NOV 16 1964

SUBJECT: Beach Erosion Control Study, Duval County, Florida

THROUGH: Division Engineer
U. S. Army Engineer Division, South Atlantic
Atlanta, Georgia

TO: Chief of Engineers
Department of the Army
Washington, D. C.

I. INTRODUCTION

1. Authority.--This report is in response to the following resolutions adopted January 7, 1963, and June 19, 1963, respectively:

a. Resolved by the Committee on Public Works of the United States Senate, That in accordance with Section 110 of the River and Harbor Act, approved October 23, 1962, the Secretary of the Army be, and is hereby, requested to cause to be made, under the direction of the Chief of Engineers, a survey of the shores in Duval and St. Johns Counties, Florida, with particular reference to Neptune Beach, Florida, and such adjacent shores as may be necessary, in the interest of beach erosion control, hurricane protection, and related purposes.

b. Resolved by the Committee on Public Works of the House of Representatives, United States, That in accordance with Section 110 of the River and Harbor Act, approved October 23, 1962, the Secretary of the Army be, and is hereby, requested to cause to be made, under the direction of the Chief of Engineers, a survey of the shores in Duval and St. Johns Counties, Florida, with particular reference to Neptune Beach, Florida, and such adjacent shores as may

be necessary, in the interest of beach erosion control, hurricane protection, and related purposes.

Preparation of two separate reports on the survey of Duval and St. Johns Counties shores was approved by the Chief of Engineers May 27, 1963, provided that such procedure was satisfactory to the congressional and local interests concerned.

2. Scope and purpose.--The study is of survey scope. This report covers the entire ocean shoreline of Duval County, about 16 miles. The purpose of the study is to survey the shores of Duval County and to determine the need and feasibility of providing measures to control beach erosion and prevent hurricane-induced flooding.

3. The study includes an economic analysis of the problem and a determination of the extent to which local interests are qualified for Federal aid under terms of Public Law 826, 84th Congress, as amended by Public Law 874, 87th Congress.

4. Prior reports and studies.--Prior reports involving shore processes in Duval County have been primarily in connection with the Federal navigation project, St. Johns River, Jacksonville to the Ocean. The latest published report on that project is Senate Document 179, 79th Congress, 2d Session. A survey-review report on Jacksonville Harbor is currently nearing completion. A preliminary-examination report on St. Johns River, Fla., Jacksonville to the Ocean, was made in 1948. The examination was made with a view to determining the effect of the Federal project improvements at the entrance to St. Johns River on the shoreline contiguous thereto. Conclusions reached in the 1948 report were as follows: (1) The Federal navigation improvements at the entrance to St. Johns River have caused accretion to the shorelines contiguous to the jetties, which has directly benefited local interests by formation of additional land and by preventing erosion from natural causes which would have otherwise resulted; (2) the erosion and damage complained of south of and remote from the entrance are due almost entirely to natural causes and only to a minor and indeterminate extent to the jetties or other project works; (3) dredging of material from the St. Johns River has had little effect on the shorelines; (4) erosion of the shoreline occurred before the harbor structures were built and presumably would have continued had they not been provided; (5) present erosion and damages are no more than were anticipated when the beach developments were made; (6) alteration of the harbor structures is unnecessary and would serve no useful purpose insofar as erosion at the locality is concerned; and (7) if local interests desire development of a detailed plan of improvement for beach protection it can be

done on a cooperative basis. Other reports on beach erosion in Duval County by municipal and county engineers, and consulting engineers were submitted in a public hearing held May 18, 1948 in Jacksonville Beach for the 1948 preliminary-examination report. Those reports were incorporated in the 1948 public hearing records.

5. A letter report, dated December 7, 1962, on the damaging effects of the November-December 1962 northeast storm in Duval County was prepared by this District at the request of the Federal Office of Emergency Planning. Jacksonville Beach and Neptune Beach were subsequently declared disaster areas due to damages resulting from that storm. Temporary emergency relief measures that were provided, as well as the characteristics of the storm and its effects, are discussed later in the report.

II. DESCRIPTION

6. General.--Duval County is located on the upper east coast of Florida, within 20 miles of the Florida-Georgia State line. The length of ocean shoreline is about 16 miles. The Duval County shore, a barrier beach with a low tidal marsh and lagoon behind it, is separated from the mainland by the Intracoastal Waterway. It is bounded on the north by Nassau Sound and interrupted in the north-south direction by Fort George Inlet and the mouth of St. Johns River. The barrier beach, ranging in width from about 3,000 feet to about 13,000 feet and in elevation from about 10 feet to over 30 feet, mean low water*, is highly developed in the approximate southern half and virtually undeveloped in the northern half, except for Mayport Naval Station and a State Park. The locality is shown on United States Coast and Geodetic Survey Charts Nos. 577, 841-SC, and 1243, and on plate 1 accompanying this report. Figure 1 shows an aerial view of the entire county frontage. The photograph was taken January 15, 1964, at about low tide.

7. The study area consists of Little Talbot Island, a small peninsula of Fort George Island, the ocean frontage of the United States Naval Station at Mayport, an unincorporated county area immediately south of Mayport Naval Station known locally as Seminole Beach (recently redesignated Chosen Beach) and the towns of Atlantic Beach, Neptune Beach, and Jacksonville Beach.

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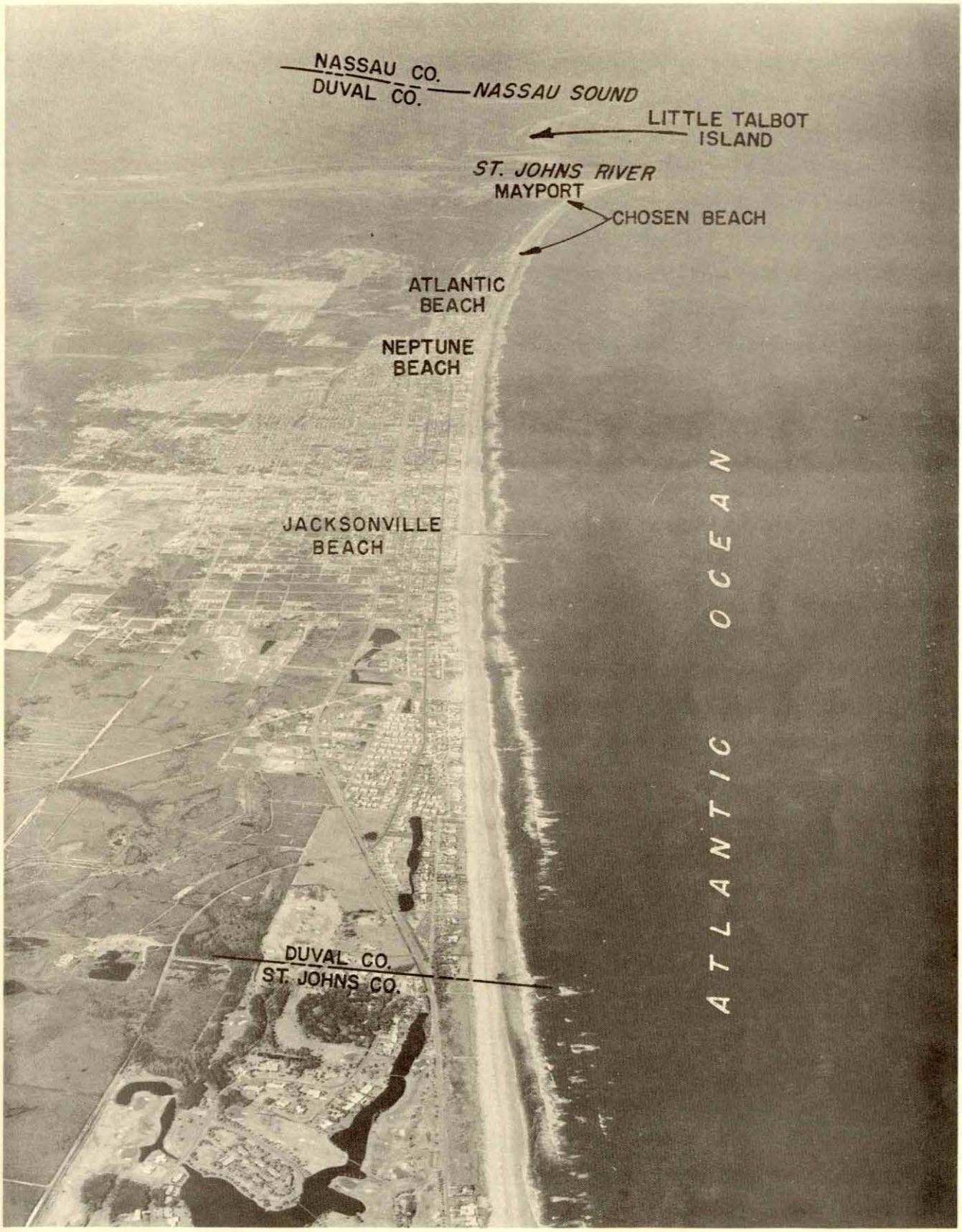
*Unless otherwise indicated, all stages and elevations throughout this report refer to mean low water datum.



AERIAL VIEW OF DUVAL COUNTY SHORE

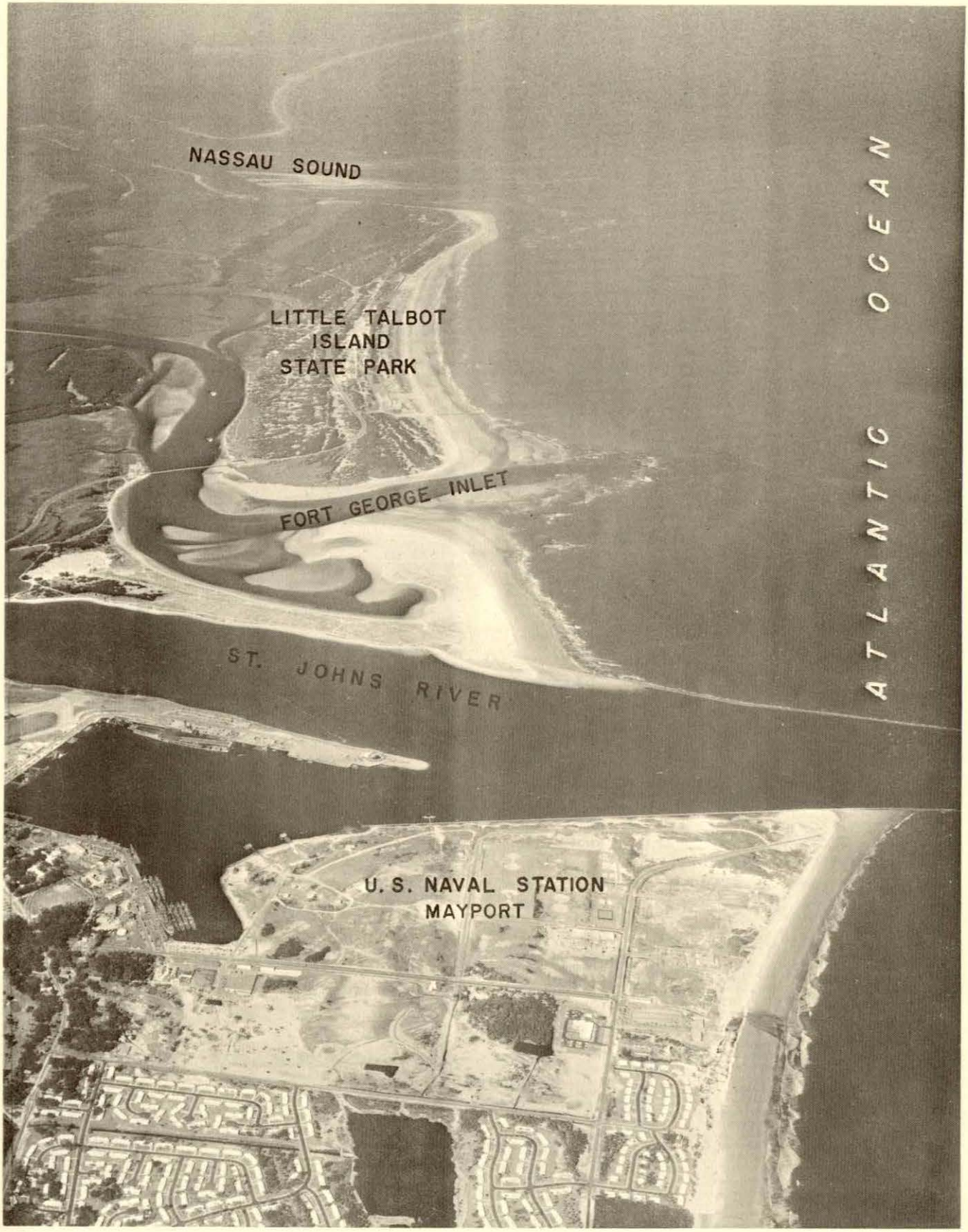
FIGURE 1

8. Little Talbot Island, a State Park occupying about 2,500 acres, is of irregular shape with widths of about 2,000 to 4,000 feet and a length from north to south of about 5 miles. The ocean shoreline is crescent-shaped; the point of maximum indentation is near the middle of the island. South of Little Talbot Island is Fort George Inlet and a small peninsula of Fort George Island formed by the north jetty at the mouth of St. Johns River. Figure 2 shows an aerial view of the area from Nassau Sound to St. Johns River. The photograph was taken January 15, 1964, at about low tide.

9. From the jetties south for about 4 miles the shoreline is slightly concave; thence south for about 29 miles to St. Augustine Inlet, in St. Johns County, it is generally straight and unbroken by tidal inlets. The beach along this area is composed of fine, hard sand with a minimum of shell content, which when damp compacts into a hard smooth surface suitable for motoring during low tide. The excellent motoring afforded by the beaches is one of their chief attractions to visitors and residents alike. Figure 3 is an aerial view of the study area south of St. Johns River. The photograph was taken January 15, 1964, at about low tide.

10. The first mile of the ocean shoreline south of St. Johns River jetties is occupied by United States Naval Station at Mayport. The beach at Mayport is composed of very fine sand and is unusually flat for an eroding beach. The dune line, with elevations as high as 20 feet, is nearly continuous and is, at times, heavily attacked by erosion. A nearly vertical dune face existed prior to artificial restoration by the Navy in 1963. The beach and dune at Mayport are particularly vulnerable during storms.

11. Atlantic Beach, Neptune Beach, and Jacksonville Beach, aggregating about 5 miles in length, are highly developed with homes, apartment houses, resort motels and hotels, and concession facilities throughout. Jacksonville Beach is the principal recreational and commercial community in the beach area. The 1960 permanent populations of Jacksonville Beach, Neptune Beach, and Atlantic Beach were 12,049, 2,868, and 3,125, respectively; the percent increases in population from 1950 to 1960 were 82 percent, 62 percent, and 95 percent, respectively. In the summer months these figures are about quadrupled due to the influx of temporary residents and visitors from inland sections of all the southeastern states, especially north Florida and south Georgia. The metropolitan Jacksonville area population in 1960 was 372,569. The population of Duval County in 1960 was 455,411; an increase of 48 percent since 1950. All figures of permanent population are from official censuses by the United States.



NASSAU SOUND TO ST. JOHNS RIVER

FIGURE 2

STUDY AREA SOUTH OF ST. JOHNS RIVER

FIGURE 3

12. St. Johns River, Fla., Jacksonville to the ocean (Jacksonville Harbor).--The existing Federal navigation project provides for: A channel 34 feet deep and 400 to 1,200 feet wide from the ocean to Commodore Point via a cutoff 500 feet wide from Fulton to Dame Point and via Terminal Channel, and thence 28 feet deep to the Florida East Coast Railway Bridge at Jacksonville; Arlington Cut, 30 by 300 feet; a navigation and floodway channel 26 by 200 feet along south side of Commodore Point; an approach and mooring basin 20 feet deep, 1,300 feet long at 20-foot depth contour and 600 feet long at pierhead line near Naval Reserve Armory in south Jacksonville; a depth of 24 feet between that depth contour and the pierhead line from Hogan Creek to the foot of Laura Street; a depth of 28 feet to within 60 feet of pierhead line between foot of Laura Street and St. Elmo W. Acosta Bridge; construction of training walls and revetments; and maintenance of two converging, rubblestone jetties built at the entrance under a previous project. The easterly section of the bar cut has been dredged to 42-foot depth with Navy funds. The north jetty is 14,300 feet long, and the south jetty is 11,183 feet long. The jetties are parallel and 1,600 feet apart for 4,022 feet from the sea ends. The jetties are described further under the paragraph on existing structures appearing later in the report. As stated in paragraph 4, a survey review of Jacksonville Harbor to determine the feasibility of modifying the existing project is nearing completion.

13. The Intracoastal Waterway from Jacksonville to Miami, a Federal navigation project, traverses the entire county. Authorized project dimensions are 12 by 125 feet from Jacksonville to Fort Pierce, thence 10 by 125 feet to Miami. Authorized dimensions have been provided as far south as Broward County.

14. Fort George Inlet is an unimproved natural inlet located immediately north of the mouth of St. Johns River. The hydrography of the inlet, which is characterized by large shoals and breakers, changes continuously. The throat of the inlet is generally about 1,000 feet wide, with depths ranging from 1 to 13 feet. The instability and migration of the inlet are discussed in appendix C.

15. Nassau Sound separates Amelia Island from Talbot and Little Talbot Islands, and is the northern boundary of Duval County at the ocean. The sound is about 14,000 feet wide at the seaward edge and 3,500 feet wide at the narrowest point, near the bridge for highway A1A. The mouth of the sound is generally blocked by a complex system of large shoals. One large shoal, Bird Island, is above mean high water at this time. The area is very changeable and there are no recent detailed surveys available. According to the latest Coast and Geodetic Survey charts, depths in the sound vary considerably--from mean low water to 35 feet.

16. Publicly owned shore-front property.--Upland public property west of the seawall, or the toe of the dune in unprotected areas, consists of: Little Talbot Island State Park, about 24,000 feet; United States Naval Station at Mayport, about 5,700 feet; 5 easements totaling 180 feet at the unincorporated county area south of Mayport; 16 street ends in Atlantic Beach totaling 625 feet; 26 street ends in Neptune Beach totaling 1,209 feet; 59 street ends and walkways in Jacksonville Beach totaling 3,537 feet; and a public pavilion and recreational area at Jacksonville Beach of 590 feet. In addition, east of the seawall or the toe of the dune the entire length of ocean beach is publicly owned. There are no restrictions whatsoever to public use of the beaches of the county south of the Mayport Naval Station.

17. Privately owned shore-front property.--West of the seawall or dune line there are about 8 miles of privately owned property fronting the public beach. Except for about 2 miles south of Mayport Naval Station, the area is highly developed with private residences, motels, apartments, and concession facilities catering to beach visitors and tourists. The value of private property along the ocean front is in the millions.

18. Access to beaches by the public.--A 1925 Act of the State of Florida legislature declared portions of the beaches of Duval County to be a public highway, but subject to the paramount right of the public to them for bathing and recreation. Vehicular traffic along the beach is restricted at times in the interests of public safety. In practice and in actuality, all of the beaches in Duval County are open to the public at all times except for the 5,700-foot frontage of the United States Naval Station at Mayport. Unrestricted access to the beach is by ramps and by numerous street ends which are open to the general public.

19. Water pollution.--Coastal areas near large urban centers are subjected to intense recreational usage, but require the presence of clean water for maximum utility, especially for swimming. Yet, in a number of instances throughout the nation, improperly or inadequately treated sewage and industrial or ship wastes discharged in the waters near these beach areas have made it necessary, because of the resulting dangers to health, as well as for esthetic reasons, to close the areas to all uses involving human contact with the water. Those situations are particularly serious because of the large populations involved, and the consequent need to utilize every possible mile of beach front for recreation to the maximum extent possible, if the people of those areas and recreation-seeking visitors are to be provided with adequate recreational opportunities under suitable

conditions of esthetic acceptability and minimum crowding. In the past two decades there have been notable instances of the effects of pollution on beach areas. In California, the beaches of Santa Monica Bay were closed from 1942 to 1951 because of pollution. In the Lake Michigan area a number of beaches near Milwaukee were closed during the summer of 1960 and again in 1961 because of pollution of the adjacent lake, and beaches near Chicago were threatened with closure. At Cleveland, Ohio, beaches have been closed every summer for several years because of pollution in Lake Erie. Beaches near Detroit were closed in 1961 for the same reason. Similar situations exist or have existed as recently as 1962 in the New York metropolitan area.

20. The importance of maintaining unpolluted coastal waters in Florida cannot be overemphasized. As a general rule, the public uses all sandy beaches in the State for recreational bathing. There would be a serious impact on the well-being of the bathers, and the economy of the entire State would be adversely affected were coastal waters permitted to become polluted. Accordingly, it is established policy in all beach erosion control investigations to determine the existing quality of coastal waters in the study area, and to make it a project condition of local cooperation that those coastal waters be maintained in an unpolluted condition so as to safeguard the health of bathers. By letter of April 27, 1964, the Duval County Board of Commissioners transmitted a statement of the County Health Department relative to the bathing beaches. The Duval County Health Department stated that, at the present time, there is no pollution of water at the bathing beaches to an extent which might constitute a hazard to the health of bathers. Furthermore, that organization stated that all applications to dispose of waste or other material potentially hazardous to health are carefully screened by its office and by the Florida State Board of Health to prevent, insofar as possible, the occurrence of pollution of the beaches.

III. STATEMENT OF THE PROBLEM AND IMPROVEMENTS DESIRED

21. The beach erosion problem.--The problem in Duval County is one of erosion and lowering of the beach profile where protected by seawalls and recession of the dunes where unprotected by seawalls. Erosion of the beach and dune places seawalls and other structures in a position vulnerable to severe damage, especially during storms. Instability and erosion of the Duval County shores was reported as early as 1834. The erosion and damage to the beach, seawalls and ocean-front property have been accelerated and greatly magnified during storms, especially the storms of 1925, 1932, 1947, 1962, and the

most recent severe storm of September 1964 (Hurricane Dora). As a result of such storms the beach level is lowered and the width is reduced. Thousands of feet of seawall are damaged or destroyed, vehicular access ramps are damaged or destroyed, valuable ocean-front property is eroded, and, most important, use of the principal recreational beach in the tributary area is impaired. Figures 4-8 show results of the storms of 1947, 1962, and 1964. Natural buildup of the beach during the summer months generally alleviates the situation to some degree, though complete recovery seldom occurs. However, erosion during the winter months still leaves the shore vulnerable to possible severe damage from storms.

22. Improvements desired.--Local interests desire study and long-range planning to define the improvements needed to combat erosion and hurricane-induced flooding to insure the availability of a recreational beach and to prevent further damage to the lands and property adjacent to the ocean shores of Duval County. Local interests also desire that this investigation determine the effect of the St. Johns River jetties on adjacent beaches.

EFFECTS OF SEPTEMBER 1947 NORTHEAST STORM

FIGURE 4

EFFECTS OF NOV.-DEC. 1962 NORTHEAST STORM

FIGURE 5

EFFECTS OF NOV.-DEC. 1962 NORTHEAST STORM

FIGURE 6

EFFECTS OF NOV. - DEC. 1962 NORTHEAST STORM

FIGURE 7

EFFECTS OF SEPTEMBER 1964 HURRICANE (DORA)

FIGURE 8

23. Public hearing.--The District Engineer conducted a public hearing in Jacksonville Beach July 23, 1963, to discuss beach erosion problems in Duval County with local interests and to receive their views relative to the need and feasibility of providing remedial improvements. There were about 80 persons present. The Board of County Commissioners of Duval County, which is the local sponsoring agency, and the beach communities of Atlantic Beach, Neptune Beach, and Jacksonville Beach were represented at the hearing. It was brought out in the hearing that local interests believe that the jetties at the mouth of St. Johns River (entrance to Jacksonville Harbor) contribute significantly to the beach erosion problems of Duval County. A copy of the hearing record accompanies this report. A brief digest of the hearing is given in appendix A.

IV. FACTORS PERTINENT TO THE PROBLEM

24. Geology.--The State of Florida occupies only a part of a much larger geographic unit, the Floridian Plateau. The deep water of the Gulf of Mexico is separated from the deep water in the Atlantic Ocean by a partially submerged platform nearly 500 miles long and about 250 to 450 miles wide. The plateau for many millions of years has been alternately dry land or covered by shallow seas.

25. The east coast of Florida from the Georgia line to Miami Beach, a distance of more than 350 miles, consists of a series of sandy barrier islands, broken here and there by inlets. For the most part, the beach is rather straight. The Duval County shoreline, a barrier bar with a swamp behind it, is typical of young shorelines of emergence. According to one geological theory, the barrier bar has been built during recent times from material cut from the sea floor by wave action in front of the bar and to a lesser extent by deposition of sand from the southward moving currents. Another theory holds that the bar was formed as an offshore bar during a time of higher sea level and became dry land upon lowering of the sea level with respect to the land. Prior to the recent emergence, the Duval County shoreline was inundated by the Pamlico Sea.

26. The normal development for such beaches as those in Duval County would be for the shoreline or barrier bar to be moved back against the mainland. As the water is deepened in front of the bar, more direct wave action, especially during storms, is able to attack the bar, tending to move it shoreward.

27. Littoral materials.--Silica sand on the Florida east coast is that which has been carried down to the sea by the Savannah, Altamaha, and by other rivers of Georgia and the Carolinas, and gradually shifted southward by shore currents and wave action. Due to

the geological history outlined, the underlying material of practically all the beaches contains a large proportion of a sand and shell mixture of loose or unconsolidated sedimentary form which was deposited during the later stages of emergence.

28. The general effect of the southward movement of sand by shore currents and wave action has been to provide and to maintain the supply of siliceous material generally forming the dunes and beaches, and at places to cover the calcareous materials that were deposited when the area was under water. The beaches of Duval County are generally composed of fine, hard sand with a minimum of shell content which, when damp, compacts into a hard, smooth surface excellent for motoring, especially at low tide.

29. Surface sand samples were obtained from the dune, the backshore, the foreshore, and at elevations -3, -6, -12, -18, and -30 feet on five representative beach profiles. In addition, samples were obtained at elevations -18, -30, -38, and -40 feet on two profiles adjacent to the north and south jetties at the mouth of St. Johns River. Median diameters of the samples obtained ranged from 0.01 to 2.10 millimeters. Average median diameters of samples collected along the backshore ranged from 0.12 to 0.50 millimeters; average median diameters of samples collected along the foreshore ranged from 0.16 to 0.66 millimeters. Tabulations of the median diameter of the sand samples collected, and detailed information concerning beach material are contained in appendix B.

30. Littoral forces.--a. Winds.--(1) Records of the United States Weather Bureau station at Jacksonville for the period 1951-1960 were used in compiling the wind diagram shown on plate 1. The diagram indicates the velocity in four separate velocity groups, the directions from which the winds blow, and the duration in days. The diagram indicates that the direction of the predominant onshore winds is northeast. The following tabulation gives the percent of time and direction from which the winds blow as indicated by those records.

Yearly average winds at Jacksonville, Fla.
(from observations 1951-1960)

Direction	Percent of time	Direction	Percent of time	Direction	Percent of time
N	10.4	SE	12.3	W	13.2
NE	14.2	S	11.5	NW	10.7
E	10.4	SW	16.4	Calms	0.9

(2) Yearly cumulative average winds over the Atlantic and gulf coasts, compiled from records of the United States Hydrographic Office, are shown in the offshore wind diagram on plate 1. The wind rose in each square shows the yearly average winds that have prevailed within that square as reported by ships at sea from 1879 to 1933. The diagram shows that in the 5-degree square off Duval County average winds in the Atlantic Ocean blow from the different directions as tabulated below.

Yearly average offshore winds
(from observations 1879-1933)

Direction	Percent of time	Direction	Percent of time	Direction	Percent of time
N	9	SE	6	W	7
NNE	5	SSE	4	WNW	4
NE	12	S	6	NW	8
ENE	5	SSW	3	NNW	3
E	8	SW	11	Calms	2
ESE	4	WSW	3		

b. Swells and waves.--(1) The ocean swell diagram on plate 1 shows, for the 5-degree square of ocean area off Duval County, the percentage of observations during which swells from given directions occurred between 1932 and 1942. The swells are classified according to the height of waves and are indicated on the diagram by the width of lines. Because of the configuration and bearing of the shoreline, swells approaching from the north and northeast cause a southerly littoral drift; swells from the south and southeast cause a northerly drift. Swells from the east approach the study area normal to the shoreline and probably create very little drift in either direction. Seasonally, the analysis of data for the period 1932-1942 for the study area indicates that except for the months June, July, and August, the prevailing and predominant swells approach from directions which set up a southerly drift. Swells during June, July, and August approach from directions which set up a northerly drift.

(2) Gage-recorded wave data are not available for Duval County. However, 20-foot waves were reported offshore along the beaches during the 1944 hurricane; 20- to 30-foot waves were reported offshore during the 1964 hurricane (Dora). During the 1932 northeast storm, waves were reported to have reached a greater height than at any time during the preceding 60 years. On occasions, during northeast storms and after the beach has eroded, large waves during high tides have overtopped the seawalls. The ramps leading from the streets to the beach are the principal points through which flood waters penetrate upland areas during high tides and waves.

c. Tides and currents.--The mean range of tide in the Atlantic Ocean at Duval County is 5.2 feet. The range varies from 5.4 feet at Nassau Sound to 4.9 feet at the south jetty of the St. Johns River. The spring tide range is from 6.3 feet at Nassau Sound to 5.7 feet at the south jetty. The lowest tide to be expected is 3 feet below mean low water. Ocean tide-gage data for hurricanes and severe northeast storms of record are not available. However, a tide of at least 2.5 feet above mean high water was estimated during the November-December 1962 northeast storm. Tidal current velocity in St. Johns River at the strength of the current is about 2.9 miles per hour near the mouth. A crosscurrent of concern to navigators of deep-draft ships is reported to occur off the end of the north jetty of St. Johns River. Northerly winds cause a strong southerly set on flood tide.

d. The net result of littoral forces in Duval County is to produce a predominately southerly drift.

31. Storms and their effects.--The study area is in a zone subjected to tropical storms of hurricane intensity. The study area is also subjected to relatively frequent coastal storms from the northeast (extra-tropical). Specific hurricanes and northeast storms and their effects on the beaches of Duval County are discussed in detail in appendix C.

32. Hurricanes.--The paths of hurricanes which have passed within 50-mile and 150-mile radii of Jacksonville are shown on plate 1. The study area has experienced, within a 150-mile radius, 44 storms of hurricane intensity between 1830 and 1964, inclusive, or an average of one hurricane every 3 years. However, only 19 hurricanes passed within a 50-mile radius in that period, or an average of one hurricane every 7 years. With the exception of Hurricane Dora (September 1964), the effect of hurricanes on the beaches at Duval County has not been as severe as that of many northeast storms. Storm-damage analysis made for evaluation of anticipated project benefits indicated that very few hurricanes since the early part of the century caused major beach erosion damage. The short duration of hurricane-force winds and waves in the area has usually limited the severity of erosion damage.

33. Northeast storms.--Large, intense Atlantic storms, generally caused by a stationary high pressure area north of a low pressure area at the southeastern part of the United States during the winter months, have caused great damage to beaches and ocean-front property, not only at the Jacksonville beaches but along practically the entire east coast of Florida. Particularly severe northeast storms occurred in 1925, 1932, 1947, and 1962. Several lesser northeast storms adversely affected the Duval County beaches in 1963.

34. Shoreline changes.--Comparative positions of shoreline over the period of record are shown on plates 2-4. The bases for comparison are surveys made by the United States Coast and Geodetic Survey in 1858, 1923-24, 1951-54, 1958-59, and by the Corps of Engineers in October-December 1963. Details are presented in appendix C.

35. Changes in shoreline positions over various periods are tabulated in table C-1 of appendix C. The data indicate advance in the shoreline north of St. Johns River and recession in the shoreline south of the river except in the extreme south end of the county. The ocean shoreline of Little Talbot Island advanced considerably during the period of record--about 16 feet annually from 1923-24 to 1963. In 1853 the south end of Little Talbot Island was near the confluence of Fort George River and Simpson Creek. Immediately south of the island a long sand bar was covered during high tide. Since 1853 the south end of the island extended about 9,000 feet southward.

36. For the short-term period of 1958-59 to 1963, data for the 14 profiles south of the jetties show both advance and recession in almost equal distribution. Analysis for the period 1923-24 to 1963 shows an average total recession of 79 feet from the south jetty for a distance of about 6.5 miles southward and an average total advance of 56 feet for the remaining distance of about 3.5 miles to the south county line. Changes in the Neptune Beach-Jacksonville Beach area reflect the emergency restoration carried out there in 1963 at the direction of the Federal Office of Emergency Planning. Changes immediately south of the jetties reflect the restoration made at the Mayport Naval Station.

37. Offshore depth changes.--Comparisons of offshore depth changes are based on the surveys of 1874-75, 1923-24, 1953-54, 1958-59, and 1963. The results of those surveys are shown on plates 2-7. Details are in appendix C. Changes in the position of offshore depth contours from 1874-75 to 1923-24, 1923-24 to 1953-54 (north of St. Johns River), 1923-24 to 1958-59 (south of St. Johns River), 1953-54 to 1963 (north of St. Johns River), 1958-59 to 1963 (south of St. Johns River), and summarized from 1923-24 to 1963 are given in table C-2 of appendix C. The 6- and 12-foot depth contours on Little Talbot Island advanced during the period 1923-24 to 1953-54 and receded during the period 1953-54 to 1963, with the net average change being about 900 feet and 890 feet of recession, respectively. The 18-foot depth contour on Little Talbot Island advanced 1,660 feet during the period 1923-24 to 1953-54 but receded 340 feet from 1953-54 to 1963. The 6-, 12-, and 18-foot depth contours in the reach south of St. Johns River receded for the periods 1874-75 to 1923-24, 1923-24 to 1958-59 and 1958-59 to 1963, the average net change from 1923 to 1963 being about 320 feet, 250 feet, and 330 feet of recession, respectively. The 30-foot depth

contour in the reach south of St. Johns River receded during the periods 1923-24 to 1958-59 and 1958-59 to 1963, the net change being about 350 feet of recession from 1923 to 1963. As may be deduced from the above data, the trend of offshore contour movement south of St. Johns River is predominantly recessive.

38. Comparative beach profiles.--Profiles obtained in 1963 were compared with those constructed from the survey of 1923-24, the survey of 1952-53 north of St. Johns River, and the survey of 1958-59 south of St. Johns River. Plottings of the comparative profiles are on file in the office of the District Engineer (plates 1-10 of map file No. 24-28,620). The comparative profiles, with adjustments to reflect artificial nourishment placed on the beach in 1963 at Jacksonville Beach, Neptune Beach and Mayport Naval Station, are the basis for the volumetric accretion and erosion changes discussed in the next paragraph and used to estimate future nourishment requirements.

39. Volumetric accretion and erosion.--Volumetric changes in the study area are given in tables C-3, C-4, and C-5 of appendix C. The tables show the changes, the net change, and the average annual change from 1923-24 to 1953-54, 1953-54 to 1963, and 1923-24 to 1963 at Little Talbot Island, and from 1923-24 to 1958-59, 1958-59 to 1963, and 1923-1963 for the reach south of St. Johns River. Data in the tables have been divided to show changes in the profiles landward and seaward of the approximate 18-foot depth contour, where data seaward of that depth were available. Data show long-term accretion at Little Talbot Island except for some heavy short-term erosion from 1953 to 1963 primarily attributable to offshore channel shifting and relocation under the influence of Nassau Sound and Fort George Inlet. The net average annual change at Little Talbot Island for the period 1923-24 to 1963 is 188,000 cubic yards of accretion. That change occurred landward of the 18-foot depth contour.

40. South of St. Johns River, for the period 1923-24 to 1958-59, the average annual erosion rates were 77,000 cubic yards landward of the 18-foot depth contour and 35,000 cubic yards seaward of the 18-foot depth contour, or a total of 112,000 cubic yards. Average annual net changes from St. Johns River to the Duval County-St. Johns County line for the period 1923-24 to 1963 were 191,000 cubic yards of erosion landward of the 18-foot depth contour and 47,000 cubic yards of erosion seaward of the 18-foot depth contour, or a total of 238,000 cubic yards from the entire length of profile surveyed.

41. Volumetric changes based on 1963 survey data in the reach south of St. Johns River require adjustment due to artificial fill placed on the beach at Mayport Naval Station, Neptune Beach, and Jacksonville Beach. Adjusting the 1923-1963 data, the average annual erosion rate south of St. Johns River over the entire length of profile surveyed becomes 256,000 cubic yards; round to 260,000 cubic yards. That amount, which consists of about 90,000 cubic yards annual loss from the area between the northern limit of Atlantic Beach and the south jetty, and 170,000 cubic yards annual loss from Atlantic Beach, Neptune Beach, and Jacksonville Beach, was used as the basis for future periodic nourishment requirements.

42. Prior corrective action.--Corrective action relative to protection of property and development from the ocean has been primarily limited to construction, maintenance, and replacement of seawalls and bulkheads. Extensive timber bulkheads were constructed in the 1920's during the Florida boom, some of which were located as far north as Mayport. After the severe northeast storm of 1925 the timber bulkheads were rebuilt to be destroyed again during the 1932 storm. In the years immediately after the storm of 1932 Atlantic Beach, Neptune Beach, and Jacksonville Beach constructed, with Federal aid, more nearly permanent concrete seawalls. Some of the concrete walls were destroyed or damaged during a hurricane in 1944 and many were destroyed and damaged during the severe 1947 northeast storm. In 1956 some seawalls were destroyed and damaged, and again in 1962 and 1964. Until 1962, most destroyed or damaged walls were replaced by concrete walls of the same type. After the 1962 storm, under authorization of the Office of Emergency Planning, granite revetments were installed where the seawall was destroyed or severely damaged in Neptune Beach and Jacksonville Beach. In addition, about 320,000 cubic yards of sand fill were placed on the beach of Neptune Beach and Jacksonville Beach to form a temporary protective beach. A protective beach was provided at the Mayport Naval Station by dredged fill. Plans are currently underway for nourishment of that beach by use of maintenance dredging material from the entrance channel to the carrier basin at Mayport and to Jacksonville Harbor. About 200,000 cubic yards of material are to be placed on the Mayport Naval Station beach. After Hurricane Dora in September 1964, the Office of Emergency Planning authorized, as an emergency relief measure, provision of 25,750 linear feet of granite revetment at Jacksonville Beach, Neptune Beach, Atlantic Beach and at the developed area immediately north of Atlantic Beach.

43. Future periodic nourishment for the reach between the south jetty and Atlantic Beach (about 100,000 cubic yards annually) would be obtained from shoals in the Pilot Town and Bar Cuts (mile 0.5 to mile 2.5) of the Federal navigation project for Jacksonville Harbor. Records

indicate that Pilot Town and Bar Cuts are the most critical reaches of the project to maintain. Over the 11.5-year period from 1952 to fiscal year 1963, about 1,771,000 cubic yards of shoal material have been removed from the two cuts, or an annual average of 154,000 cubic yards. Table 1 shows maintenance dredging in Pilot Town and Bar Cuts from 1925 to 1963. All the dredging was by hopper dredges and disposition was at sea. A contract for removal of about 570,000 cubic yards of shoal material from Pilot Town and Bar Cuts has been recently awarded.

TABLE 1

Maintenance dredging 1925-1963
Pilot Town and Bar Cuts
Jacksonville Harbor

Year	Volume (cu. yd.)	Source
1925	585,500	Wards Bank and Bar Cut
1926	593,700	Do.
1927	371,600	Bar Cut
1929	433,000	Do.
1930	478,600	Do.
1932	221,600	Do.
1934	1,932,000	Between entrance and Mayport
1935	14,200	Bar Cut
1937	270,800	Do.
1938	Indeterminate amount and source	
1940	356,700	Specific location indeterminate
1941	222,000	Bar Cut
1943	201,300	Do.
1944	248,000	Do.
1945	10,200	Do.
1946	249,100	Pilot Town and Bar Cuts
1948	291,600	Bar Cut
1952	444,000	Pilot Town and Bar Cuts
1953	245,000	Do.
1956	198,000	Do.
1958	15,000	Do.
1961	629,000	Do.
1962-63	486,000	Do.

44. Existing structures.--The only existing structure in the beach zone north of St. Johns River is a timber fishing pier at the south end of Little Talbot Island. Two converging rubble-mound stone jetties 14,200 feet and 11,192 feet long, north and south, respectively, are at the ocean entrance to St. Johns River. The 4,600-foot reach immediately north of Atlantic Beach is partially protected by concrete seawalls intermittently spaced. The entire ocean frontage of Atlantic Beach, about 6,000 linear feet, is partially protected by a continuous curved-face concrete seawall except at three concrete access ramps. Atlantic Beach also has a timber fishing pier. The ocean frontage of Neptune Beach and Jacksonville Beach is partially protected by a continuous concrete seawall, except at nine access ramps and at gaps where the seawall has been destroyed and granite revetment installed. A timber fishing pier also exists in Jacksonville Beach. About 25,750 linear feet of granite revetment are being provided as Federal emergency relief measures necessitated by the September 1964 hurricane (Dora). Detailed information concerning St. Johns River jetties and all the existing structures in the study area is presented in appendix D.

V. ANALYSIS OF THE PROBLEM

45. Shore processes.--The beaches in Duval County are composed of fine sand and fine shell fragments. The sand and shell are easily moved by littoral currents and by wave action. The predominant direction of littoral movement along the beaches is southerly. The direction of littoral drift is reversed to northerly during the summer months when mostly gentle southeasterly winds create waves which cause movement from south to north. The drift reversal is more than offset by the large and rapid movement of beach material from north to south during the fall and winter months when the more violent action of waves from the northeast prevails.

46. Recorded beach volume changes.--As may be seen in appendix C, the average annual accretion rate north of St. Johns River at Little Talbot Island, based on the period 1923 to 1963 and on measurements to the 18-foot depth, is 188,000 cubic yards. The average annual erosion rate south of St. Johns River, based on the same period and depth, is 210,000 cubic yards. The average annual erosion rate south of the river, based on losses to the 30-foot depth and the period 1923 to 1963, is 256,000 cubic yards. A 1961 cooperative beach erosion control study at Amelia Island by the Savannah District (H. D. No. 200, 87th Cong., 1st Sess.), established the annual accretion rate at the north jetty of St. Marys entrance as 130,000 cubic yards and the annual erosion rate on Amelia Island (between St. Marys entrance and Nassau Sound, north of Little Talbot Island) as 325,000 cubic yards.

47. Littoral drift rate.--The approximate rate of littoral drift at the beaches of Duval County can be partially estimated from

the rate of volumetric changes north and south of the jettied St. Johns River entrance and from shoaling rates within the entrance. The part of the drift rate that can be accounted for is as follows:

	Cu. yd. per year
Accretion at Little Talbot Island----------	188,000
Shoaling in Bar Cut and Pilot Town Cut at St. Johns River entrance----------	154,000
Total----------	342,000

The above rate does not take into account the rapid growth of the dunes on Little Talbot Island, nor the part of the drift that passes around the north jetty and is either diverted into deeper water or crosses the entrance channel and moves south. Therefore, based on the above measured amount and taking into account the above factors, the annual drift rate at the Duval County beaches is estimated to approach about 500,000 cubic yards.

48. Inlets influencing shore processes in the study area.--

a. Nassau Sound.--That sound, which is about 1,400 feet wide at the seaward edge, contains a complex system of large shoals and channels. One large shoal, Bird Island, is above mean high water at this time. Natural channels within the sound are very changeable and at times encroach upon the north shore of Little Talbot Island. The sound acts as a settling basin for southerly moving littoral drift, as evidenced by the large shoals and breakers at the mouth. The 6- and 12-foot depth contours for all surveys of record meander widely throughout the sound.

b. Fort George Inlet.--That inlet is within the shadow of the north jetty of St. Johns River. It is a natural inlet that has been forced southward about 9,000 feet since 1853 by the accretion and extension of Little Talbot Island. The inlet in its present position serves to disperse drift material that would normally lodge against the north jetty to form an accretion fillet. The material is therefore dispersed and scattered throughout the immediate vicinity (north of the north jetty), forming numerous shoals and, to a less-than-normal degree, an accretion fillet at the north jetty. Conditions at Fort George Inlet and the north jetty are shown by the recent aerial photograph of figure 2.

c. St. Johns River.--Prior to construction of the jetties, there was an offshore bar across the river entrance. The bar was traversed by a shifting channel with maximum depths of 6 to 8 feet. In general, the channel migrated gradually southward until it reached the south land point, when it would break through the bar to the north and resume its southerly migration, completing each cycle over a period of several years. Dredging to improve the bar channel was done in 1852, 1870 to 1873, and in 1878 with little or no permanent results. Soon afterwards jetty construction was started.

d. The existing deep-draft entrance channel of St. Johns River, along with the jetties, forms a partial littoral barrier. During severe wave action some material enters the channel over a small part of the north jetty near its landward end. Some of that material is subsequently removed during maintenance dredging operations. Future nourishment requirements for the beaches will be satisfied, in part, by use of some of that material, thereby introducing it back into the littoral regimen along the coast. Not all of the drift is trapped at the north jetty or the channel, and some continues its southerly movement past the barrier.

49. Effects of St. Johns River jetties.--Local interests have long insisted that erosion problems south of St. Johns River have been intensified by the improvement of the river for navigation--specifically the two jetties and the deepened channel. Definitive surveys before the beginning of the improvements in 1879 are lacking for the entire problem area, and are limited to the area just south (about a mile) of the river. Available pertinent data are shown on figures C-1 and C-2 of appendix C. In the reach represented by available data the shoreline just south of the river receded from 1823 to 1879, advanced from 1879 to 1900, and receded again until 1923. Since that time the shore in that limited area has been relatively stable from a long-term consideration. The data do not show what happened between surveys, and are not necessarily representative of what has happened farther south in the developed areas of Atlantic Beach, Neptune Beach, and Jacksonville Beach.

50. As may be noted from the above discussion, data are insufficient to reach a firm conclusion as to what have been the effects of the St. Johns River improvements on adjacent shores. However, dominant littoral drift in the area is from north to south, and it would be most unusual were the jetties and the deep channel not a contributing factor to the erosion problems of the shores of Duval County to the south. A quantitative determination of the extent of the contribution cannot be made from available data. An unprotected inlet across a sandy beach with an alongshore movement of drift material, such as is the case on

the Florida east coast, acts as a barrier in itself and traps littoral drift material. If the inlet is improved and stabilized by jetties the effectiveness of the barrier is increased and therefore less material reaches the leeside (downdrift) beaches.

51. Methods of correcting problem conditions.--The problem is one of providing and preserving adequate recreational beaches to meet future demands and, in addition, providing protection for upland property and existing structures. Because of the deficiency in supply of littoral material reaching the shore south of St. Johns River, successful remedial action would depend on some method of artificial nourishment of the beaches, thereby making up the deficiency. The problem could be best corrected by partially restoring and then periodically nourishing the restored beaches. A program of artificial restoration and nourishment would have no appreciable effect on the shores north of the improvement; however, there would be beneficial drift of material to the shores south of the improvement.

52. Other methods of correcting problem conditions were considered. These included groins, revetment, and a detached breakwater off the south jetty of St. Johns River. However, none were as feasible nor would provide as much protection and benefits as a protective beach obtained by restoration and nourishment. Emergency revetting after Hurricane Dora (September 1964) precludes the need for additional improvement of that type, and that particular corrective method is not considered further.

53. It is considered necessary to insure preservation of the dunes as they now exist in the undeveloped area north of Atlantic Beach and to provide for setback of future development from the seaward face of the dunes, in the interest of not accelerating or intensifying existing problem conditions. The dunes should not be leveled nor lowered but preserved with as much vegetation as possible as they afford excellent natural protection.

54. Design criteria.--a. The improvement selected for beach erosion control should serve two purposes. Protection should be provided against normal weather and to a partial degree against storms; and ample beach area should be preserved or provided for present and future recreational needs.

b. The width of the design berm selected (60 feet) was based on behavior of the beach berm prior to the severe 1962 northeast storm, on the behavior of the artificially restored beach after that storm, and on past long-term, short-term and seasonal losses and changes. That berm width would permit seasonal changes and normal losses for about 3-4 years without significant reduction of protection. The

design elevation of the berm was based on the estimated 1962 storm tide of 2.5 feet above mean high water and 3.3 feet of runup. Mean-high-water elevation in the area considered for improvement is 5.2, as detailed in paragraph 30c. The design berm elevation is 2.5 + 5.2 + 3.3 = 11.0 feet above mean low water. Natural berm elevations in areas where the berm is unaffected by wave energy reflected off vertical seawalls range from 9 to 11 feet above mean low water. The estimated slopes of 1 on 20 from the berm to mean high water, 1 on 30 from mean high water to mean low water, and 1 on 45 from mean low water to intersection with existing bottom are based on the existing average slopes of those three zones, and are used for estimating quantities. Actual slopes will be as adjusted by wave action.

c. The design beach in itself would be inadequate to prevent flooding during a severe hurricane. A hurricane having a frequency of occurrence of about once in 100 years would require a berm elevation of 13.3, other factors such as slope and berm width being unchanged. However, existing seawalls and dunes in the area considered for improvement either equal or exceed that elevation. Therefore, the considered improvement would largely eliminate flooding except during unusually severe and infrequent hurricanes.

VI. PLAN OF IMPROVEMENT

55. Beach erosion control.--The basic method of achieving the results desired by local interests and of providing the most practicable plan of improvement consists of provision of a protective and recreational beach by initial restoration and of future periodic nourishment. Analysis of data indicates that the shore of Little Talbot Island is accreting and therefore no improvements are required there. Initial restoration is required for the 53,000-foot reach of shore between the south jetty of St. Johns River and the Duval-St. Johns County line. See plate 8. The estimated volume of material required for initial restoration is about 3.75 million cubic yards. Periodic nourishment of the 53,000-foot restored beach would be provided when needed. The average annual nourishment requirement for the reach is 260,000 cubic yards. The restored beach would be of such dimensions as required to dissipate wave energy seaward of upland property and existing structures, and provide adequate area for recreational bathing. The restored beach would have a level berm 60 feet wide at elevation 11 feet, mean low water. Seaward slope of the restored beach, as shaped by wave action, would be about 1 on 20 from berm crest to mean high water, 1 on 30 from mean high water to mean low water, and 1 on 45 from mean low water to intersection with existing bottom. The improved beach is designed to provide enough

width so that sufficient protective and recreational beach remains during periods of temporary recession. Periodic nourishment, which will be provided when and where needed, would restore the beach to desired dimensions. It is considered desirable to place a 4-year advance supply of nourishment in connection with the initial beach restoration to avoid the possibility of excessive narrowing of the beach prior to beginning of subsequent nourishment operations. Since material for nourishment so placed in advance would reduce future nourishment requirements during project life, estimates of initial costs do not include the cost of that advance supply of nourishment. The advance supply of nourishment would be in the form of a feeder beach at or near the northern part of the problem area. A typical section of the restored beach is shown on plate 8. Material for initial restoration would be obtained by pipeline dredge from borrow areas in the Pablo Creek marshes east of the Intracoastal Waterway. Material for future periodic nourishment would be obtained from shoaling in St. Johns River entrance for the northern part of the reach and from inland borrow areas by truck haul for the southern part of the reach. Subsurface investigations and laboratory grain size analysis indicated that sufficient amounts of suitable sand, similar to the existing beach sand, exist for initial restoration and future nourishment purposes.

56. Alternative plans considered.--a. General.--In addition to a protective and recreational beach by artificial restoration and nourishment, the following plans were considered. Based on engineering and economic determinations, the artificial restoration and nourishment plan was established to be the most practicable plan of improvement.

b. Detached breakwater off the south jetty of St. Johns River.--Local interests have requested that consideration be given to providing a current deflector at the seaward end of the south jetty, thereby returning to the shore southerly drifting sand which has been moved offshore by the jetties and the navigation channel. Local interests also requested that tanker ships, large barges or LST ships be used to form the breakwater. While it is possible that the use of a number of LST's acting as a detached breakwater of the jetty would direct and deflect the prevailing littoral currents from shore, it is also possible that a breakwater in that position would deflect storm currents which would increase the attack on the beaches immediately south of the St. Johns River jetties. The overall effect of such a breakwater might be to increase erosion rather than alleviate it. Furthermore, the use of tanker ships, large barges or LST ships as structures in the ocean is considered impractical for many obvious reasons.

c. Hurricane protective measures.--Measures to prevent damages from hurricane-induced tidal overtopping and flooding were considered. Predominantly, previous damages along the Duval County coast have resulted from beach erosion and from destruction of the seawall, during severe northeast storms and in rare instances during hurricanes. Hurricane flooding damages have been relatively small in comparison to erosion damages from severe northeasters and hurricanes. Based on previous hurricane frequency and flooding damages it was considered that additional measures to those required for beach erosion control are not warranted at this time.

d. Groins.--The use of groins for beach erosion control is not desired at Duval County, nor is the use of groins considered suitable or adequate on this particular shore. Available data do not indicate that groins would reduce periodic nourishment requirements sufficiently to justify their expense.

VII. ECONOMIC ANALYSIS

57. Estimates of first costs.--The estimated first cost of the plan of improvement, based on fall 1964 price level, is shown in table 2; detailed estimates are presented in appendix E. Costs of the beach fill for the plan of improvement are based on the use of borrow areas in the Pablo Creek marshes and on use of a pipeline dredge.

TABLE 2

Estimated first cost

Item	Quantity (cu. yd.)	Amount
Placement of beach fill	3,750,000	$3,800,000
Engineering and design		110,000
Supervision and administration		180,000
Subtotal		(1) 4,090,000
Lands, easements, and rights-of-way		50,000
Total first cost		4,140,000

NOTE: (1) Amount subject to apportionment. Does not include $54,300 preauthorization costs (survey report).

58. Estimates of annual costs.--The annual costs of the plan of improvement are summarized in table 3. Details of the annual costs and bases of estimates are presented in appendix E. Annual nourishment costs are based on periodically nourishing the shore from St. Johns River to the south county line. Nourishment would be accomplished when needed. Future nourishment requirements are based on past losses. Periodic nourishment costs are based in part on obtaining 100,000 cubic yards (90,000 cubic yards required plus 10,000 cubic yards for allowance for losses) annually from shoaling in the Pilot Town and Bar Cuts of the Federal navigation project St. Johns River, Jacksonville to the ocean. That amount would be used to nourish the reach between the south jetty and the northern limit of Atlantic Beach. Use of that shoal material would result in reduction of maintenance dredging in the navigation channel and thus provide Federal benefits, and at the same time provide the most economical source of supply for nourishment of the north end of the area. Cost estimates for periodic nourishment of the beach at Atlantic Beach, Neptune Beach, and Jacksonville Beach are based on truck haul of material to the beach (170,000 cubic yards annually) from inland borrow areas. Details are in appendix E.

TABLE 3

Estimated annual costs

Item	Amount
Initial investment----------	(1) $4,060,000
Annual costs	
Interest at 3-1/8 percent----------	129,400
Amortization at 3-1/8 percent for 50 years---------	35,400
Periodic beach nourishment:	
100,000 cubic yards from St. Johns River shoals--	109,000
170,000 cubic yards by truck haul----------	291,000
Total annual cost----------	564,800
Round to	565,000

NOTE: (1) Estimated first cost, including $50,000 for lands, easements and rights-of-way.

59. Estimates of benefits.--Beach erosion control benefits anticipated from the plan of improvement were estimated and are shown in appendix F in detail. Benefits anticipated are in the form of direct damages prevented, benefits from prevention of loss of land, benefits from enhancement of property values, recreational benefits, and benefits to a Federal navigation project. Estimates of monetary benefits are based on fall 1964 price level, and are summarized in table 4. Figure 9 shows the extent of recreational usage of Jacksonville Beach. The photograph was taken at extreme low tide in 1960.

TABLE 4

Summary of benefits

Type of benefit	Federal	Non-Federal public	Private	Total
Benefits from prevention of loss of land	$1,800	-	$9,100	$10,900
Damages-to-development benefits	20,000	$52,000	208,000	280,000
Benefits from enhancement of property values	-	-	9,700	9,700
Recreational benefits	-	710,000	0	710,000
Benefits to Federal navigation project	40,000	-	-	40,000
Total	61,800	762,000	226,800	1,050,600
Round to	62,000	762,000	227,000	1,051,000
Percent	5.9	72.5	21.6	100

60. Justification of improvements.--Annual benefits and costs and the benefit-cost ratio for the plan of improvement are shown below. The considered improvement is economically justified.

Benefits	Costs	Benefit-cost ratio
$1,051,000	$565,000	1.9

61. Apportionment of costs.--The policy of Federal aid in the restoration and protection of shores against erosion is set forth in Public Law 826, 84th Congress, as amended by Public Law 87-874 of the River and Harbor Act of October 23, 1962. First cost and annual costs of the plan were apportioned between Federal and non-Federal interests in detail in appendix E, and are summarized in table 5. Costs for improvement of the frontage of the United States Naval Station at

HOLIDAY CROWD AT JACKSONVILLE BEACH

FIGURE 9

TABLE 5

Apportionment of first and annual costs

Item	Federal		Non-Federal		Total	
	Percent	Amount	Percent	Amount	Percent	Amount
First cost:						
Beach restoration	55.4	$2,266,000	44.6	$1,824,000	100	$4,090,000
Lands, easements, and rights-of-way	0	0	100	50,000	100	50,000
Total	54.7	2,266,000	45.3	1,874,000	100	4,140,000
Annual cost:						
Interest and amortization (beach restoration)	-	90,000	-	73,000	-	163,000
Interest and amortization (lands, easements, and rights-of-way)	-	-	-	2,000	-	2,000
Total interest and amortization		90,000		75,000		165,000
Periodic beach nourishment	57.7	(1)231,000	42.3	169,000	100	400,000
Total annual cost		321,000		244,000		565,000

NOTE: (1) This Federal share would be for the first 10 years of project life, after which benefits and techniques would be reevaluated.

Mayport were apportioned all Federal. In the reach between the south limit of the Mayport Naval Station and the Duval-St. Johns County line, the ocean beach east of the seawalls or east of the toe of dunes where there are no seawalls is public with free and unrestricted access. This public ownership of the beach was confirmed by letter of the Duval County Board of County Commissioners, dated October 19, 1964. Therefore, costs for initial restoration and future periodic nourishment in that reach were apportioned 50-percent Federal. In addition, the Federal share of periodic nourishment was increased due to Federal navigation benefits. Costs of lands, easements, and rights-of-way required for the project are local interests' responsibility. See paragraphs 11 through 18 of appendix E for details.

62. Coordination with other agencies.--a. Contact has been maintained between representatives of the Corps of Engineers and of local interests. Numerous conferences, meetings, and field inspections have been held. A public hearing was also conducted at the beginning of the investigation. By letter of October 19, 1964, the Board of County Commissioners of Duval County concurred in the need and desirability of the project and agreed to be the local sponsor of the project when it is authorized. The Board of County Commissioners also expressed its intent to implement the project after congressional authorization.

b. The proposed improvement would have no adverse effects on roads and bridges, urban renewal activities, agricultural interests, water supply, and waste disposal practices, as reported by the various concerned agencies. The Department of Health, Education and Welfare states that from the standpoint of mosquito control, precautionary measures should be taken in connection with the borrow areas. The United States Fish and Wildlife Service suggested obtaining beach fill from navigation projects in the area rather than disturb fish feeding grounds in the Pablo Creek marshes. The Fish and Wildlife Service recommended that if borrow areas in the Pablo Creek marshes are used a gradual slope be left around the perimeter of the borrow pit. Comments of the various agencies are presented in appendix G.

63. Supplemental report.--Additional information on recommended and alternative projects called for by Senate Resolution 148, 85th Congress, 1st Session, adopted January 28, 1958, is contained in Supplement I to this report.

VIII. CONCLUSIONS

64. Conclusions.--It is concluded that the most practicable plan of improvement for beach erosion control in the problem area of Duval County consists of artificial placement of a protective and recreational beach in the area, and of periodic nourishment of the restored

beach when needed. The problem area requiring restoration is the 53,000-foot reach between the St. Johns River jetties and the Duval-St. Johns County line. The plan of improvement recommended for the problem area would provide needed protection during northeast storms and to an extent during hurricanes, and would provide adequate recreational beach to meet present and future demands. The plan is economically justified. The shoreline of Little Talbot Island is accreting; therefore, no beach erosion control improvements are needed there. Initial construction and periodic nourishment for the first 10 years of project life would be accomplished by the Corps of Engineers after receipt of the local share. After the first 10 years of project life, benefits and techniques would be reevaluated to determine if Federal participation in periodic nourishment should be extended for an additional period. At the present, the most economical source of material for periodic nourishment of the restored beach between the jetties and Atlantic Beach are the shoals in Pilot Town and Bar Cuts of Jacksonville Harbor. Use of the shoals would also provide navigation benefits, which results in an increase in the percent of Federal participation in periodic nourishment.

IX. RECOMMENDATIONS

65. Recommendations.--It is recommended that a Federal project be adopted for beach erosion control in Duval County, Florida, providing for a protective and recreational beach having a level berm 60 feet wide at elevation 11 feet above mean low water and a natural slope seaward as would be shaped by wave action along the 53,000 feet of shore between the St. Johns River jetties and the Duval-St. Johns County line, and for periodic nourishment of that restored beach; all in accordance with the plan of improvement described in this report and shown on plate 8, with the initial construction to be by the United States, after receipt of the local share, and the periodic nourishment to be by the United States for the first 10 years of project life, after receipt of the local share. The Federal share of the project consists of 55.4 percent of the first cost of construction exclusive of lands, easements, rights-of-way, and relocation costs, now estimated at $2,266,000, and 57.7 percent of the periodic nourishment costs for 10 years after completion of the initial fill placement, now estimated at $231,000 annually. Federal participation in the project would be subject to the provisions that local interests:

a. Contribute in cash 44.6 percent of the first cost (including contract price, engineering and design, and supervision and administration, and excluding the costs of lands, easements, rights-of-way, and relocations) of all items of work to be provided by the

Corps of Engineers, the amount as presently estimated being $1,824,000, to be paid in a lump sum prior to start of construction, or in installments prior to start of pertinent work items in accordance with construction schedules as required by the Chief of Engineers, the final apportionment of costs to be made after the actual costs have been determined;

b. Contribute in cash 42.3 percent of the periodic nourishment costs for the first 10 years of project life, now estimated at $169,000 annually, such contributions to be prior to each nourishment operation;

c. Periodically nourish the above project work, as may be required to serve the intended purpose, after the first 10 years and throughout the economic life of the project;

d. Provide without cost to the United States all lands, easements, rights-of-way, and relocations required for construction and subsequent nourishment of the project, now estimated at $50,000;

e. Hold and save the United States free from damages that may be attributed to construction and maintenance of the project;

f. Control water pollution to the extent necessary to safeguard the health of bathers; and

g. Furnish assurances satisfactory to the Secretary of the Army that they will maintain continued public ownership of and free access to the shore upon which the amount of Federal participation is based, and its administration for public use during the economic life of the project.

The total estimated first cost of the recommended project is $4,140,000. The estimated nourishment costs are $400,000 annually. Net cost to the United States, as now estimated, is $2,266,000 for initial construction and $231,000 annually for periodic nourishment for 10 years.

H. R. PARFITT
Colonel, Corps of Engineers
District Engineer

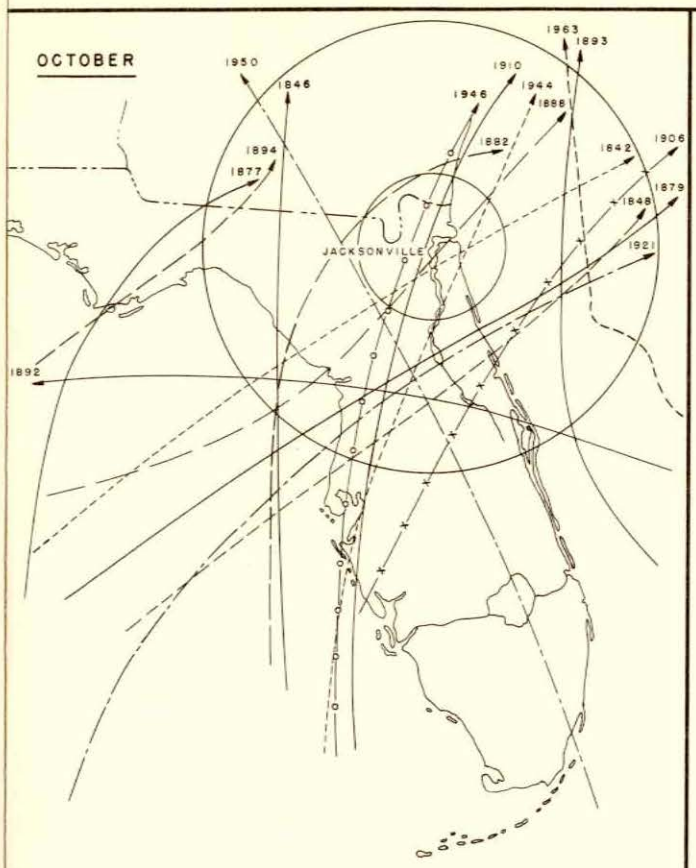
SADER (16 Nov 64) 1st Ind
SUBJECT: Beach Erosion Control Study, Duval County, Florida

U. S. Army Engr Div, South Atlantic, Atlanta, Ga., 24 November 1964

TO: Chief of Engineers, Department of the Army, Washington, D. C.

I concur in the recommendations of the District Engineer.

A. C. WELLING
Major General, USA
Division Engineer



DIAGRAM

AGRAM THE LENGTH OF
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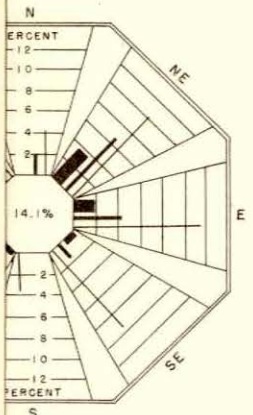
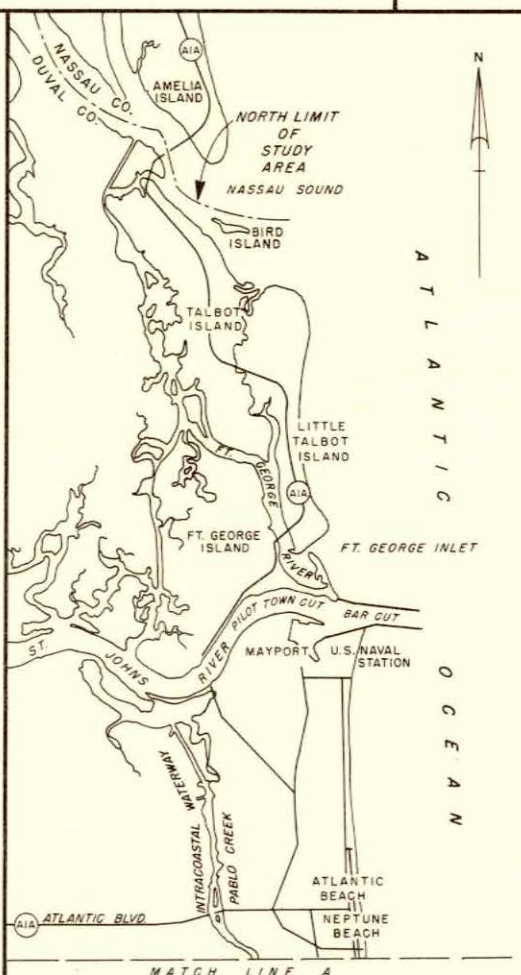
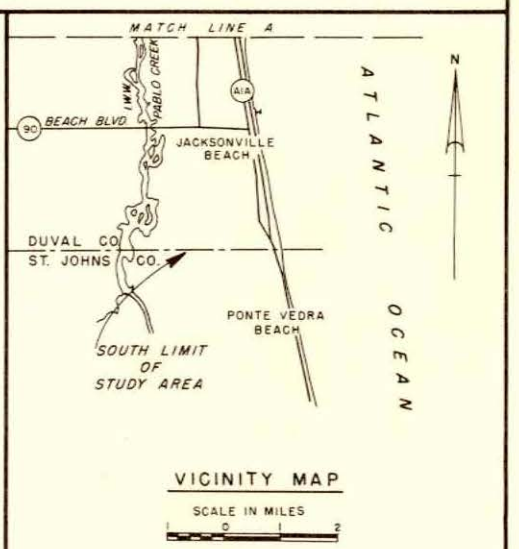
FIGURE IN THE CENTER
INDICATES THE PER-

SED ON OBSERVATION
ERIOD 1932-1942.



SWELLS (1-6 FT.)
IUM SWELLS (6-12 FT.)
H SWELLS (OVER 12 FEET)





BEACH EROSION CONTROL STUDY
DUVAL COUNTY, FLORIDA

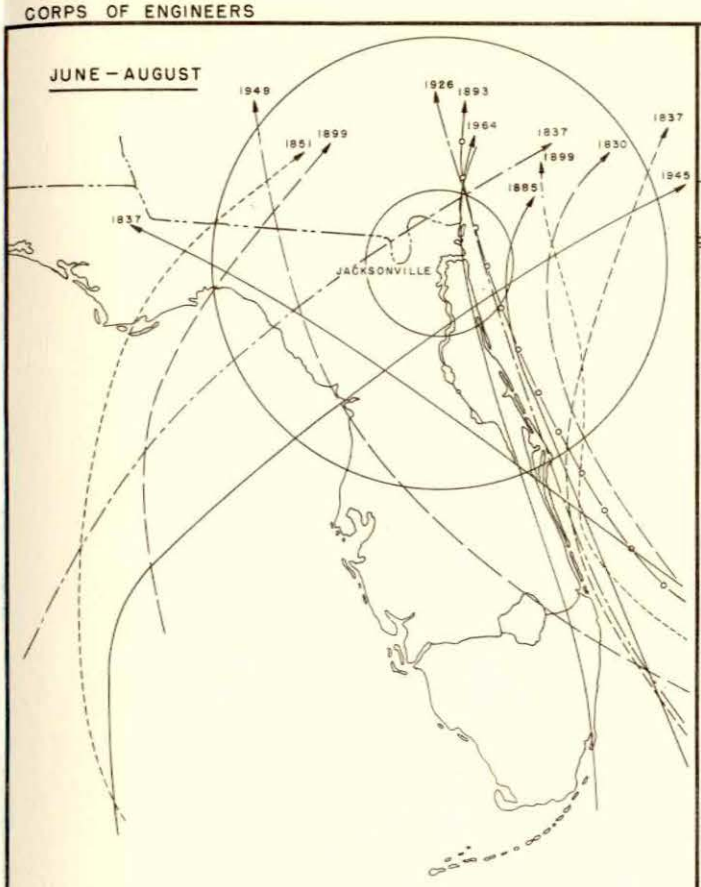
HURRICANE, WIND, AND SWELL DIAGRAMS

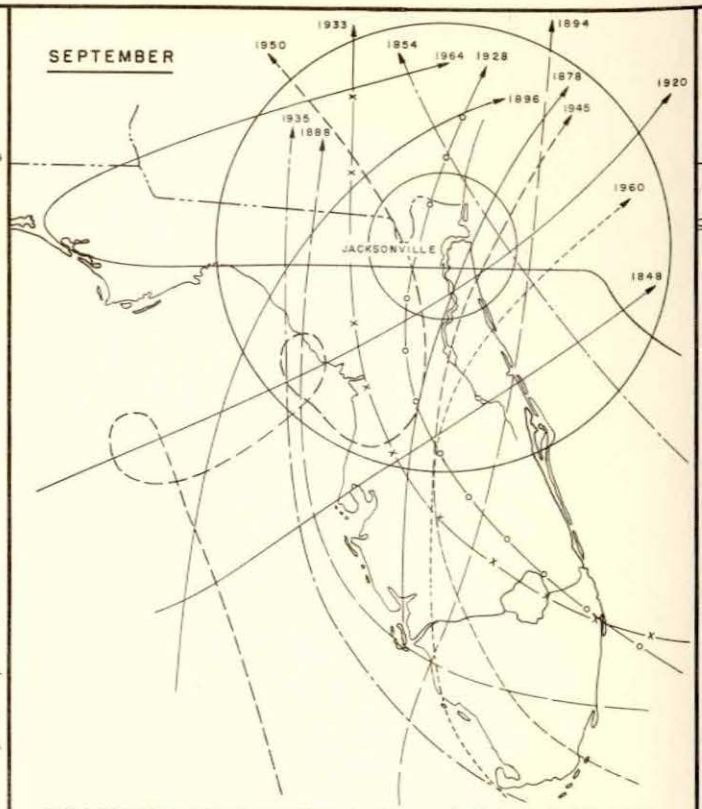
IN 1 SHEET SCALES AS SHOWN

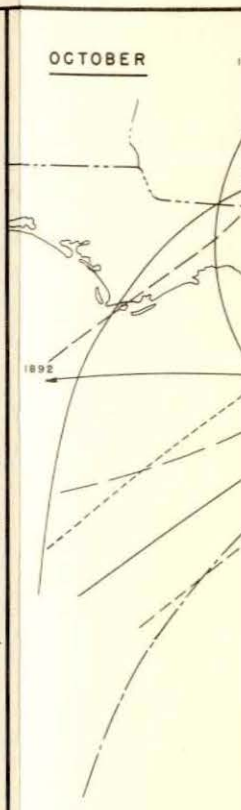
U.S. ARMY ENGINEER DISTRICT, JACKSONVILLE
CORPS OF ENGINEERS, JACKSONVILLE, FLORIDA

DRAWN BY: F.D.R.
CHECKED BY: A.J.S.

D.O. FILE NO.
24-28,713







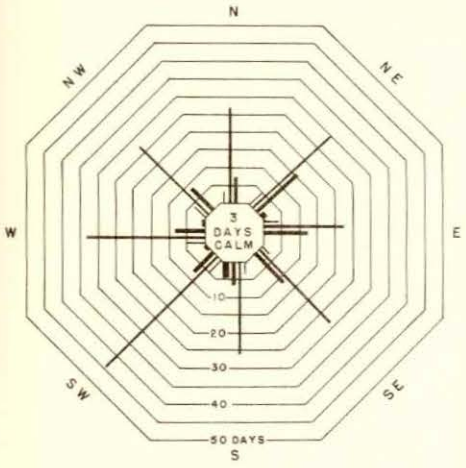
PATHS OF TROPICAL STORMS OF HURRICANE INTENSITY THAT HAVE PASSED WITHIN APPROXIMATELY 50-MILE RADIUS AND 150-MILE RADIUS OF JACKSONVILLE FROM 1830 TO 1964 INCLUSIVE.

HURRICANES

SCALE IN MILES

50 0 50 100

WIND DIAGRAMS

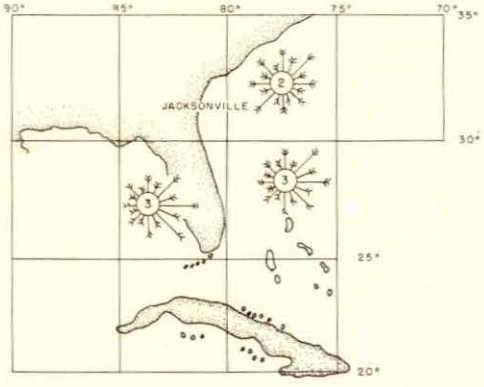


AVERAGE DIRECTION, DURATION, AND VELOCITY OF WINDS FOR ONE YEAR AT JACKSONVILLE, FLORIDA

BASED ON HOURLY READINGS OVER TEN-YEAR PERIOD (1951-1960) BY THE UNITED STATES WEATHER BUREAU AT JACKSONVILLE, FLORIDA

VELOCITIES	M.P.H.
———	1 TO 3
———	4 TO 12
———	13 TO 24
———	25 OR MORE

PREVAILING WINDS ATLANTIC & GULF COASTS



THE WIND ROSE IN EACH 5° SQUARE SHOWS THE YEARLY AVERAGE WINDS THAT HAVE PREVAILED WITHIN THAT SQUARE. THE ARROWS FLY WITH THE WIND. THE LENGTH OF THE ARROWS MEASURED FROM THE OUTSIDE OF THE CIRCLE AS DEMONSTRATED ON THE SCALE BELOW, GIVES THE PERCENT OF THE TOTAL NUMBER OF OBSERVATIONS IN WHICH THE WIND HAS BLOWN FROM OR NEAR THE GIVEN DIRECTION. THE NUMBER OF FEATHERS SHOWS THE AVERAGE FORCE OF THE WIND ON THE BEAUFORT SCALE. THE FIGURE IN THE CENTER GIVES THE PERCENTAGE OF CALMS.

SCALE OF WIND PERCENTAGES

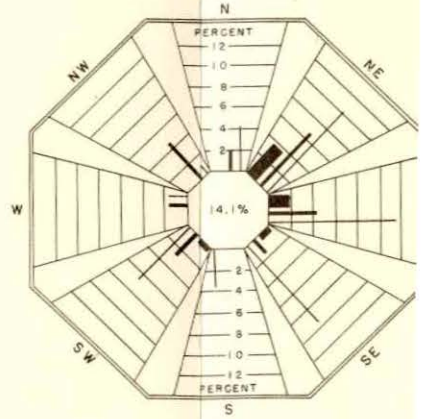
10 0 10 20 30 40

3

SWELL DIAGRAM

IN THE SWELL DIAGRAM THE LENGTH OF THE BAR DENOTES THE PERCENT OF THE TIME THAT SWELLS OF EACH TYPE HAVE BEEN MOVING FROM OR NEAR THE GIVEN DIRECTION. THE FIGURE IN THE CENTER OF THE DIAGRAM INDICATES THE PERCENT OF CALMS.

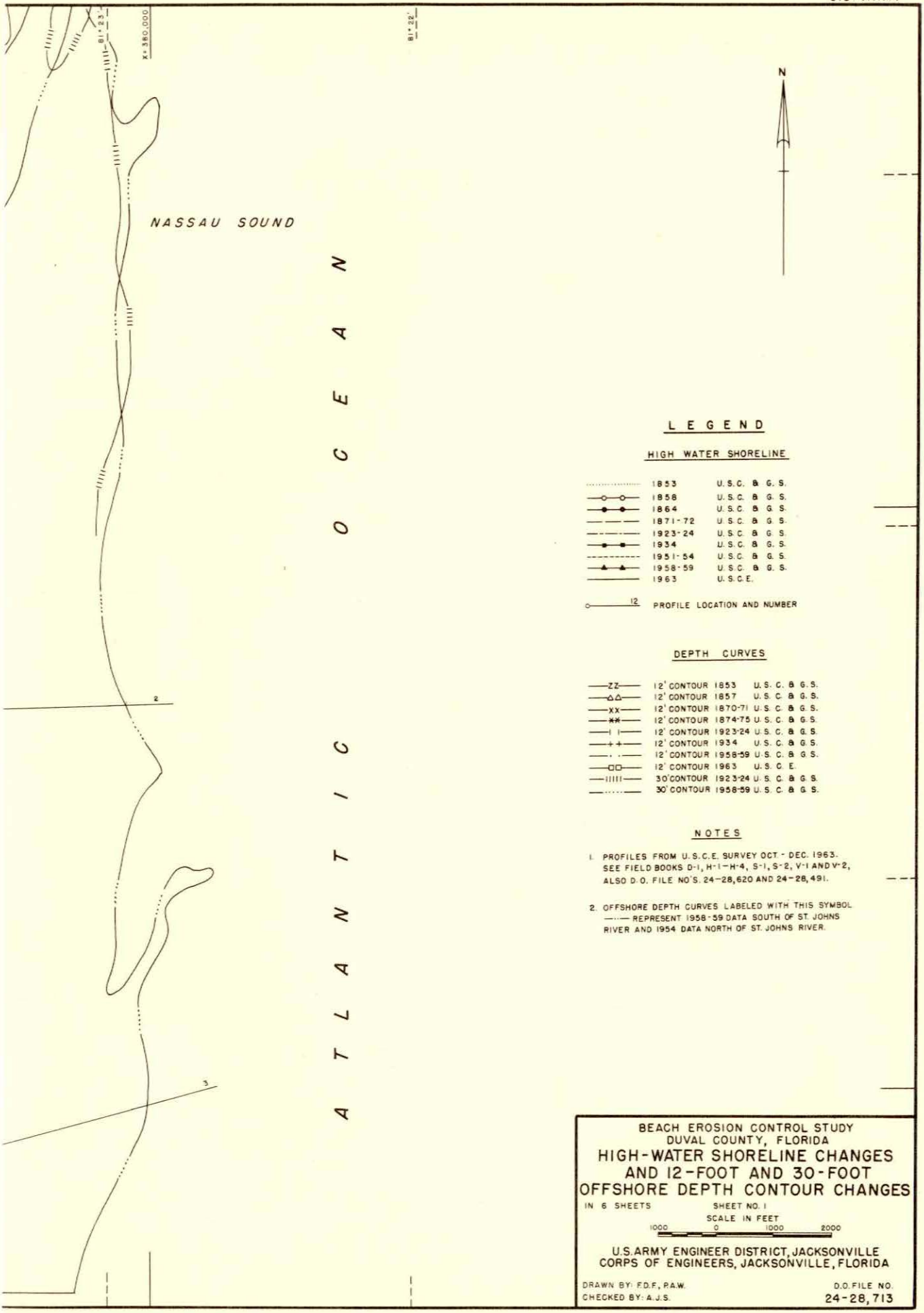
SWELL DATA BASED ON OBSERVATION FOR 10-YEAR PERIOD 1932-1942.



——— LOW SWELLS (1-6 FT.)

——— MEDIUM SWELLS (6-12 FT.)

▬▬ HIGH SWELLS (OVER 12 FEET)



LEGEND

HIGH WATER SHORELINE

1853	U.S.C. & G.S.
1858	U.S.C. & G.S.
1864	U.S.C. & G.S.
1871-72	U.S.C. & G.S.
1923-24	U.S.C. & G.S.
1934	U.S.C. & G.S.
1951-54	U.S.C. & G.S.
1958-59	U.S.C. & G.S.
1963	U.S.C.E.

12 PROFILE LOCATION AND NUMBER

DEPTH CURVES

12' CONTOUR 1853	U.S.C. & G.S.
12' CONTOUR 1857	U.S.C. & G.S.
12' CONTOUR 1870-71	U.S.C. & G.S.
12' CONTOUR 1874-75	U.S.C. & G.S.
12' CONTOUR 1923-24	U.S.C. & G.S.
12' CONTOUR 1934	U.S.C. & G.S.
12' CONTOUR 1958-59	U.S.C. & G.S.
12' CONTOUR 1963	U.S.C.E.
30' CONTOUR 1923-24	U.S.C. & G.S.
30' CONTOUR 1958-59	U.S.C. & G.S.

NOTES

1. PROFILES FROM U.S.C.E. SURVEY OCT.-DEC. 1963. SEE FIELD BOOKS D-1, H-1-H-4, S-1, S-2, V-1 AND V-2, ALSO D.O. FILE NO'S. 24-28,620 AND 24-28,491.

2. OFFSHORE DEPTH CURVES LABELED WITH THIS SYMBOL —·—·— REPRESENT 1958-59 DATA SOUTH OF ST. JOHNS RIVER AND 1954 DATA NORTH OF ST. JOHNS RIVER.

BEACH EROSION CONTROL STUDY
DUVAL COUNTY, FLORIDA

HIGH-WATER SHORELINE CHANGES AND 12-FOOT AND 30-FOOT OFFSHORE DEPTH CONTOUR CHANGES

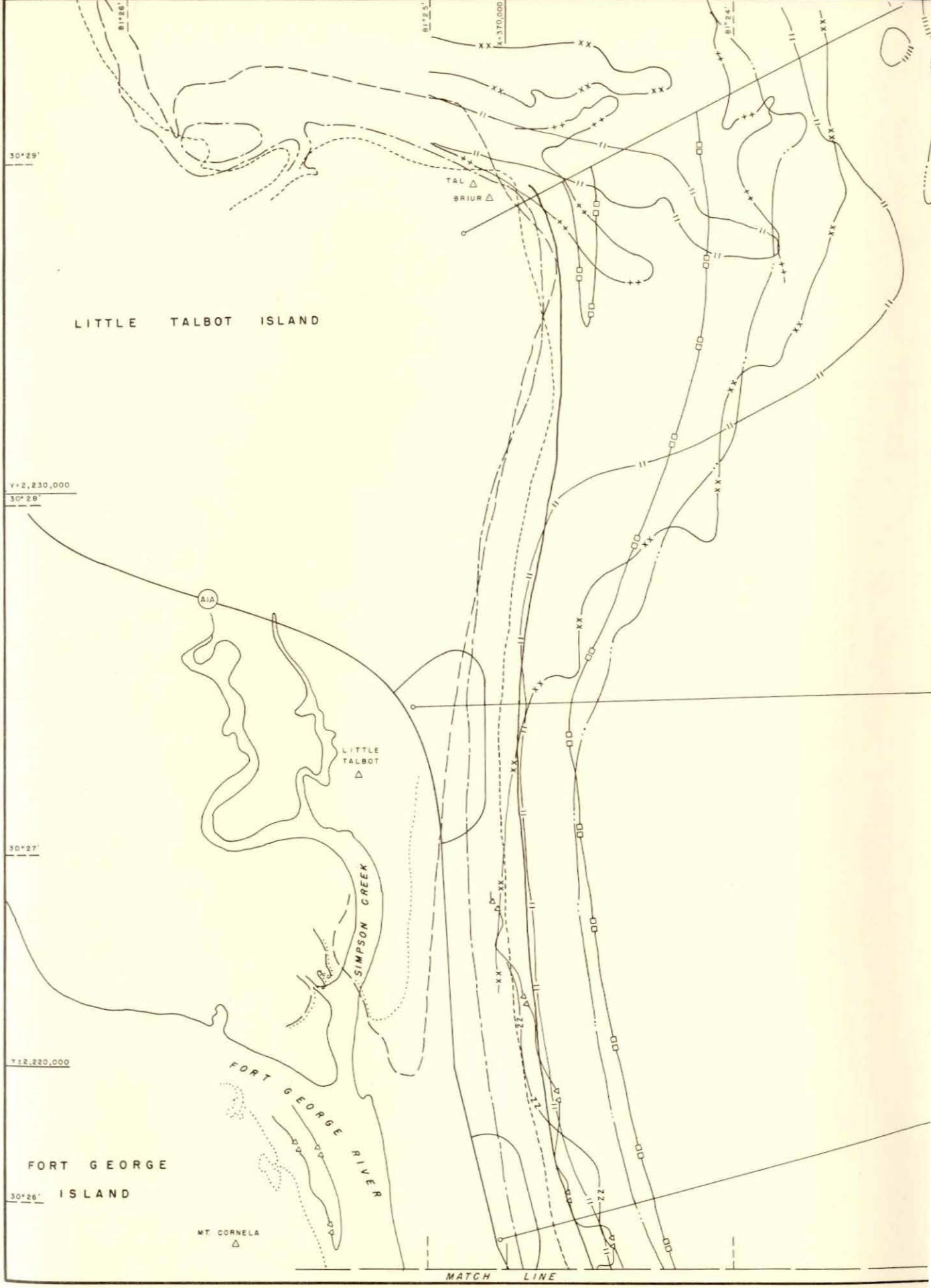
IN 6 SHEETS SHEET NO. 1

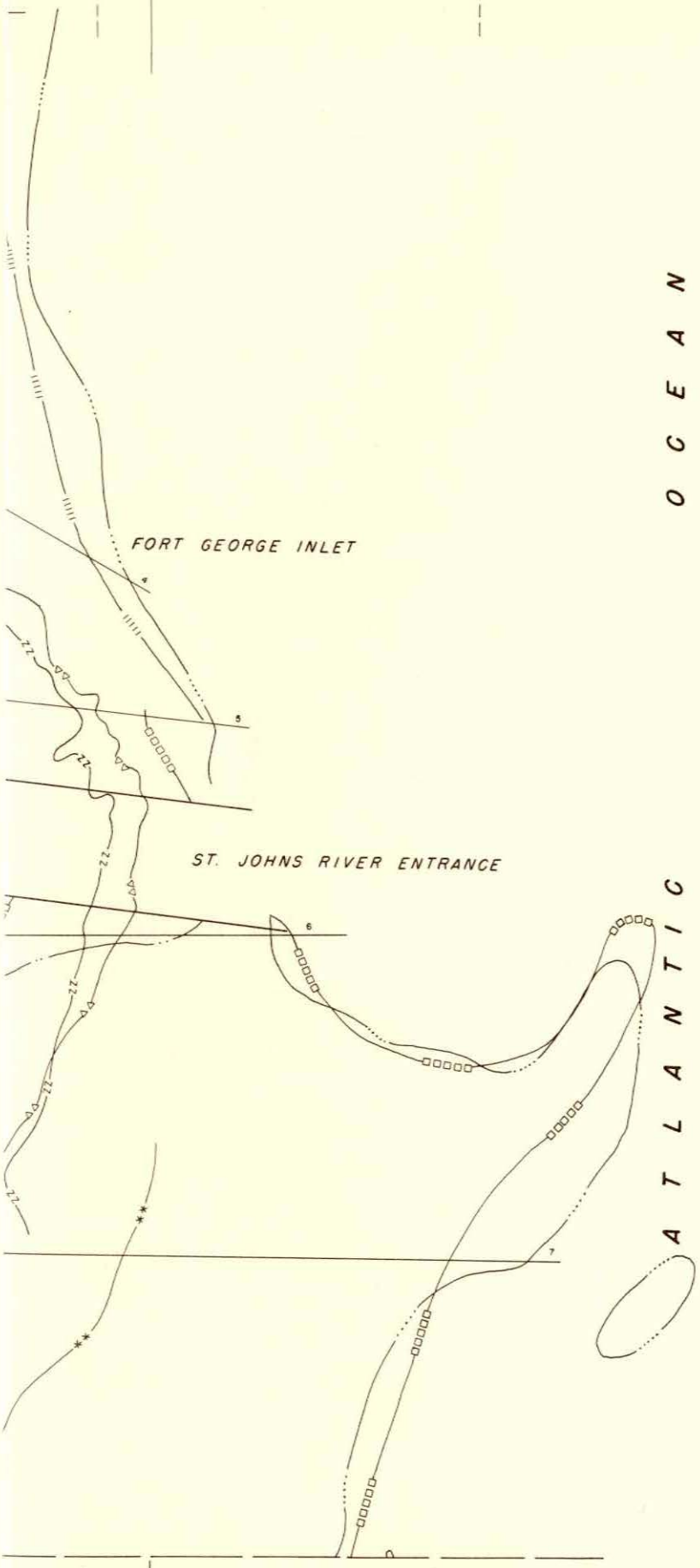
SCALE IN FEET
1000 0 1000 2000

U.S. ARMY ENGINEER DISTRICT, JACKSONVILLE
CORPS OF ENGINEERS, JACKSONVILLE, FLORIDA

DRAWN BY: F.D.F., P.A.W.
CHECKED BY: A.J.S.

D.O. FILE NO. 24-28,713


81°26'
81°25'
X=370,000
81°24'
30°29'
TAL △
BRIUR △
LITTLE TALBOT ISLAND
Y=2,230,000
30°28'
A1A
LITTLE TALBOT △
30°27'
SIMPSON CREEK
Y=2,220,000
FORT GEORGE RIVER
FORT GEORGE ISLAND
30°26'
MT. CORNELA △
MATCH LINE



N

LEGEND

HIGH WATER SHORELINE

.....	1853	U.S.C. & G.S.
—o—o—	1858	U.S.C. & G.S.
—●—●	1864	U.S.C. & G.S.
— - — -	1923-24	U.S.C. & G.S.
—●—●	1934	U.S.C. & G.S.
- - - - -	1951-54	U.S.C. & G.S.
—▲—▲	1958-59	U.S.C. & G.S.
———	1963	U.S.C.E.

o——— 7 PROFILE LOCATION AND NUMBER

DEPTH CURVES

—ZZ—	12' CONTOUR 1853	U.S.C. & G.S.
—ΔΔ—	12' CONTOUR 1857	U.S.C. & G.S.
—**	12' CONTOUR 1874-75	U.S.C. & G.S.
— I I —	12' CONTOUR 1923-24	U.S.C. & G.S.
— · —	12' CONTOUR 1958-59	U.S.C. & G.S.
—□□—	12' CONTOUR 1963	U.S.C.E.
—IIIII—	30' CONTOUR 1923-24	U.S.C. & G.S.
———	30' CONTOUR 1958-59	U.S.C. & G.S.
—□□□□□—	30' CONTOUR 1963	U.S.C.E.

NOTES

1. PROFILES FROM U.S.C.E. SURVEY OCT. - DEC. 1963. SEE FIELD BOOKS D-1, H-1 - H-4, S-1, S-2, V-1 AND V-2, ALSO D.O. FILE NO'S. 24-28, 620 AND 24-28, 491.

2. OFFSHORE DEPTH CURVES LABELED WITH THIS SYMBOL —·— REPRESENT 1958-59 DATA SOUTH OF ST. JOHNS RIVER AND 1954 DATA NORTH OF ST. JOHNS RIVER.

BEACH EROSION CONTROL STUDY
DUVAL COUNTY, FLORIDA

HIGH-WATER SHORELINE CHANGES AND 12-FOOT AND 30-FOOT OFFSHORE DEPTH CONTOUR CHANGES

IN 6 SHEETS SHEET NO. 2

SCALE IN FEET
1000 0 1000 2000

U.S.ARMY ENGINEER DISTRICT, JACKSONVILLE
CORPS OF ENGINEERS, JACKSONVILLE, FLORIDA

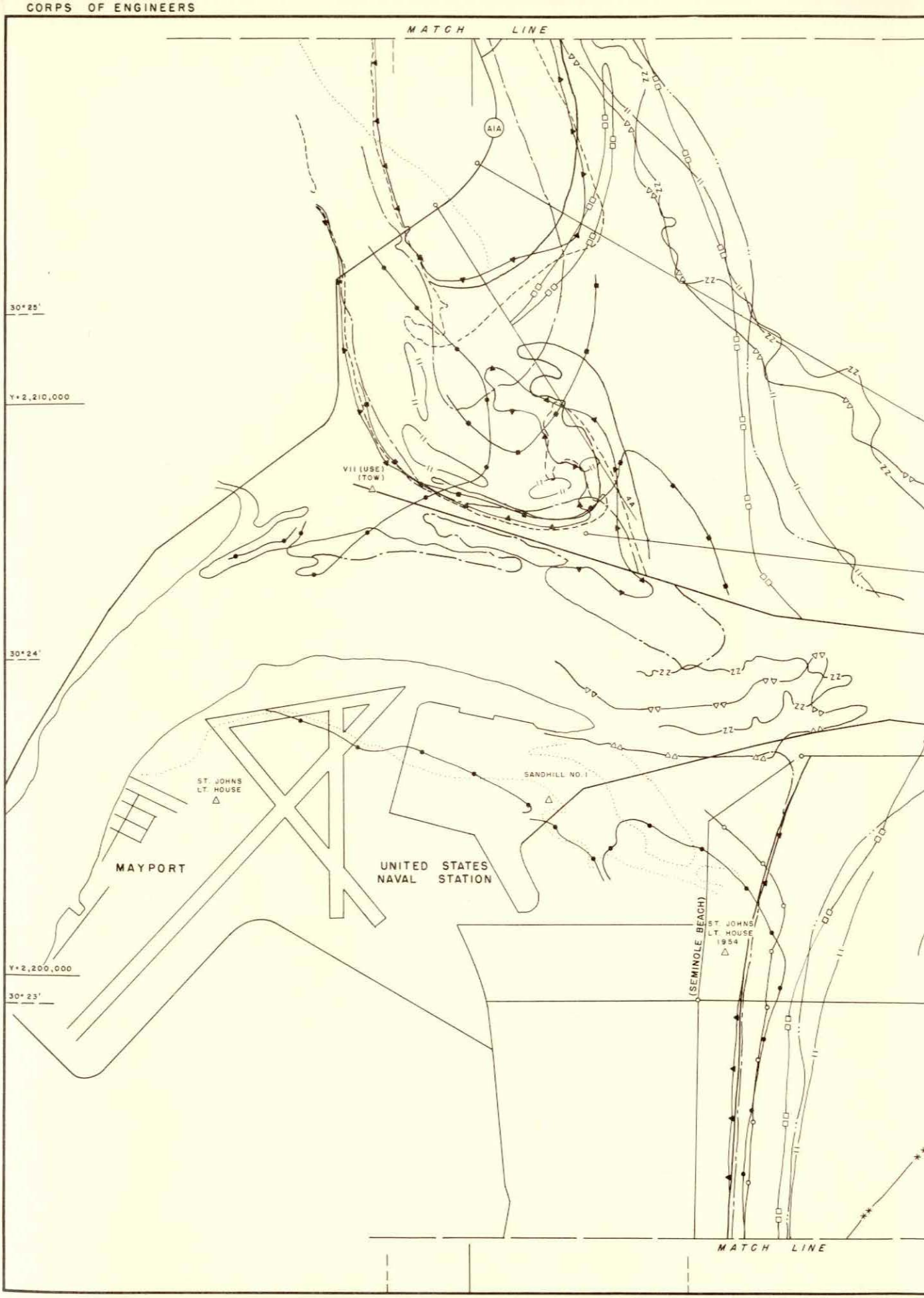
DRAWN BY: F.D.F., P.A.W.
CHECKED BY: A.J.S.

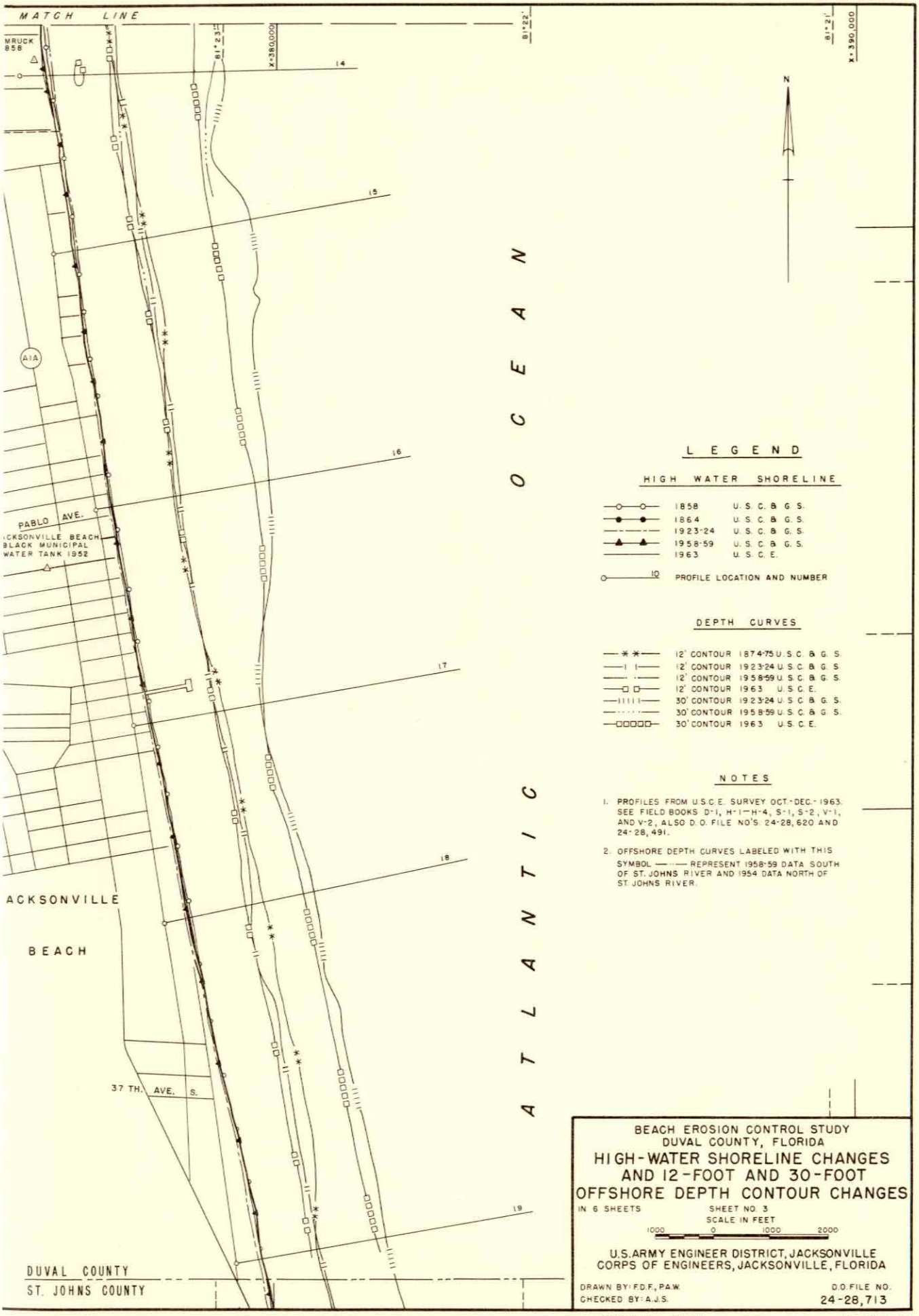
D.O. FILE NO. 24-28, 713

OCTOBER 1964

PLATE 3

CORPS OF ENGINEERS





LEGEND

HIGH WATER SHORELINE

1858	U. S. C. & G. S.
1864	U. S. C. & G. S.
1923-24	U. S. C. & G. S.
1958-59	U. S. C. & G. S.
1963	U. S. C. E.

10 PROFILE LOCATION AND NUMBER

DEPTH CURVES

12' CONTOUR 1874-75	U. S. C. & G. S.
12' CONTOUR 1923-24	U. S. C. & G. S.
12' CONTOUR 1958-59	U. S. C. & G. S.
12' CONTOUR 1963	U. S. C. E.
30' CONTOUR 1923-24	U. S. C. & G. S.
30' CONTOUR 1958-59	U. S. C. & G. S.
30' CONTOUR 1963	U. S. C. E.

NOTES

1. PROFILES FROM U.S.C.E. SURVEY OCT.-DEC.-1963. SEE FIELD BOOKS D-1, H-1—H-4, S-1, S-2, V-1, AND V-2, ALSO D.O. FILE NO'S. 24-28, 620 AND 24-28, 491.
2. OFFSHORE DEPTH CURVES LABELED WITH THIS SYMBOL ——·—— REPRESENT 1958-59 DATA SOUTH OF ST. JOHNS RIVER AND 1954 DATA NORTH OF ST. JOHNS RIVER.

BEACH EROSION CONTROL STUDY
DUVAL COUNTY, FLORIDA

HIGH-WATER SHORELINE CHANGES AND 12-FOOT AND 30-FOOT OFFSHORE DEPTH CONTOUR CHANGES

IN 6 SHEETS SHEET NO. 3

SCALE IN FEET
1000 0 1000 2000

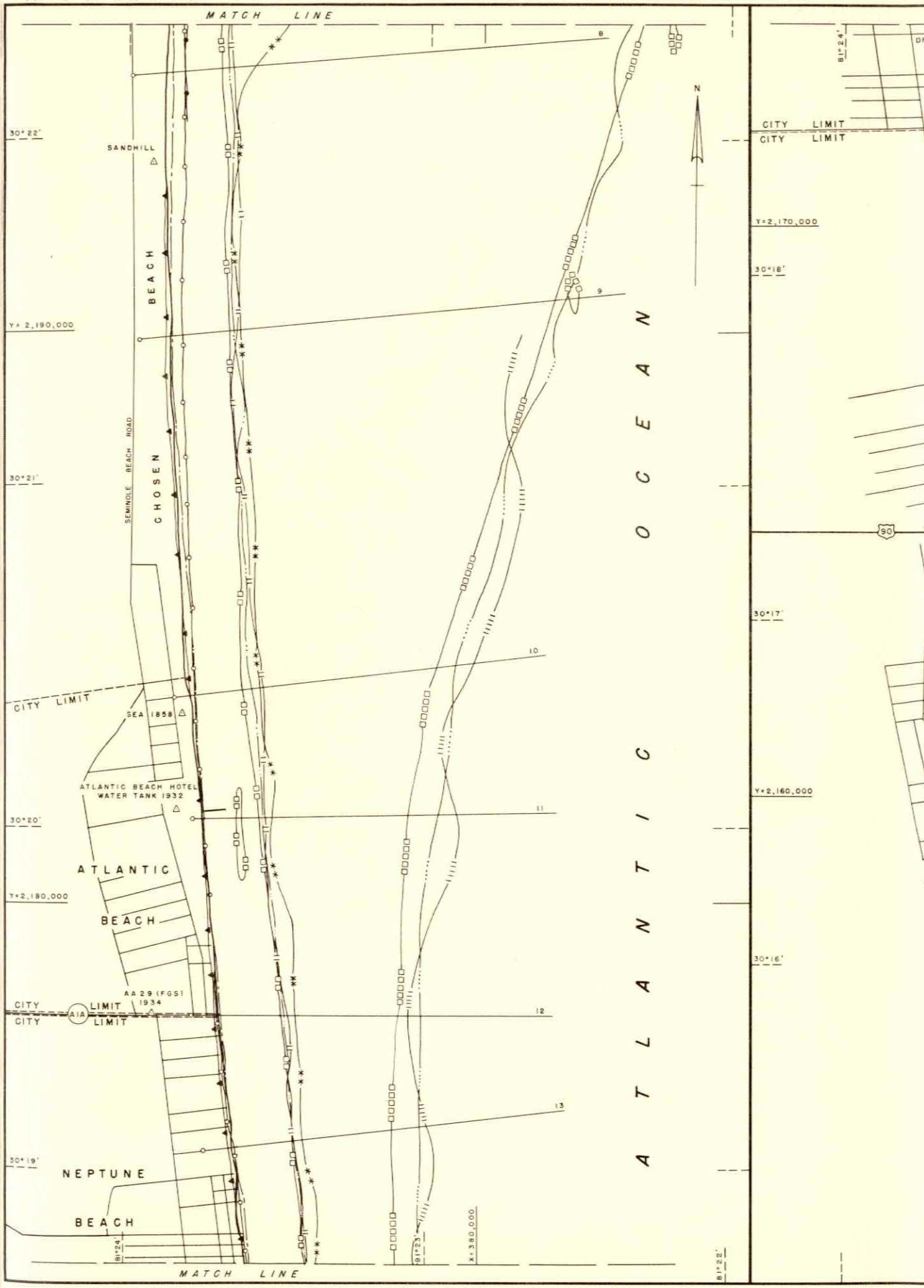
U.S. ARMY ENGINEER DISTRICT, JACKSONVILLE
CORPS OF ENGINEERS, JACKSONVILLE, FLORIDA

DRAWN BY: F.D.F., P.A.W.
CHECKED BY: A.J.S.

D.O. FILE NO.
24-28,713

OCTOBER 1964

PLATE 4


MATCH LINE
SANDHILL
BEACH
CHOSEN
SEMINOLE BEACH ROAD
CITY LIMIT
SEA 1858
ATLANTIC BEACH HOTEL
WATER TANK 1932
ATLANTIC
BEACH
AA 29 (FGS)
1934
CITY LIMIT
A1A
NEPTUNE
BEACH
MATCH LINE
OCEAN
ATLANTIC
N
8
9
10
11
12
13
30°22'
30°21'
30°20'
30°19'
30°18'
30°17'
30°16'
Y=2,190,000
Y=2,180,000
Y=2,170,000
Y=2,160,000
81°24'
81°23'
81°22'
X=380,000
90

81°23'

X = 380,000

81°22'

N

NASSAU SOUND

ATLANTIC OCEAN

HIGH WATER SHORELINE

1963 U. S. C. E.

9 PROFILE LOCATION AND NUMBER

DEPTH CURVES

—Z—	6' CONTOUR	1853	U.S.C. & G.S.
—△—	6' CONTOUR	1857	U.S.C. & G.S.
—X—	6' CONTOUR	1870-71	U.S.C. & G.S.
—I—	6' CONTOUR	1923-24	U.S.C. & G.S
—+—	6' CONTOUR	1934	U.S.C. & G.S.
—·—	6' CONTOUR	1958-59	U.S.C. & G.S.
—□—	6' CONTOUR	1963	U.S.C. E.
—ZZZ—	18' CONTOUR	1853	U.S.C. & G.S.
—△△△—	18' CONTOUR	1857	U.S.C. & G.S.
—XXX—	18' CONTOUR	1870-71	U.S.C. & G.S.
—III—	18' CONTOUR	1923-24	U.S.C. & G.S.
—+++—	18' CONTOUR	1934	U.S.C. & G.S.
—···—	18' CONTOUR	1958-59	U.S.C. & G.S.
—□□□—	18' CONTOUR	1963	U.S.C. E.

NOTES

1. PROFILES FROM U.S.C.E. SURVEY OCT.-DEC.-1963. SEE FIELD BOOKS D-1, H-1—H-4, S-1, S-2, V-1 AND V-2, ALSO D.O. FILE NO'S. 24-28,620 AND 24-28, 491.

2. OFFSHORE DEPTH CURVES LABELED WITH THIS SYMBOL —·—·— REPRESENT 1958-59 DATA SOUTH OF ST. JOHNS RIVER AND 1954 DATA NORTH OF ST. JOHNS RIVER.

BEACH EROSION CONTROL STUDY
DUVAL COUNTY, FLORIDA

6-FOOT AND 18-FOOT OFFSHORE DEPTH CONTOUR CHANGES

IN 6 SHEETS SHEET NO. 4

SCALE IN FEET

1000 0 1000 2000

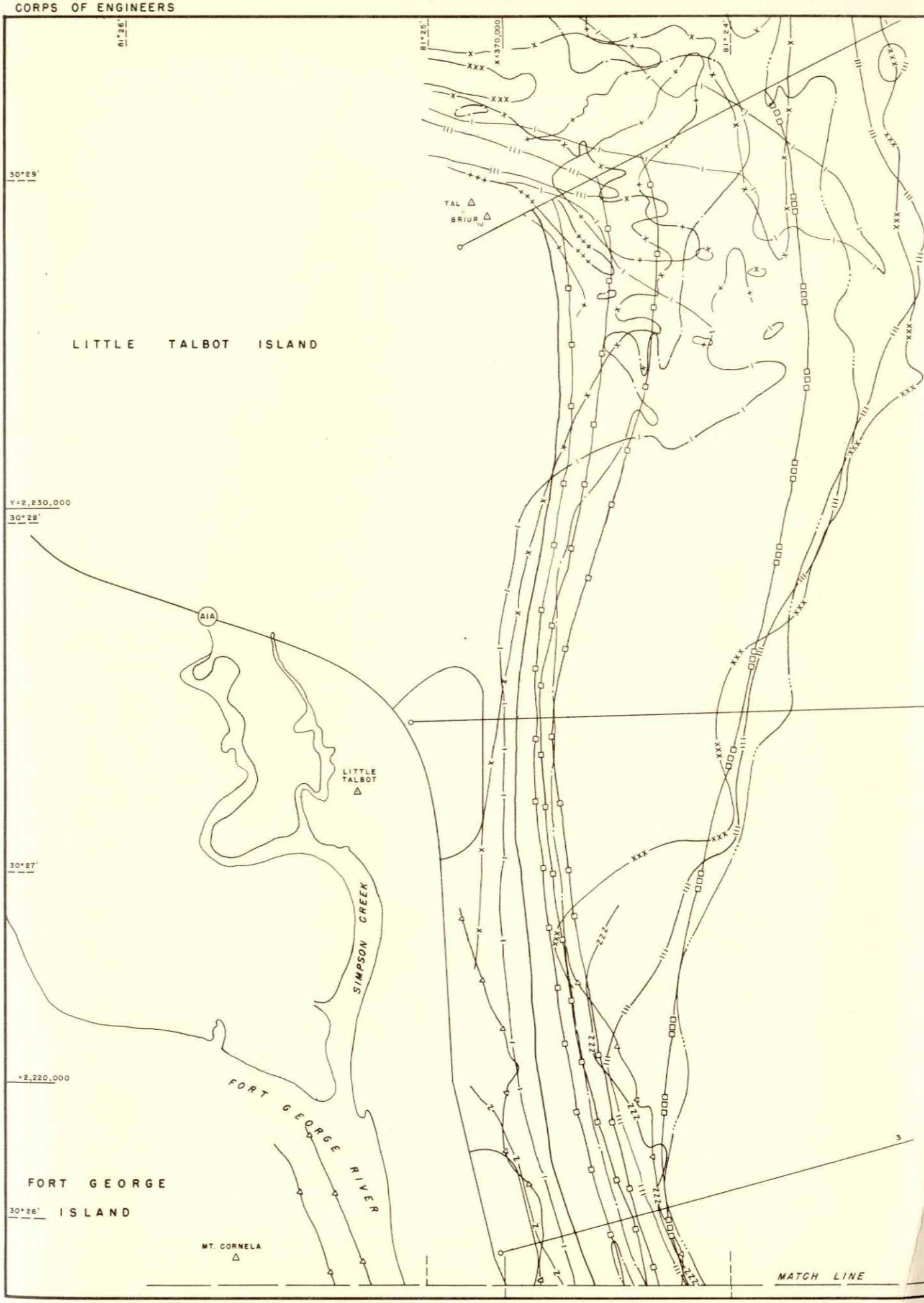
U.S. ARMY ENGINEER DISTRICT, JACKSONVILLE
CORPS OF ENGINEERS, JACKSONVILLE, FLORIDA

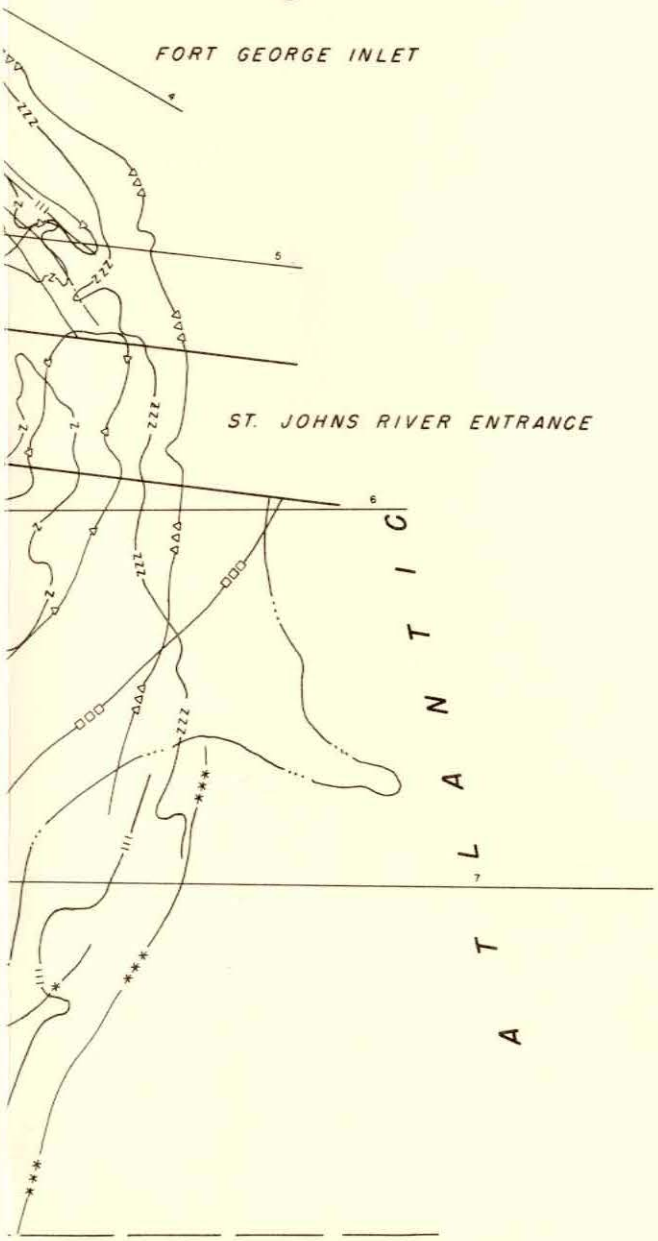
DRAWN BY: F.D.F, P.A.W.
CHECKED BY: A.J.S.

D.O. FILE NO.
24-28,713

OCTOBER 1964

PLATE 5


81°26'
81°25'
X=370,000
81°24'
30°29'
TAL
BRIUR
LITTLE TALBOT ISLAND
Y=2,230,000
30°28'
A1A
LITTLE TALBOT
30°27'
SIMPSON CREEK
2,220,000
FORT GEORGE RIVER
FORT GEORGE ISLAND
30°26'
MT. CORNELA
MATCH LINE



N

LEGEND

HIGH WATER SHORELINE

1963 U.S.C.E.

7 PROFILE LOCATION AND NUMBER

DEPTH CURVES

Z	6' CONTOUR	1853	U.S.C.& G.S.
△	6' CONTOUR	1857	U.S.C.& G.S.
*	6' CONTOUR	1874-75	U.S.C.& G.S.
I	6' CONTOUR	1923-24	U.S.C.& G.S.
·	6' CONTOUR	1958-59	U.S.C.& G.S.
□	6' CONTOUR	1963	U.S.C.E.
ZZZ	18' CONTOUR	1853-	U.S.C.& G.S.
△△△	18' CONTOUR	1857	U.S.C.& G.S.
***	18' CONTOUR	1874-75	U.S.C.& G.S.
III	18' CONTOUR	1923-24	U.S.C.& G.S.
···	18' CONTOUR	1958-59	U.S.C.& G.S.
□□□	18' CONTOUR	1963	U.S.C.E.

NOTES

1. PROFILES FROM U.S.C.E. SURVEY OCT.-DEC.-1963. SEE FIELD BOOKS D-1, H-1—H-4, S-1, S-2, V-1 AND V-2, ALSO D.O. FILE NO'S. 24-28, 620 AND 24-28, 491.

2. OFFSHORE DEPTH CURVES LABELED WITH THIS SYMBOL —·—·— REPRESENT 1958-59 DATA SOUTH OF ST. JOHNS RIVER AND 1954 DATA NORTH OF ST. JOHNS RIVER.

BEACH EROSION CONTROL STUDY
DUVAL COUNTY, FLORIDA

6-FOOT AND 18-FOOT OFFSHORE DEPTH CONTOUR CHANGES

IN 6 SHEETS SHEET NO. 5

SCALE IN FEET
1000 0 1000 2000

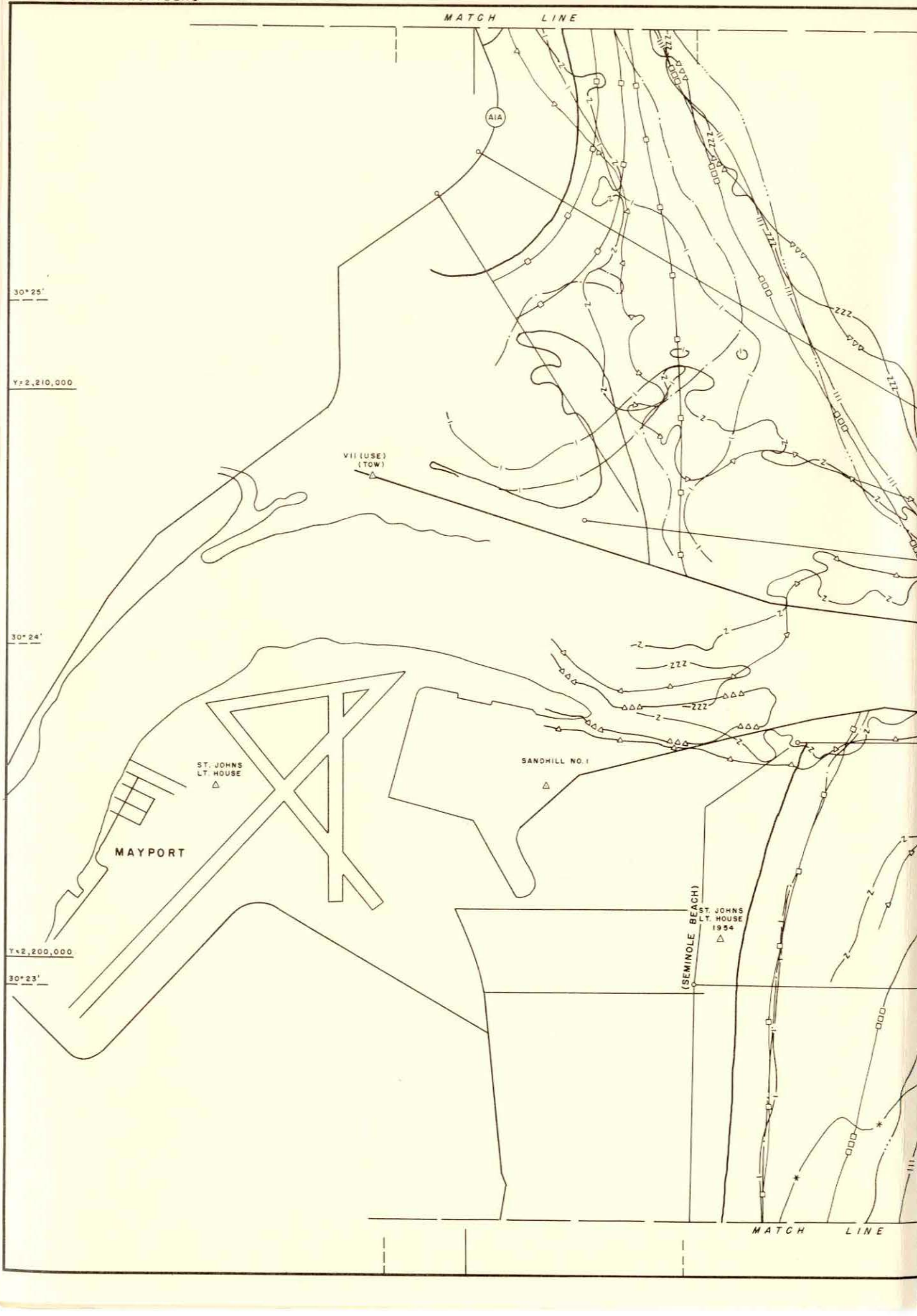
U.S. ARMY ENGINEER DISTRICT, JACKSONVILLE
CORPS OF ENGINEERS, JACKSONVILLE, FLORIDA

DRAWN BY: F.D.F., P.A.W.
CHECKED BY: A.J.S.

D.O. FILE NO. 24-28,713

OCTOBER 1964

PLATE 6


MATCH LINE
A1A
30° 25'
Y=2,210,000
VII (USE)
(TOW)
30° 24'
ST. JOHNS
LT. HOUSE
SANDHILL NO. 1
MAYPORT
(SEMINOLE BEACH)
ST. JOHNS
LT. HOUSE
1954
Y=2,200,000
30° 23'
MATCH LINE

NOTES

1. PROFILES FROM U.S.C.E. SURVEY OCT-DEC. 1963. SEE FIELD BOOKS D-1, H-1-H-4, S-1, S-2, V-1 AND V-2, ALSO D.O. FILE NO'S. 24-28,620 AND 24-28,491.

2. OFFSHORE DEPTH CURVES LABELED WITH THIS SYMBOL —·— REPRESENT 1958-59 DATA SOUTH OF ST. JOHNS RIVER AND 1954 DATA NORTH OF ST. JOHNS RIVER.

LEGEND

HIGH WATER SHORELINE

——— 1963 U.S.C.E.

o——8 PROFILE LOCATION AND NUMBER

DEPTH CURVES

—*— 6' CONTOUR 1874-75 U.S.C. & G.S.
—|— 6' CONTOUR 1923-24 U.S.C. & G.S.
—·— 6' CONTOUR 1958-59 U.S.C. & G.S.
—□— 6' CONTOUR 1963 U.S.C.E.
—***— 18' CONTOUR 1874-75 U.S.C. & G.S.
—|||— 18' CONTOUR 1923-24 U.S.C. & G.S.
—···— 18' CONTOUR 1958-59 U.S.C. & G.S.
—□□□— 18' CONTOUR 1963 U.S.C.E.

BEACH EROSION CONTROL STUDY
DUVAL COUNTY, FLORIDA

6-FOOT AND 18-FOOT OFFSHORE DEPTH CONTOUR CHANGES

IN 6 SHEETS SHEET NO. 6

SCALE IN FEET
1000 0 1000 2000

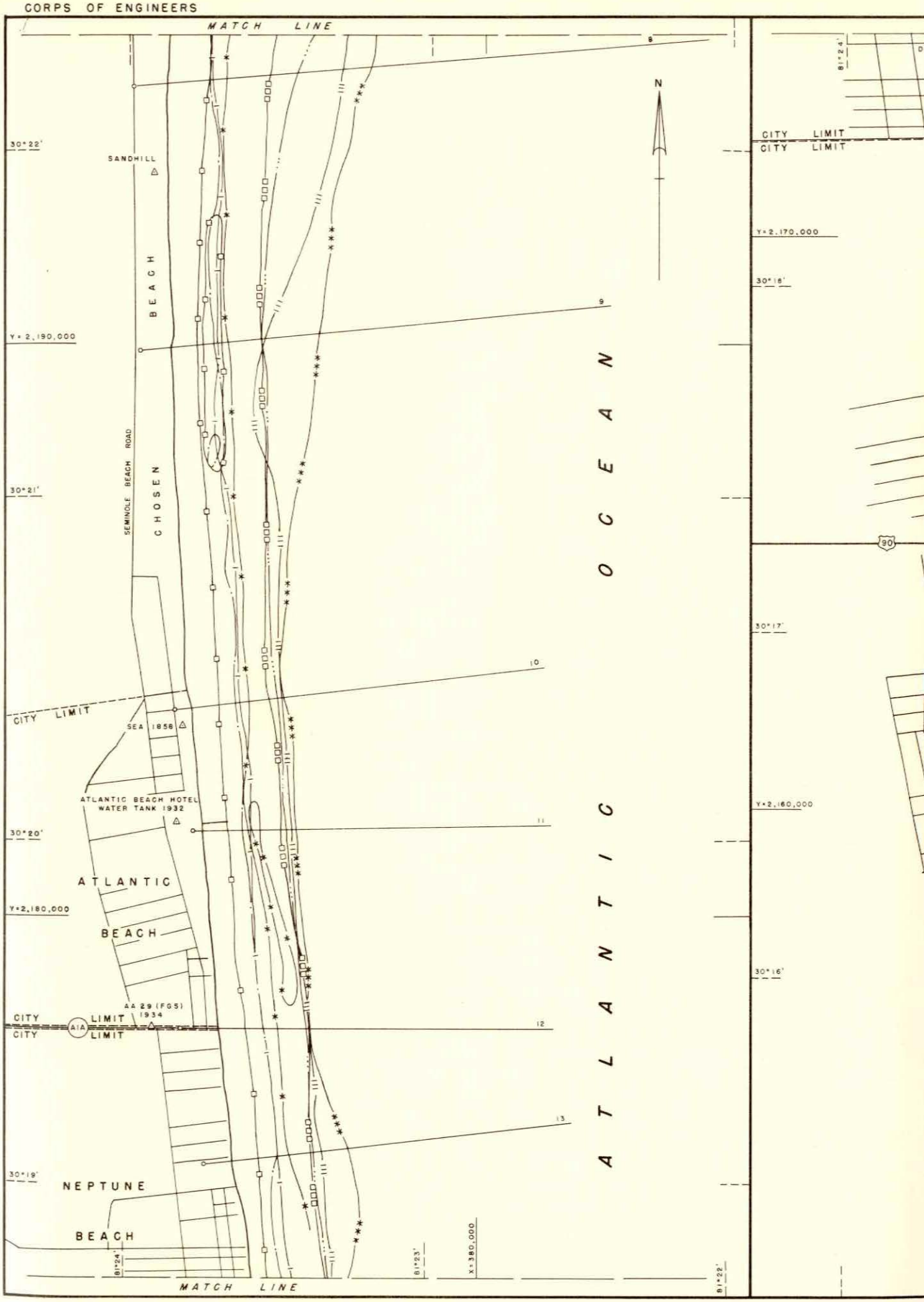
U.S.ARMY ENGINEER DISTRICT, JACKSONVILLE
CORPS OF ENGINEERS, JACKSONVILLE, FLORIDA

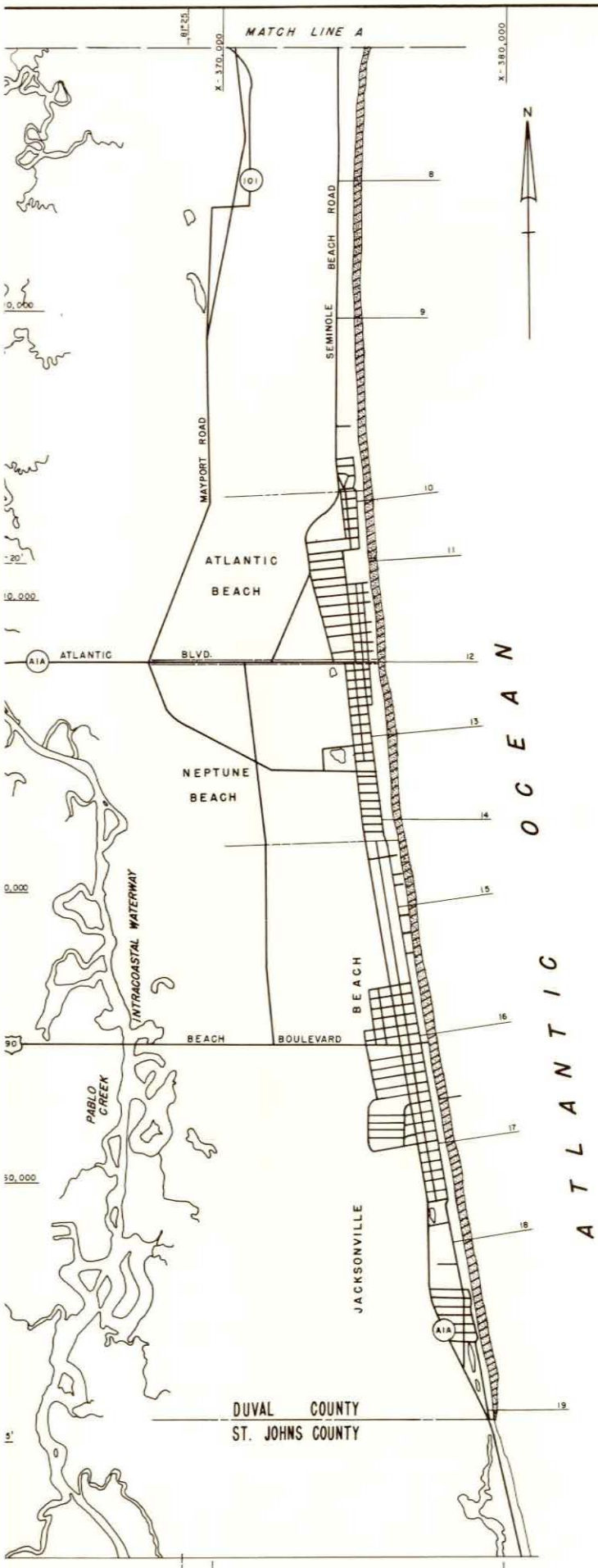
DRAWN BY: F.D.F., P.A.W.
CHECKED BY: A.J.S.

D.O.FILE NO.
24-28,713

OCTOBER 1964

PLATE 7


MATCH LINE
N
30°22'
SANDHILL
BEACH
CHOSEN
SEMINOLE BEACH ROAD
Y = 2,190,000
30°21'
CITY LIMIT
SEA 1858
ATLANTIC BEACH HOTEL WATER TANK 1932
30°20'
ATLANTIC
BEACH
Y=2,180,000
AA 29 (FGS) 1934
CITY LIMIT
A1A
CITY LIMIT
30°19'
NEPTUNE
BEACH
81°24'
81°23'
X=380,000
81°22'
MATCH LINE
OCEAN
ATLANTIC
CITY LIMIT
CITY LIMIT
Y=2,170,000
30°18'
90
30°17'
Y=2,160,000
30°16'



LEGEND

- INITIAL RESTORATION AND PERIODIC NOURISHMENT
- 14 PROFILE LOCATION AND NUMBER
- CITY LIMIT

NOTES

1. FEDERAL PARTICIPATION RECOMMENDED FOR INITIAL RESTORATION AND PERIODIC NOURISHMENT OF BEACH FROM SOUTH JETTY TO DUVAL COUNTY–ST. JOHNS COUNTY LINE, ABOUT 53,000 LINEAR FEET.
2. SLOPES SHOWN ON TYPICAL SECTION ARE APPROXIMATE. ACTUAL SLOPES WILL BE AS SHAPED BY WAVE ACTION.
3. REVETMENT SHOWN ON TYPICAL SECTION PROVIDED UNDER O.E.P. AUTHORITY.

BEACH EROSION CONTROL STUDY
DUVAL COUNTY, FLORIDA

PLAN OF IMPROVEMENT

SCALE IN FEET
1000 0 1000 2000 3000 4000 5000 6000 7000

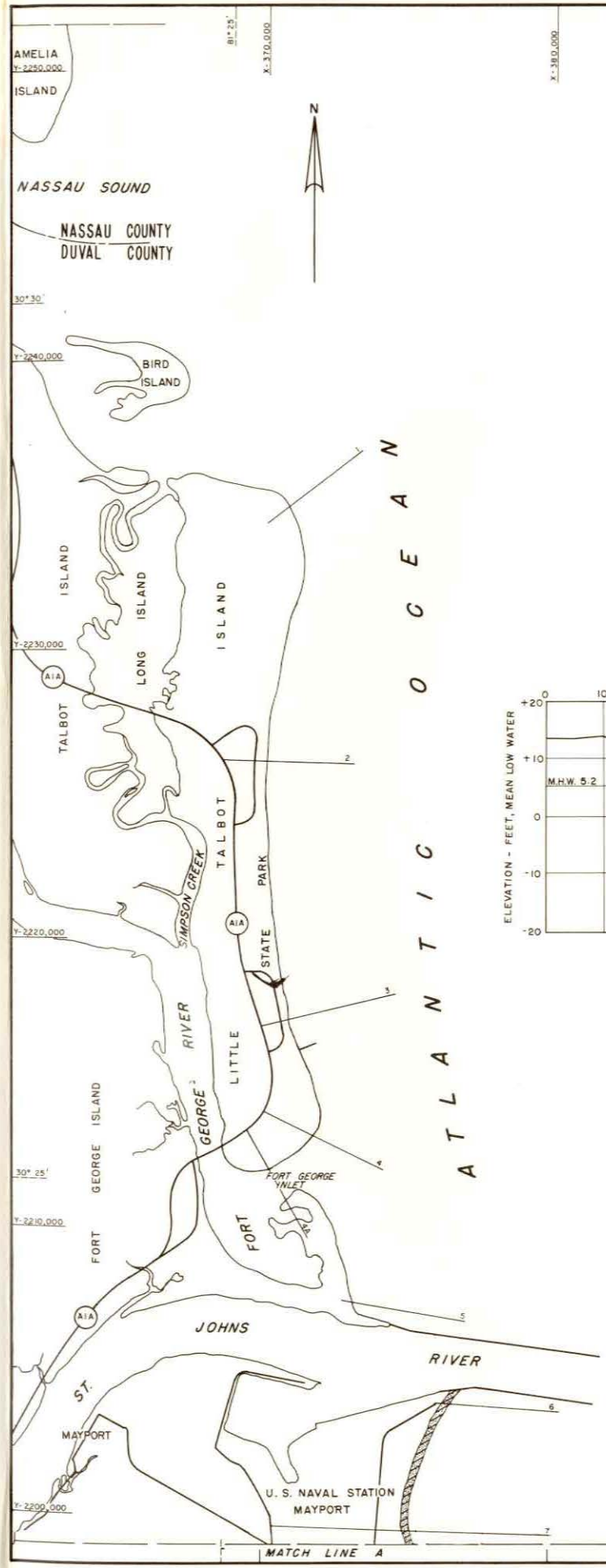
U.S. ARMY ENGINEER DISTRICT, JACKSONVILLE
CORPS OF ENGINEERS, JACKSONVILLE, FLORIDA

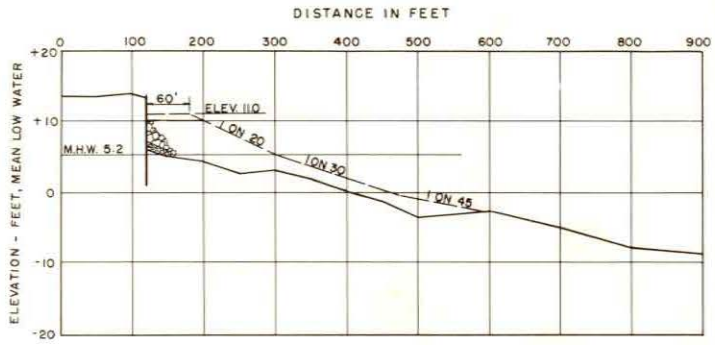
SUBMITTED	APPROVAL RECOMMENDED	APPROVED
Edw. W. Edwards	Joe J. Kovarsky	H. R. Crosby
CHIEF, PLNG. & RPTS. BR.	CHIEF, ENGINEERING DIV.	COL. C.E. DIST. ENGINEER

DRAWN BY: P.A.W.
CHECKED BY: A.J.S.

D.O. FILE NO. 24-28,713

OCTOBER 1964 PLATE 8





TYPICAL SECTION

BEACH RESTORATION

——— EXISTING SECTION – OCT. - DEC. 1963

— — — IMPROVED SECTION

BEACH EROSION CONTROL STUDY

DUVAL COUNTY, FLA.

APPENDIX A

PUBLIC HEARING

TABLE OF CONTENTS

BEACH EROSION CONTROL STUDY

DUVAL COUNTY, FLA.

APPENDIX A

PUBLIC HEARING

1. General.--This appendix presents a digest of the public hearing conducted for this investigation.

2. Public hearing.--The hearing was held by the District Engineer in Jacksonville Beach, Fla., on July 23, 1963. About 80 persons attended, including representatives of Duval County Board of Commissioners, Atlantic Beach, Neptune Beach, and Jacksonville Beach. A copy of the hearing record accompanies this report. A brief digest of the hearing follows.

DIGEST OF PUBLIC HEARING, JACKSONVILLE BEACH, FLA.
JULY 23, 1963

Speaker	Interest Represented	Remarks
Mr. Bob Harris	County Commissioner, Duval County	Stated the Board of County Commissioners is the sponsoring agency. Expressed concern over beaches in Duval County. Hopes that survey will show that people in the county use the beaches.
Mr. John Crosby	County Engineer	County has provided access by one vehicular ramp and four pedestrian ramps and lifeguard protection for the county beach area north of Atlantic Beach for public convenience. Desires that study include determination of effect of St. Johns River jetties on beach erosion south of jetties.
Mr. Glover Weiss	Property owner, Atlantic Beach	Has made measurements of beach level since 1945. Reported that beach was 4 ft. below top of Atlantic Beach seawall in 1945 and is presently 10.2 ft. below top of wall. Expressed belief that jetties at St. Johns River are the direct cause of sand loss. Offered plan to renourish the beaches. Plan consists of chaining together 3 LST's, loading them with rock, and sinking them at the southeast corner of south jetty. Details could be worked out in laboratory. LST's would act as breakwater and would catch currents as they sweep around and reflect them shoreward again and thus bring sand to beaches. Also stated that Atlantic Beach seawall is in danger due to the low sand level in front of it.

Speaker	Interest Represented	Remarks
Mr. Robert P. Permenter	Chairman, N.A.B. Freeholders Association, North Atlantic Beach, Fla.	Wishes to thank Government for assistance and for study. Resident of area since 1907. Expressed interest in North Atlantic Beach as well as the other beaches.
Mr. Henry Isaacs	Mayor of Atlantic Beach and Chairman of the Ocean Front Erosion Committee	Property owners and City of Atlantic Beach desire to provide temporary works for protection during next storm season. They wish opinion of Corps of Engineers on feasibility and adequacy. Expressed appreciation for hearing.
Mr. Bob Gordon	City Councilman, Neptune Beach	Neptune Beach requested beach erosion study from Congressmen. Stated that First Street which is one block back of ocean is low and expressed concern over the adequacy of existing seawall, especially where there is no revetment, and stated that gaps in revetment may aggravate storm wave impact. Also stated that engineering data, beach profiles, photographs are available to sustain the fact that erosion problems were created by building of the jetties at St. Johns River. He desires a continuous revetment for protection, as present work is not adequate.
Mr. H. W. Strickland	Beach resident	Expressed concern over effect of storms on present condition of beach. Stated that emergency repair work provided is inadequate. Desires investigation to determine the effect of St. Johns River jetties on the beaches. Asked if 1948 survey on effect of jetties was considered final.

Speaker	Interest Represented	Remarks
Mr. W. S. Wilson	Mayor, Jacksonville Beach	Expressed appreciation for emergency repair work provided. Desires study of sloping revetment-type wall as on Jupiter Island for possible construction at Jacksonville Beach. Stated that he was familiar with 1948 study and that the Federal Government would not accept responsibility for the effect of the jetties on the beaches at that time. Stated that theory of jetties having no adverse effect on beaches has been at least partially disproven, and that everywhere there are natural inlets an erosion problem exists whether there are jetties there or not, but erosion situation seems to be aggravated where the jetties stop the flow of sand. Believes City can probably meet cost-sharing requirements developed for permanent improvements. Also believes that matter is a responsibility of general public and not confined to any one community.
Mr. Jack Weatherford	Civil Defense Director, Jacksonville, the Beaches, and Duval County	Expressed appreciation for relief to the beach communities from storm. Pointed out that law doesn't permit any action until emergency has arrived, then appeals for relief are channeled through proper authorities. Offered his office for assistance if possible.
Mr. Walter Murphy	State Office of Civil Defense	Offered cooperation on matters pertaining to his office.

Speaker	Interest Represented	Remarks
Mr. Taylor Harris	Retired businessman and longtime beach resident	Considers that Federal, State, county, and local community governments should help with program. Expressed concern over present conditions in event of another storm.
Mr. Jack Proctor	Merchant and landowner	If it could be proven that there is a big correlation between beach erosion and the St. Johns River jetties, which are a Federal project, could Public Law 99 be applied? Wishes to endorse Mr. Glover Weiss's idea for study and wishes study on the effect of the deepening of the mouth of St. Johns River on adjacent beaches.
Mrs. Ruth Evans Perry	Property owner	Raised the following question. Would it be feasible to have staggered openings in the jetties to allow sand to flow through and replenish the beaches? Another idea put forth would be a wooden bulkhead with jetties (groins and revetment) in front of it to hold the shoreline. Stated that she believes, with help, property owners would be willing to do their part in front of their property.
Mr. Ney C. Landrum	Director, Division of Beaches and Shores--State Board of Conservation	Stated that 1963 Florida Legislature created a Division of Beaches and Shores in the State Board of Conservation and vested same with broad powers and responsibilities for certain aspects of beach preservation and erosion control. Briefly gave the 10 functions of his office. Wanted to impress local people with the fact that an authorized project must be physically carried out and that they should organize and plan to meet the local requirements for the project. Inferred that State financial contribution may be available towards a project.

BEACH EROSION CONTROL STUDY

DUVAL COUNTY, FLA.

APPENDIX B

SOURCE-OF-MATERIALS INVESTIGATIONS AND SAND SAMPLES

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

BEACH EROSION CONTROL STUDY

DUVAL COUNTY, FLA.

APPENDIX B

SOURCE-OF-MATERIAL INVESTIGATIONS AND SAND SAMPLES

1. Subsurface investigations.--Thirty-six dry-rod probings and twenty-two core borings were taken along the east side of the Pablo Creek marsh. Locations of the core borings and probings are shown on figure B-1. One boring was taken in Ft. George River as shown on figure B-2. The dry-rod probings were taken to determine the depth and extent of the soft organic material known to mantle the surface in the marsh area. The core borings were taken to determine the types of material available for beach fill. The borings were drilled using a Sprague and Henwood Model 40C barge-mounted core drill. The operations were performed during periods of high tide, the areas being unaccessible to floating plant at other times.

2. Study of underlying materials.--Subsurface conditions vary greatly as would be expected in a tidal marsh. The thickness of the soft silts and organic material which mantle the marsh ranges from a feather's edge to over 27 feet. Underlying the soft material are deposits ranging from clean or silty and clayey sands to fat clay and silt. Shell content varies from a few shell fragments to almost pure shell deposits. Rock was encountered in some of the borings at a depth of about 40 feet. The core-boring logs, in 34 sheets, are included at the end of this appendix. Table B-1 shows the thickness of the upper layer of soft material as determined by probings.

3. Sample analysis.--Samples of all granular materials taken from the borings were analyzed for grain size. A tabulation of the median diameter for each sample tested is shown in table B-2. One hundred and seventy-five samples from 17 core borings were analyzed. Gradation curves are on file in the District Office. Shell content was not analyzed since many of the Florida sands are composed partly of fine shell fragments.

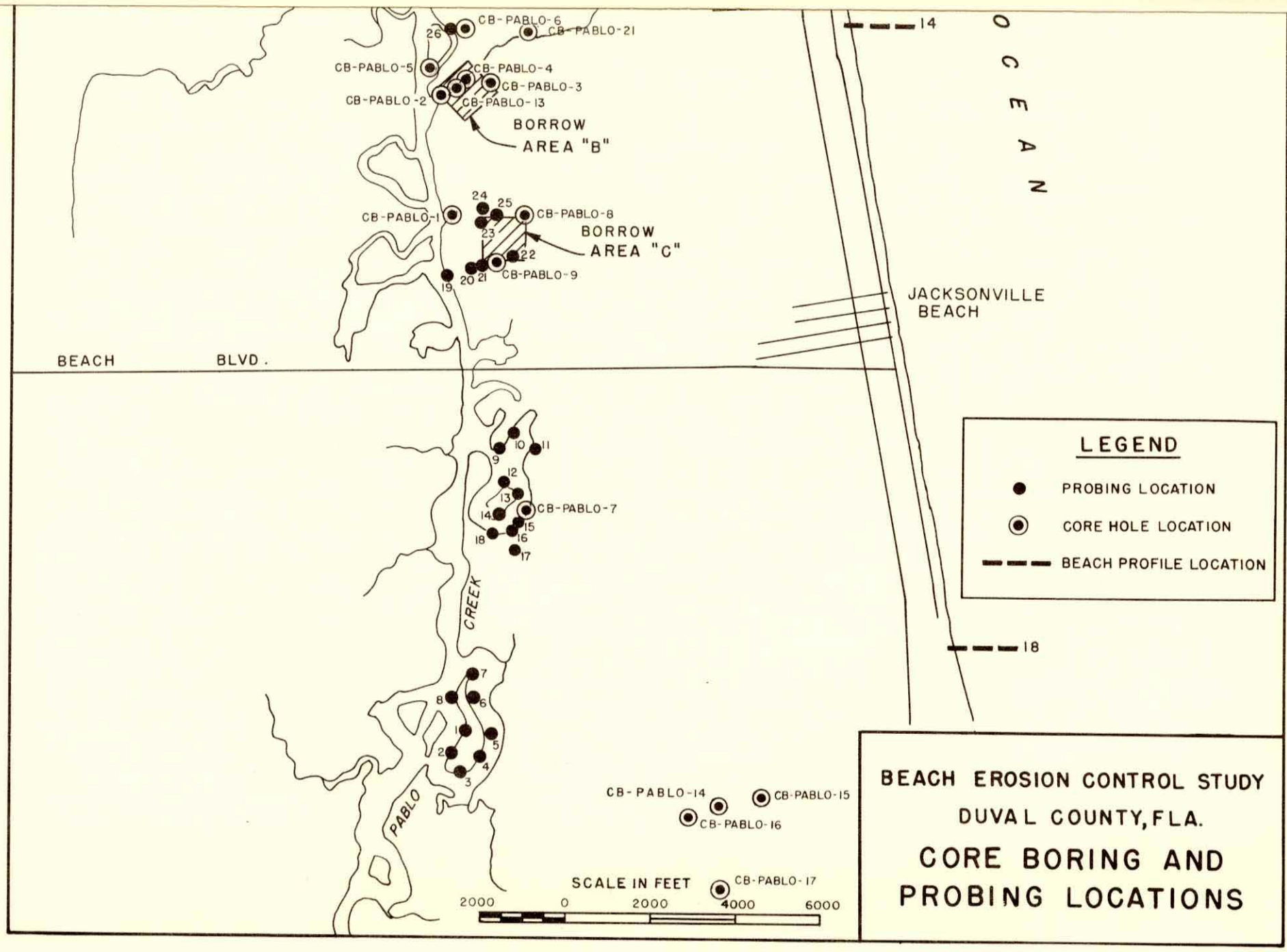
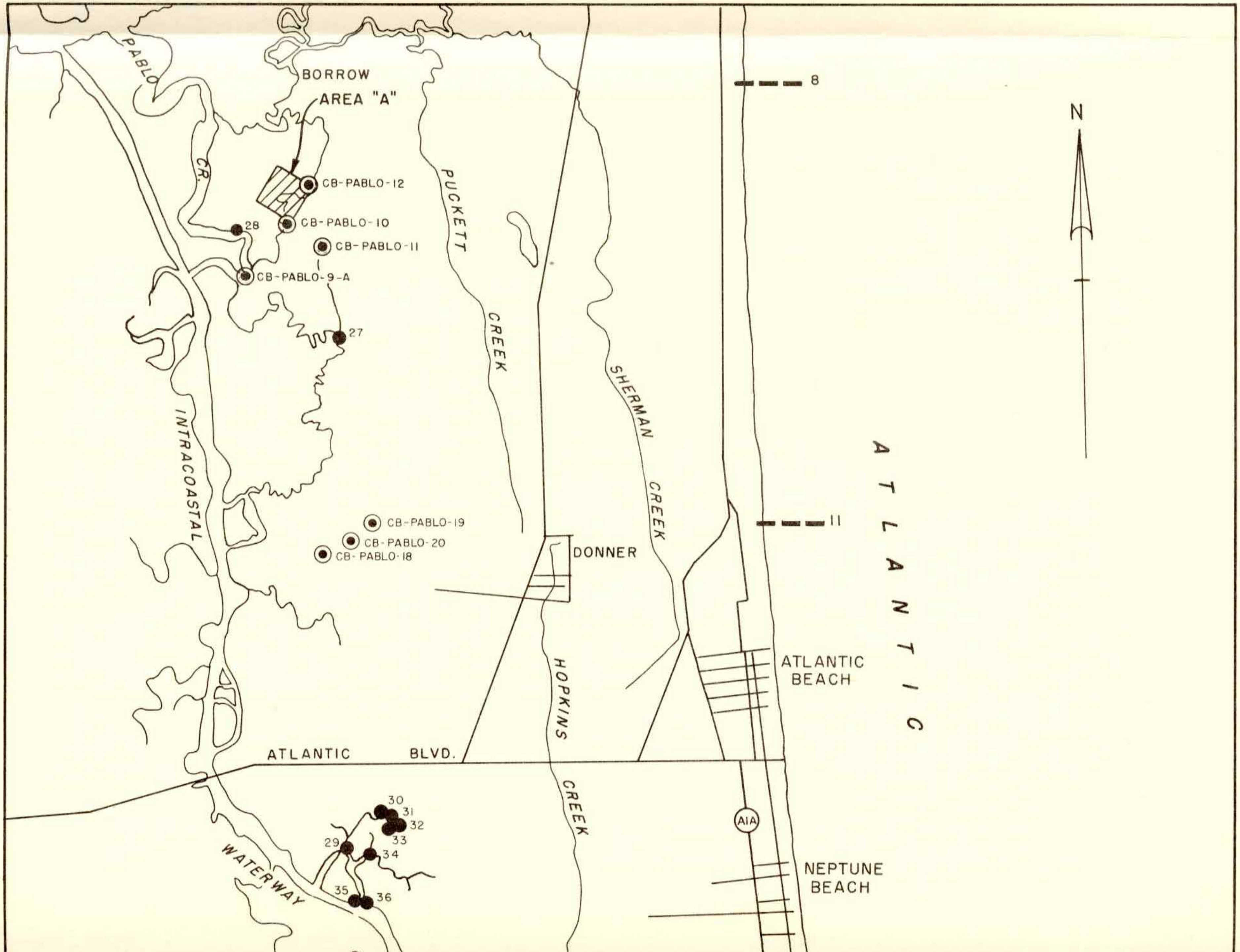

CB-PABLO-6
CB-PABLO-21
26
CB-PABLO-5
CB-PABLO-4
CB-PABLO-3
CB-PABLO-2
CB-PABLO-13
BORROW
AREA "B"
24
25
CB-PABLO-1
CB-PABLO-8
BORROW
AREA "C"
23
22
19
20
21
CB-PABLO-9
14
OCEAN
JACKSONVILLE
BEACH
BEACH
BLVD.
10
11
9
12
13
CB-PABLO-7
14
15
18
16
17
CREEK
18
7
8
6
1
5
2
4
3
PABLO
CB-PABLO-14
CB-PABLO-15
CB-PABLO-16
CB-PABLO-17
SCALE IN FEET
2000
0
2000
4000
6000
LEGEND
PROBING LOCATION
CORE HOLE LOCATION
BEACH PROFILE LOCATION
BEACH EROSION CONTROL STUDY
DUVAL COUNTY, FLA.
CORE BORING AND
PROBING LOCATIONS

FIGURE B-1


N
ATLANTIC
8
11
BORROW
AREA "A"
CB-PABLO-12
CB-PABLO-10
CB-PABLO-11
CB-PABLO-9-A
27
28
PABLO
CR.
PUCKETT
CREEK
SHERMAN
CREEK
INTRACOASTAL
WATERWAY
CB-PABLO-19
CB-PABLO-20
CB-PABLO-18
DONNER
HOPKINS
CREEK
ATLANTIC BEACH
NEPTUNE BEACH
ATLANTIC
BLVD.
A1A
29
30
31
32
33
34
35
36

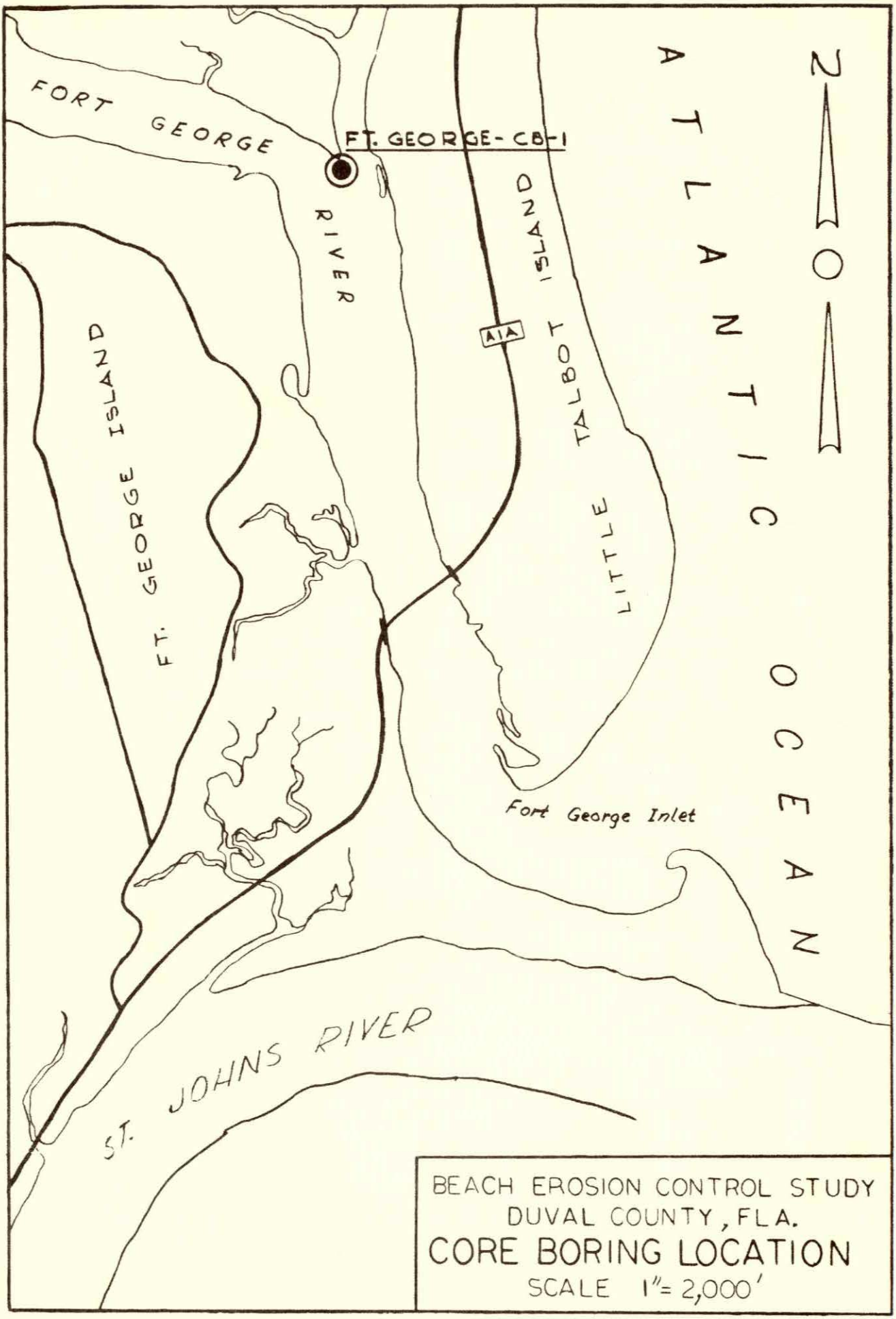

FORT GEORGE
FT. GEORGE - CB-1
RIVER
FT. GEORGE ISLAND
A1A
LITTLE TALBOT ISLAND
ATLANTIC OCEAN
Fort George Inlet
ST. JOHNS RIVER
BEACH EROSION CONTROL STUDY
DUVAL COUNTY, FLA.
CORE BORING LOCATION
SCALE 1" = 2,000'

FIGURE B-2

TABLE B-1

Probings

Probing No.	Thickness of soft material (ft.)	Probing No.	Thickness of soft material (ft.)
1	12.0	19	18.0+
2	14.0	20	6.0
3	14.5	21	0.0
4	14.8	22	0.0
5	15.0	23	5.0
6	18.0+	24	4.5
7	17.3+	25	0.0
8	17.5+	26	0.0
9	17.5+	27	21.0+
10	17.3+	28	15.0+
11	15.5+	29	10.5
12	0.0	30	7.5
13	0.0	31	10.5
14	12.3	32	4.0
15	0.0	33	2.5
16	0.0	34	14.5+
17	0.0	35	11.0
18	16.5+	36	12.0

NOTE: Thickness of soft material unsuitable for beach fill determined using a 1/2-inch closed-end pipe pushed down by hand.

TABLE B-2

Grain-size analysis
(All borings tested)

Hole No.	Sample No.	Median diameter (mm.)	Hole No.	Sample No.	Median diameter (mm.)
Fort George					
CB-1			Pablo-5		
	1	0.33		1A	OL (silt)
	2	0.20		2A	OL (silt)
	3	0.16		4A	0.14
	4	0.08		5A	CH (clay)
	5	0.15		7A	0.25

(Continued)

TABLE B-2--Continued

Hole No.	Sample No.	Median diameter (mm.)	Hole No.	Sample No.	Median diameter (mm.)
Pablo-6			Pablo-10		
	1A	0.18		5	0.23
	1B	0.18		8	0.90
	2A	0.15		9	0.13
	5A	0.14		10	2.70
	6A	0.08		11	0.30
	7A	0.21		12	0.32
	9A	0.40		13	0.36
	10	0.40			
	11A	0.30	Pablo-12		
				2	0.15
Pablo-7				3	0.14
	2A	0.14		4	0.16
	3A	0.16		5	0.20
	6A	0.14		6	0.21
	7A	1.10		7	0.09
	8A	0.01		8	0.13
	10A	0.50		9	0.24
				10	0.40
Pablo-8				11	0.25
	1A	0.14			
	2A	0.30	Pablo-13		
	3A	0.17		2	0.16
	4A	0.14		3	0.16
	5A	0.09		4	0.16
	6A	0.10		5	0.17
	8A	0.25		6	0.09
	9A	0.18		7	0.23
	10A	0.17		8	0.90
	11A	0.22		9	0.40
				10	0.31
Pablo-9				11	0.30
			Pablo-14		
	1A	0.16		1	0.15
	2A	0.17		2	0.17
	5A	0.12		3	0.15
	7A	0.17		4	0.18
	8A	0.13		5	0.15
	9A	0.71		6	0.13
	10A	3.25		7	0.13
	11A	0.16		8	0.19
	12A	0.60		9	0.26
				10	0.21
				11	0.20
				12	0.28

(Continued)

TABLE B-2--Continued

Hole No.	Sample No.	Median diameter (mm.)	Hole No.	Sample No.	Median diameter (mm.)
Pablo-15			Pablo-17		
	1	0.39		8	0.17
	2	0.17		9	0.16
	3	0.18		10	0.16
	4	0.18		11	0.20
	5	0.17		12	0.07
	6	0.18		13	0.23
	7	0.15		14	0.15
	8	0.14			
	9	0.18	Pablo-18		
	10	0.15		1	0.17
	11	0.14		2	0.17
	12	0.13		3	0.15
	13	0.30		4	0.14
	14	0.35		5	0.14
	15	0.26		6	0.10
				7	0.14
Pablo-16				8	0.07
	1	0.16		9	0.25
	2	0.13		10	0.27
	3	0.17			
	4	0.18	Pablo-19		
	5	0.18		1	0.18
	6	0.10		2	0.17
	7	0.15		3	0.20
	8	0.17		4	0.17
	9	0.23		5	0.15
	10	0.27		6	0.15
	11	0.16		7	0.17
	12	0.25		8	0.08
	13	0.27		9	0.10
				10	0.18
Pablo-17				11	0.21
	1	0.18		12	0.27
	2	0.18		13	0.29
	3	0.18			
	4	0.16	Pablo-20		
	5	0.15		1	0.15
	6	0.17		2	0.14
	7	0.17		3	0.15
				5	0.13
				8	0.28

(Continued)

TABLE B-2--Continued

Hole No.	Sample No.	Median diameter (mm.)	Hole No.	Sample No.	Median diameter (mm.)
Pablo-20			Pablo-20		
	1	0.15		1	0.15
	2	0.14		2	0.18
	3	0.15		3	-
	4	0.16		4	0.17
	5	0.13		5	0.15
	6	0.15		6	0.15
	7	-		7	0.12
	8	0.28		8	0.077
	9	0.16		9	-
	10	0.35		10	Lost
	11	0.41		11	Lost
	12	Lost		12	Lost
				13	0.38
				14	0.43

4. Probable source and abundance of beach material.--Probable borrow areas in the Pablo Creek marsh are indicated as Borrow Areas A, B, and C on figure B-1. Several million yards of beach fill could be obtained from each of the indicated areas. Based on the existing borings and the sample analysis, the material available would be very similar to that now existing on the beach. A comparison of the median diameter of the materials obtained from the probable borrow areas and the median diameter of surface samples obtained from adjacent beach profiles is shown in table B-3. The adjacent beach profile locations are shown on figure B-1. Little or no movement of material is currently taking place in the Pablo Creek marsh area. Many sand spits, located in Ft. George River, could provide beach fill for those beaches located north of St. Johns River if ever needed. Core boring number "Ft. George CB-1," shown on figure B-2, is located on the edge of one of these spits. Those spits and bars are the result of stream detritus and are constantly changing in location and pattern due to variations in currents and tidal action.

5. Summary.--Very large quantities of sand, similar to present beach sands, are available in the Pablo Creek marsh and in the Ft. George River areas. Available data indicate that an ample supply of sand suitable for beach fill can be obtained for project purposes. Closely spaced borings and probings would be required to better define the limits of unsuitable material. Stripping of about 6 feet would be required to remove unsuitable material in the probable borrow areas along Pablo Creek. From the investigation performed, suitable material extends to a depth at approximately 40 feet below the soft material.

TABLE B-3

Grain-size analysis
(Probable borrow areas and adjacent beach samples)

Hole No.	Sample No.	Median diameter (mm.)	Profile No.	Median diameter (mm.)
Pablo CB-8				
	1A	0.14	14	0.19
	2A	0.30		0.18
	3A	0.17		0.16
	4A	0.14		0.20
	5A	0.09		0.21
	6A	0.10		0.13
	8A	0.25		0.16
	9A	0.18		
	10A	0.17		
	11A	0.22		
Pablo CB-9				
	1A	0.16		
	2A	0.17		
	5A	0.12		
	7A	0.17		
	8A	0.13		
	9A	0.71		
	10A	3.25 (shell)		
	11A	0.16		
	12A	0.80		
Pablo CB-10				
	5	0.23	8	0.17
	8	0.09		0.17
	9	0.13		0.17
	10	2.70		0.15
	11	0.30		0.15
	12	0.32		0.17
	13	0.36		0.17
				0.10

(Continued)

TABLE B-3--Continued

Hole No.	Sample No.	Median diameter (mm.)	Profile No.	Median diameter (mm.)
Pablo CB-12				
	2	0.15		
	3	0.14		
	4	0.16		
	5	0.20		
	6	0.21		
	7	0.09		
	8	0.13		
	9	0.24		
	10	0.40		
	11	0.25		
Pablo CB-13				
	2	0.16	11	0.16
	3	0.16		0.24
	4	0.16		0.18
	5	0.17		0.13
	6	0.09		0.12
	7	0.23		0.09
	8	0.90		0.09
	9	0.40		
	10	0.31		
	11	0.30		

6. Surface sand samples.--Fifty-two sand samples were obtained from the dune, the back shore, the foreshore, and at -3, -6, -12, -18, and -30 feet, mean low water, on five representative profiles. Sand samples were taken at -18, -30, -40, and at -18, -30, -38 feet, mean low water, on profiles 5 and 6 respectively, which are adjacent to the north and south jetties of St. Johns River. Median diameters of the samples obtained ranged from 0.01 to 2.10 millimeters. Average median diameter of samples along the back shore ranged from 0.12 to 0.50 millimeters; average median diameter of samples collected along the foreshore ranged from 0.16 to 0.66 millimeters; average median diameter at -18 was 0.10. Results of mechanical analysis of the samples are given in table B-4. Gradation curves for all samples are on file in the office of the District Engineer.

TABLE B-4

Grain size of surface sand samples collected on beach profiles

Location of sample on profile	Median sand diameter in millimeters (including shell)							Average all profiles
	Profiles							
	2	5	6	8	11	14	18	
Dune	0.15	-	-	0.17	-	-	0.26	0.19
Do.	0.13	-	-	0.17	-	-	-	0.20
Back shore	0.12	-	-	0.17	0.16	0.19	0.50	0.27
Do.	0.16	-	-	0.15	-	0.18	0.17	0.17
Foreshore	0.16	-	-	0.16	0.24	0.16	0.66	0.28
Do.	0.17	-	-	0.17	-	0.20	-	0.18
Elevation -3	0.28	-	-	0.17	0.18	0.21	1.80	0.53
Do. -6	0.18	-	-	0.10	0.14	0.14	0.16	0.14
Do. -12	0.13	-	-	0.01	0.13	0.16	0.14	0.11
Do. -18	0.10	0.10	0.16	0.08	0.09	0.09	0.11	0.10
Do. -30	-	0.14	0.85	0.09	0.09	0.10	2.10	0.56
Do. -38	-	-	0.13	-	-	-	-	0.13
Do. -40	-	0.08	-	-	-	-	-	0.08

DEPARTMENT OF THE ARMY
DIVISION: Corps of Engineers
INSTALLATION: Jacksonville, Florida

DRILLING LOG

1. PROJECT: Jax Beach Fill
SHEET 1 OF 1
2. LOCATION (Coordinates or Station)
3. DRILLING AGENCY: Corps of Engineers
4. HOLE NO. (As shown on drawing title and file no.): CB-1 Ft. George
5. NAME OF DRILLER: W. D. Roppel
6. DIRECTION OF HOLE: ☑ VERTICAL ☐ INCLINED; DEGREES WITH VERTICAL:
7. THICKNESS OF OVERBURDEN:
8. DEPTH DRILLED INTO ROCK:
9. TOTAL DEPTH OF HOLE: 25'
10. SIZE AND TYPE OF BIT: See remarks
11. DATUM FOR ELEVATION SHOWN (TBM or MSL):
12. MANUFACTURER'S DESIGNATION OF DRILL: Sprague & Henwood 40C
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED; UNDISTURBED
14. TOTAL NO. CORE BOXES: 1
15. ELEV. GROUND WATER:
16. DATE HOLE: STARTED 2/11/64; COMPLETED 2/11/64
17. ELEV. TOP OF HOLE:
18. TOTAL CORE RECOVERY FOR BORING (%): 100
19. [illegible] Geologist: C. F. Dreves, Jr.

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (drilling time, water loss, depth of weathering, etc., if significant)
	0.0					Bit & Barrel Bls/Ft
			SAND, fine quartz and medium shell fragments, light gray (SP)	100	1	2" I.D. Spoon Bailed, 3, 6, 10
	6.0					
			SAND, fine, quartz, shelly (SP)	100	2	" " Bailed, 6, 12, 18
	10.0					
			SAND, fine, quartz, very silty, very shelly, dark gray (SM)	100	3	" " Bailed, 6, 3, 2
				100	4	" " Bailed, 3, 4, 5
				100	5	" " Bailed, 3, 3, 4
	25.0					
			Hole drilled in 5' of water at low tide next to a sand spit which is at least 5' out of the water at low tide			300# Hammer w/18" Drop Used on 2" I.D. Spoon

HOLE NO. Pablo CB-1

DEPARTMENT OF THE ARMY
DIVISION Corps of Engineers
INSTALLATION Jacksonville, Florida

DRILLING LOG

1. PROJECT: Jax Beach Emergency Fill — SHEET 1 OF 1
2. LOCATION (Coordinates or Station):
3. DRILLING AGENCY: Corps of Engineers
4. HOLE NO. (As shown on drawing title and file no.): Pablo CB-1
5. NAME OF DRILLER: Doyle L. Loadholtz
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED; DEGREES WITH VERTICAL:
7. THICKNESS OF OVERBURDEN:
8. DEPTH DRILLED INTO ROCK:
9. TOTAL DEPTH OF HOLE: 36.0'
10. SIZE AND TYPE OF BIT: 2" I.D. Spoon see remarks
11. DATUM FOR ELEVATION SHOWN (TBM or MSL):
12. MANUFACTURER'S DESIGNATION OF DRILL: Sprague & Henwood 40C
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED: UNDISTURBED:
14. TOTAL NO. CORE BOXES: None
15. ELEV. GROUND WATER: Tidal
16. DATE HOLE: STARTED 1/10/63; COMPLETED 1/10/63
17. ELEV. TOP OF HOLE:
18. TOTAL CORE RECOVERY FOR BORING (%): 29
19. [redacted] Geologist: C. F. Dreves Jr.

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (drilling time, water loss, depth of weathering, etc., if significant)
						Bit & Barrel Bls/Ft
	0.0					
			SILT, black, lenses of brown peat (OH)	50	1	2" I.D. Spoon Pushed
				40	2	Pushed " "
	11.0		PEAT, brown to black, lenses of organic silt (PT)	20	3	Settled " "
				20	*	" " Settled
				20	*	" " Settled
	27.0		CLAY, gray, soft (CH)	20	*	Pushed " "
	36.0					
			*Discarded Samples			300# Hammer w/18" Drop Used on 2" I.D. Spoon

HOLE NO. Pablo CB-2

DEPARTMENT OF THE ARMY
DIVISION Corps of Engineers
INSTALLATION Jacksonville, Florida

DRILLING LOG

1. PROJECT: Jax Beach Emergency Fill — SHEET 1 OF 1
2. LOCATION (Coordinates or Station):
3. DRILLING AGENCY: Corps of Engineers
4. HOLE NO. (As shown on drawing title and file no.): Pablo CB-2
5. NAME OF DRILLER: Doyle L. Loadholtz
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED; DEGREES WITH VERTICAL:
7. THICKNESS OF OVERBURDEN:
8. DEPTH DRILLED INTO ROCK:
9. TOTAL DEPTH OF HOLE: 31.0
10. SIZE AND TYPE OF BIT: 2" I.D. Spoon see remarks
11. DATUM FOR ELEVATION SHOWN (TBM or MSL):
12. MANUFACTURER'S DESIGNATION OF DRILL: Sprague & Henwood 40C
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED; UNDISTURBED
14. TOTAL NO. CORE BOXES: None
15. ELEV. GROUND WATER: Tidal
16. DATE HOLE: STARTED 1/10/63; COMPLETED 1/10/63
17. ELEV. TOP OF HOLE:
18. TOTAL CORE RECOVERY FOR BORING (%): 68
19. ~~INSPECTOR~~ Geologist: C. F. Dreves, Jr.

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (drilling time, water loss, depth of weathering, etc., if significant)	Bls/Ft
	0.0					Bit & Barrel	
	3.0		SILT, black, lenses of peat (OL)			2" I.D. Spoon	Pushed
			SAND, gray, fine, quartz, slight organic stain (SP)	50	1		2
					2		5 6
			Clean below depth of 8.0'	40	3	" "	1 3 3 5 6
				80	4	" "	1 3 3 6 14
				80	5	" "	3 7 12 13 15
				80	6	" "	1 3 5 7 16
				80	7	" "	3 7 12 13 16
	31.0						
						300# Hammer w/18" Drop Used on 2" I.D. Spoon	

ENG FORM 1836 1 MAR 61 (EM 1110-1-1801) TRANSLUCENT — PREVIOUS EDITION MAY BE USED UNTIL EXHAUSTED.

PROJECT Jax Beach Emergency Fill — HOLE NO. Pablo CB-2

HOLE NO. Pablo CB-3

DEPARTMENT OF THE ARMY
DIVISION Corps of Engineers
INSTALLATION Jacksonville, Florida

DRILLING LOG

1. PROJECT: Jax Beach Emergency Fill — SHEET 1 OF 1
2. LOCATION (Coordinates or Station):
3. DRILLING AGENCY: Corps of Engineers
4. HOLE NO. (As shown on drawing title and file no.): Pablo CB-3
5. NAME OF DRILLER: Doyle L. Loadholtz
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED; DEGREES WITH VERTICAL:
7. THICKNESS OF OVERBURDEN:
8. DEPTH DRILLED INTO ROCK:
9. TOTAL DEPTH OF HOLE: 30.0'
10. SIZE AND TYPE OF BIT: 2" I.D. Spoon see remarks
11. DATUM FOR ELEVATION SHOWN (TBM or MSL):
12. MANUFACTURER'S DESIGNATION OF DRILL: Sprague & Henwood 40C
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED: UNDISTURBED:
14. TOTAL NO. CORE BOXES: None
15. ELEV. GROUND WATER: Tidal
16. DATE HOLE: STARTED 1/11/63 COMPLETED 1/11/63
17. ELEV. TOP OF HOLE:
18. TOTAL CORE RECOVERY FOR BORING (%): 46
19. Geologist: C. F. Dreves Jr.

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (drilling time, water loss, depth of weathering, etc., if significant)	Blows/Ft
						Bit & Barrel	
	0.0						
		~~	MUCK, black, silty (PT)		1	Pushed	
	2.0	~~~				2" I.D. Spoon	1
				66			3
			SAND, fine quartz, light gray, slightly organic stain (SP)		2		5
							6
			Clean below depth 7.0'			" "	3
							5
				40	3		6
							9
							12
						" "	3
							6
				50	4		10
							10
							13
							5
				40	5	" "	13
							9
							7
							9
				40	6	" "	3
							7
							8
							5
							8
			Becomes yellow below depth 28.0'				1
				40	7	" "	3
							3
							2
	30.0						5
						300# Hammer w/18" Drop Used on 2" I.D. Spoon	

ENG FORM 1836 1 MAR 61 (EM 1110-1-1801) TRANSLUCENT PREVIOUS EDITION MAY BE USED UNTIL EXHAUSTED.

PROJECT Jax Beach Emergency Fill HOLE NO. Pablo CB-3

HOLE NO. Pablo CB-4

DEPARTMENT OF THE ARMY
DIVISION Corps of Engineers
INSTALLATION Jacksonville, Florida

DRILLING LOG

1. PROJECT: Jax Beach Emergency Fill
SHEET 1 OF 1
2. LOCATION (Coordinates or Station)
3. DRILLING AGENCY: Corps of Engineers
4. HOLE NO. (As shown on drawing title and file No.): Pablo CB-4
5. NAME OF DRILLER: Doyle L. Loadholtz
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED; DEGREES WITH VERTICAL
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE: 30.0
10. SIZE AND TYPE OF BIT: 2" I.D. Spoon see remarks
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
12. MANUFACTURER'S DESIGNATION OF DRILL: Sprague & Henwood 40C
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED; UNDISTURBED
14. TOTAL NO. CORE BOXES: None
15. ELEV. GROUND WATER: Tidal
16. DATE HOLE: STARTED 1/11/63; COMPLETED 1/11/63
17. ELEV. TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING (%): 52
19. [redacted] Geologist: C. F. Dreves, Jr.

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)	Blo/Ft
						Bit & Barrel	
	0.0						
	2.5		MUCK, black, silty (PT)				Pushed
			SAND, fine quartz, light gray (SP)	70	1	2" I.D. Spoon	4
					2		3
							6
							7
			organic stained depth 2.5 to 5.0				3
				40	3	" "	5
							5
							4
							4
						" "	1
				50	4		2
							4
							9
							10
						" "	6
				50	5		11
							12
							14
							15
						" "	2
				40	6		3
							7
							8
							9
			Fine to medium below depth 25.0			" "	3
				60	7		3
							5
							5
	30.0						7
						300# Hammer w/18" Drop Used on 2" I.D. Spoon	

ENG FORM 1836 1 MAR 61 (EM 1110-1-1801) TRANSLUCENT PREVIOUS EDITION MAY BE USED UNTIL EXHAUSTED.

PROJECT Jax Beach Emergency Fill HOLE NO. Pablo CB4

HOLE NO. CB-Pablo-5

DEPARTMENT OF THE ARMY
DIVISION Corps of Engineers
INSTALLATION Jacksonville, Florida

DRILLING LOG

1. PROJECT: Jax Beach Fill — SHEET 1 OF 1
2. LOCATION (Coordinates or Station):
3. DRILLING AGENCY: Corps of Engineers
4. HOLE NO. (As shown on drawing title and file no.): CB-Pablo-5
5. NAME OF DRILLER: W. D. Roppel
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED; DEGREES WITH VERTICAL:
7. THICKNESS OF OVER-BURDEN:
8. DEPTH DRILLED INTO ROCK:
9. TOTAL DEPTH OF HOLE: 31.8'
10. SIZE AND TYPE OF BIT: See remarks
11. DATUM FOR ELEVATION SHOWN (TBM or MSL):
12. MANUFACTURER'S DESIGNATION OF DRILL: Sprague & Henwood 40C
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED; UNDISTURBED
14. TOTAL NO. CORE BOXES: 1/2
15. ELEV. GROUND WATER: Tidal
16. DATE HOLE: STARTED 1/27/64; COMPLETED 1/27/64
17. ELEV. TOP OF HOLE:
18. TOTAL CORE RECOVERY FOR BORING (%): 96
19. [illegible] Geologist: Robert R. Thompson

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (drilling time, water loss, depth of weathering, etc., if significant)
						Bit & Barrel — Bls/Ft
	0.0		PEAT, silty, dark brown (PT)	100	1	2" I.D. Spoon — Pushed
					1A	Pushed
	3.4		SILT, very organic, dark brown (OL)	100	2	" "
					2A	Pushed
			0.4' layer of clean sand from 9.4 to 9.8	88	3	" " — Pushed; 2; 3; 2
	11.5		SAND, very fine quartz, very clayey, very silty, very organic, dark brown (SC-SM)	100	4	" " — Pushed
					4A	
	17.1		CLAY, slightly organic gray (CL)	100	5	" " — Pushed
					5A	
				100	6	" " — Pushed; 1; 3
	26.6		SAND, fine to medium quartz, gray (SP)	84		" " — 3; 12; 8; 8; 8
					7	
	31.8				7A	

300# Hammer w/18" Drop
Used on 2" I.D. Spoon

ENG FORM 1836 1 MAR 61 (EM 1110-1-1801) TRANSLUCENT — PREVIOUS EDITION MAY BE USED UNTIL EXHAUSTED.

PROJECT Jax Beach Fill — HOLE NO. CB-Pablo-5

HOLE NO. CB-Pablo-6

DEPARTMENT OF THE ARMY
DIVISION Corps of Engineers
INSTALLATION Jacksonville, Florida

DRILLING LOG

1. PROJECT: Jax Beach Fill
SHEET 1 OF 2
2. LOCATION (Coordinates or Station)
3. DRILLING AGENCY: Corps of Engineers
4. HOLE NO. (As shown on drawing title and file no.): CB-Pablo-6
5. NAME OF DRILLER: W. D. Roppel
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED; DEGREES WITH VERTICAL
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE: 48.5'
10. SIZE AND TYPE OF BIT: See remarks
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
12. MANUFACTURER'S DESIGNATION OF DRILL: Sprague & Henwood 40C
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED; UNDISTURBED
14. TOTAL NO. CORE BOXES: 1/2
15. ELEV. GROUND WATER: Tidal
16. DATE HOLE: STARTED 1/28/64; COMPLETED 1/28/64
17. ELEV. TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING (%): 86
19. ~~SIGNATURE OF INSPECTOR~~ Geologist: Robert R. Thompson

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (drilling time, water loss, depth of weathering, etc., if significant)	Bls/Ft
						Bit & Barrel	Bls/Ft
	0.0						
			SAND, fine quartz, silty, very organic, dark brown (SM) Upper 0.6' is peat	100	1	2" I.D. Spoon	Pushed
					1A		3
	3.9		SAND, fine to medium, clayey gray (SC)				2
						" "	7
				26	1B		5
							7
	8.5						8
			SAND, fine quartz, slightly silty, light gray (SP)				3
					2		7
				100	2A	" "	7
							9
							11
							4
							8
				44	3	" "	8
							10
							12
							3
							6
				40	4	" "	5
	22.0						5
			SAND, fine to medium, very clayey yellow (SC)				3
							3
	25.5				5		3
			CLAY, sandy, gray (CL)				4
				100	5A	" "	4
	28.1				6		5
					6A		3
			SAND, fine to medium, very silty, dark gray (SM)				3
				100	7A	" "	4
	33.3						4
							3
			CLAY, very sandy, dark gray (CL)				1
					8	" "	1
	36.1			100			1
			SAND, medium quartz, very clayey, silty, light gray, (SC)		9		1
					9A		5

HOLE NO. CB-Pablo-6

DEPARTMENT OF THE ARMY
DIVISION Corps of Engineers
INSTALLATION Jacksonville, Florida

DRILLING LOG

1. PROJECT: Jax Beach Fill — SHEET 2 OF 2
2. LOCATION (Coordinates or Station)
3. DRILLING AGENCY
4. HOLE NO. (As shown on drawing title and file No.)
5. NAME OF DRILLER
6. DIRECTION OF HOLE: ☐ VERTICAL ☐ INCLINED; DEGREES WITH VERTICAL
7. THICKNESS OF OVER-BURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE
10. SIZE AND TYPE OF BIT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
12. MANUFACTURER'S DESIGNATION OF DRILL
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED; UNDISTURBED
14. TOTAL NO. CORE BOXES
15. ELEV. GROUND WATER
16. DATE HOLE: STARTED; COMPLETED
17. ELEV. TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING (%)
19. SIGNATURE OF INSPECTOR

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (drilling time, water loss, depth of weathering, etc., if significant)	Bls/Ft
						Bit & Barrel	Bls/Ft
	39.6						3
			SAND, medium quartz, slightly shelly, few partly consolidated zones, light gray (SP)	100	10 10A	2" I.D. Spoon	4 6 7
	43.2		SAND, medium quartz, clayey, silty, dark greenish gray (SC)				7 8 10
				98	11 11A	" "	12 30
	48.5						36
						300# Hammer w/18" Drop Used on 2" I.D. Spoon	

ENG FORM 1836 1 MAR 61 (EM 1110-1-1801) TRANSLUCENT — PREVIOUS EDITION MAY BE USED UNTIL EXHAUSTED.

PROJECT Jax Beach Fill HOLE NO. CB-Pablo-6

8

HOLE NO. CB-Pablo-7

DEPARTMENT OF THE ARMY
DIVISION: Corps of Engineers
INSTALLATION: Jacksonville, Florida

DRILLING LOG

1. PROJECT: Jax Beach Fill
SHEET 1 OF 1
2. LOCATION (Coordinates or Station)
3. DRILLING AGENCY: Corps of Engineers
4. HOLE NO. (As shown on drawing title and file no.): CB-Pablo-7
5. NAME OF DRILLER: W. D. Roppel
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED; DEGREES WITH VERTICAL:
7. THICKNESS OF OVERBURDEN:
8. DEPTH DRILLED INTO ROCK:
9. TOTAL DEPTH OF HOLE: 41.0'
10. SIZE AND TYPE OF BIT: See remarks
11. DATUM FOR ELEVATION SHOWN (TBM or MSL):
12. MANUFACTURER'S DESIGNATION OF DRILL: Sprague & Henwood 40C
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED; UNDISTURBED:
14. TOTAL NO. CORE BOXES: 1/2
15. ELEV. GROUND WATER: Tidal
16. DATE HOLE: STARTED 1/30/64; COMPLETED 1/30/64
17. ELEV. TOP OF HOLE:
18. TOTAL CORE RECOVERY FOR BORING (%): 89
19. Geologist: Robert R. Thompson

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (drilling time, water loss, depth of weathering, etc., if significant)	Bls/Ft
						Bit & Barrel	Bls/Ft
	0.0						
	2.0		SILT, very organic, dark brown (OL)	100	1	2" I.D. Spoon	Pushed
			SAND, fine to very fine, slightly silty, tan (SP)		2	" "	2
				100	2A		3
							5
			light gray below 5.0				8
							7
							9
					3	" "	13
				100	3A		15
			clean below 11.0				18
							4
							7
				86	4	" "	8
							9
							6
							4
							6
				88	5	" "	7
							8
	21.0						11
			SAND, Fine to very fine, quartz, very silty, dary gray (SM)		6	" "	2
				82	6A		2
							3
	25.6						4
							3
			SHELL, very silty, clayey, loose, gray		7	" "	1/2
					7A		1/2
	29.3			80			1
			SILT, very clayey, gray (ML)		8		1
					8A		9
	31.9						1
			CLAY, very silty, shelly in layers, gray (CL)				2
				78	9	" "	3
							5
	36.6						4
			SHELL, very silty, clayey, slightly sandy, greenish gray				2
							3
				100	10	" "	4
					10A		14
	41.0						13
						300# Hammer w/18" Drop Used on 2" I.D. Spoon	

HOLE NO. CB-Pablo-8

DEPARTMENT OF THE ARMY
DIVISION Corps of Engineers
INSTALLATION Jacksonville, Florida

DRILLING LOG

1. PROJECT: Jax Beach Fill
SHEET 1 OF 1
2. LOCATION (Coordinates or Station)
3. DRILLING AGENCY: Corps of Engineers
4. HOLE NO. (As shown on drawing title and file No.): CB-Pablo-8
5. NAME OF DRILLER: W. D. Roppel
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED; DEGREES WITH VERTICAL
7. THICKNESS OF OVER-BURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE: 41'
10. SIZE AND TYPE OF BIT: See remarks
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
12. MANUFACTURER'S DESIGNATION OF DRILL: Sprague & Henwood 40C
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED; UNDISTURBED
14. TOTAL NO. CORE BOXES: 1/2
15. ELEV. GROUND WATER: Tidal
16. DATE HOLE: STARTED 1/31/64; COMPLETED 1/31/64
17. ELEV. TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING (%): 84
19. Geologist: Robert R. Thompson

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)	Bls/Ft
						Bit & Barrel	Bls/Ft
	0.0						
			SAND, fine quartz, organic stained, slightly silty, brown (SP)		1	2" I.D. Spoon	Pushed
			Very silty below 4.8	24	1A		2
							7
							6
							3
							5
					2	" "	7
				68	2A		12
							14
							16
			White and clean below 9.8				4
							8
					3	" "	11
				62	3A		14
							16
							Jetted
					4	" "	↓
				82	4A		5
							9
							9
	20.6						
			SAND, fine to medium, quartz, very silty, dark gray SM				Jetted
					5		↓
				100	5A	" "	2
	23.8				6		2
			SILT, very sandy, dark gray (ML)		6A		3
							Jetted
					7	" "	↓
	27.5			82	8		2
			SAND, fine to medium quartz, slightly shelly, clayey (SP)		8A		8
							12
							Jetted
					9	" "	↓
					9A		4
			Very shelly at 33.0	100	10		8
					10A		18
							Jetted
			Clean below 34.8			" "	20
				100	11		50
					11A		38
	39.8						29
	41.0		LIMESTONE, hard, fossiliferous gray	100		" "	175

300# Hammer w/18" Drop
Used on 2" I.D. Spoon

HOLE NO. CB-Pablo-9

DEPARTMENT OF THE ARMY
DIVISION Corps of Engineers
INSTALLATION Jacksonville, Florida

DRILLING LOG

1. PROJECT: Jax Beach Fill — SHEET 1 OF 1
2. LOCATION (Coordinates or Station):
3. DRILLING AGENCY: Corps of Engineers
4. HOLE NO. (As shown on drawing title and file No.): CB-Pablo-9
5. NAME OF DRILLER: W. D. Roppel
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED; DEGREES WITH VERTICAL:
7. THICKNESS OF OVERBURDEN:
8. DEPTH DRILLED INTO ROCK:
9. TOTAL DEPTH OF HOLE: 46.2
10. SIZE AND TYPE OF BIT: See remarks
11. DATUM FOR ELEVATION SHOWN (TBM or MSL):
12. MANUFACTURER'S DESIGNATION OF DRILL: Sprague & Henwood 40C
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED / UNDISTURBED
14. TOTAL NO. CORE BOXES: 1
15. ELEV. GROUND WATER: Tidal
16. DATE HOLE: STARTED 2/3/64 COMPLETED 2/3/64
17. ELEV. TOP OF HOLE:
18. TOTAL CORE RECOVERY FOR BORING (%): 94
19. [illegible] Geologist: Robert R. Thompson

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (drilling time, water loss, depth of weathering, etc., if significant)	Bls/Ft
						Bit & Barrel	Bls/Ft
	0.0						
			SAND, fine quartz, slightly organic, tan (SP)	100	1	2" I.D. Spoon	4
					1A		6
							8
							8
							11
			White and clean below 5.0'	100	2	" "	Settled
					2A		6
							8
							10
							12
				100	3	" "	Settled
							8
							16
							14
							15
				78	4	" "	Jetted
							7
							8
							10
	20.6						10
			SAND, very silty, fine quartz, dark gray (SM)	100	5	" "	Settled
							4
					5A		5
							5
				84	6	" "	Pushed
							1
							1
	28.4				7		10
			SAND, fine to medium quartz, slightly shelly, very slightly silty, gray (SP)		7A		17
					8		Jetted
					8A		7
				86			5
	33.7				9	" "	6
			SHELL, very sandy, silty, gray No silt or sand below 35.4		9A		9
							7
					10	" "	20
				92	10A		28
	38.4						
			SAND, fine quartz, slightly silty, very slightly shelly, gray (SP)		11		46
					11A		57
	41.0						8
			SHELL, fine very slightly sandy, gray	100	12	" "	11
							12
			Bottom 0.3' hard limestone		12A		20
							38
	46.2			100	13		102
						300# Hammer w/18" Drop Used on 2" I.D. Spoon	

HOLE NO. Pablo CB-9A

DEPARTMENT OF THE ARMY
DIVISION Corps of Engineers
INSTALLATION Jacksonville, Florida

DRILLING LOG

1. PROJECT: Jax Beach Fill — SHEET 1 OF 1
2. LOCATION (Coordinates or Station):
3. DRILLING AGENCY: Corps of Engineers
4. HOLE NO. (As shown on drawing title and file no.): CB-9A Pablo
5. NAME OF DRILLER: W. D. Roppel
6. DIRECTION OF HOLE: ☑ VERTICAL ☐ INCLINED; DEGREES WITH VERTICAL:
7. THICKNESS OF OVERBURDEN:
8. DEPTH DRILLED INTO ROCK:
9. TOTAL DEPTH OF HOLE:
10. SIZE AND TYPE OF BIT: See remarks
11. DATUM FOR ELEVATION SHOWN (TBM or MSL):
12. MANUFACTURER'S DESIGNATION OF DRILL: Sprague & Henwood 40C
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED; UNDISTURBED:
14. TOTAL NO. CORE BOXES: 1/2
15. ELEV. GROUND WATER:
16. DATE HOLE: STARTED 2/4/64; COMPLETED 2/4/64
17. ELEV. TOP OF HOLE:
18. TOTAL CORE RECOVERY FOR BORING (%): 74
19. SIGNATURE OF INSPECTOR: C. R. Dreves Jr. Geologist

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (description)	% CORE RECOVERY	SAMPLE NO.	REMARKS (drilling time, water loss, depth of weathering, etc., if significant)
	0.0					Bit & Barrel — Bls/Ft
	2.0		SILT, organic, black (OL)	50	1	2" I.D. Spoon — Pushed
			SAND, very silty, organic stained, quartz, black (SM)		2	1, 2, 3
			Becomes gray below 5.0'	60	3	" " — Pushed; 1, 2
	15.0			60	4	" " — Pushed; 1, 2, 3
			CLAY, gray (CH)	100	5	" " — Pushed
	25.0			100	6	" " — Pushed
			Drilled in 3.0' of water at low tide			300# Hammer w/18" Drop Used on 2" I.D. Spoon

HOLE NO. Pablo CB-10

DEPARTMENT OF THE ARMY
DIVISION Corps of Engineers
INSTALLATION Jacksonville, Florida

DRILLING LOG

1. PROJECT: Jax Beach Fill
SHEET 1 OF 2
2. LOCATION (Coordinates or Station)
3. DRILLING AGENCY: Corps of Engineers
4. HOLE NO. (As shown on drawing title and file no.): CB-10 Pablo
5. NAME OF DRILLER: W. D. Roppel
6. DIRECTION OF HOLE: ☑ VERTICAL ☐ INCLINED; DEGREES WITH VERTICAL
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE: 51'
10. SIZE AND TYPE OF BIT: See remarks
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
12. MANUFACTURER'S DESIGNATION OF DRILL: Sprague & Henwood 40C
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED; UNDISTURBED
14. TOTAL NO. CORE BOXES: 1/2
15. ELEV. GROUND WATER
16. DATE HOLE: STARTED 2/4/64; COMPLETED 2/4/64
17. ELEV. TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING (%): 92
19. SIGNATURE OF INSPECTOR: Geologist
C. F. Dreves, Jr.

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
	0.0					Bit & Barrel Bls/Ft
	2.0		SILT, black, organic (OL) very sandy	60	1	2" I.D. Spoon Pushed
	9.0		SILT, dark gray to black, organic (OH) leanses of peat		2	
				100	3	" " Pushed
					4	3
	21.0		SAND, fine, quartz, gray, slightly silty (SP)	100	5	" " Bailed 1 2 3
				100	6	" " Bailed
	23.5		SILT, gray, slight organic (ML)	100	7	" " Bailed 2 3
	27.0		SAND, fine, gray, quartz, clayey (SC)		8	6
	30.0		SAND, fine, quartz, very shelly (SP)	100	9	" " Bailed 3 6 9 12
	36.5		SAND, and BROKEN SHELL (dime size), gray	100	10	" " 9 30 9 11 18
			SAND, fine, quartz, gray, very clayey (SC) organic stains	100	11	" " Bailed 9 14 27

HOLE NO. CB-10 Pablo

DEPARTMENT OF THE ARMY
DIVISION Corps of Engineers
INSTALLATION Jacksonville, Florida

DRILLING LOG

1. PROJECT: Jax Beach Fill — SHEET 2 OF 2
2. LOCATION (Coordinates or Station)
3. DRILLING AGENCY
4. HOLE NO. (As shown on drawing title and file no.)
5. NAME OF DRILLER
6. DIRECTION OF HOLE: ☐ VERTICAL ☐ INCLINED — DEGREES WITH VERTICAL
7. THICKNESS OF OVER-BURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE
10. SIZE AND TYPE OF BIT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
12. MANUFACTURER'S DESIGNATION OF DRILL
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED / UNDISTURBED
14. TOTAL NO. CORE BOXES
15. ELEV. GROUND WATER
16. DATE HOLE: STARTED / COMPLETED
17. ELEV. TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING (%)
19. SIGNATURE OF INSPECTOR

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (drilling time, water loss, depth of weathering, etc., if significant)
						Bit & Barrel Bls/Ft
	42.0					Bailed
			SAND, fine, quartz, gray to black, slightly silty, organic stains (SM)	100	12	2" I.D. Spoon ↓ 16 / 33
	49.0		SILT, calcareous, light gray lenses of limestone, phosphate pebbles (ML)	60	13	Bailed " " 14 / 21
	51.0					42 / 60
			Drilled in 5.0' of water at low tide			300# Hammer w/18" Drop Used on 2" I.D. Spoon

HOLE NO. CB-11 Pablo

DEPARTMENT OF THE ARMY
DIVISION Corps of Engineers
INSTALLATION Jacksonville, Florida

DRILLING LOG

1. PROJECT: Jax Beach Fill	SHEET 1 OF 1
2. LOCATION (Coordinates or Station):	
3. DRILLING AGENCY: Corps of Engineers	
4. HOLE NO. (As shown on drawing title and file no.): CB-11 Pablo	5. NAME OF DRILLER: Wilbert D. Roppel
6. DIRECTION OF HOLE: ☑ VERTICAL ☐ INCLINED; DEGREES WITH VERTICAL	7. THICKNESS OF OVERBURDEN; 8. DEPTH DRILLED INTO ROCK; 9. TOTAL DEPTH OF HOLE: 32.5'
10. SIZE AND TYPE OF BIT: See remarks	11. DATUM FOR ELEVATION SHOWN (TBM or MSL); 12. MANUFACTURER'S DESIGNATION OF DRILL: Sprague & Henwood 40C
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED; UNDISTURBED	14. TOTAL NO. CORE BOXES: 0; 15. ELEV. GROUND WATER; 16. DATE HOLE: STARTED 2/5/64, COMPLETED 2/5/64
17. ELEV. TOP OF HOLE	18. TOTAL CORE RECOVERY FOR BORING (%): 56; 19. SIGNATURE OF INSPECTOR: Charles F. Dreves, Jr., Geologist

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (drilling time, water loss, depth of weathering, etc., if significant)
	0.0					Bit & Barrel Bls/Ft
	7.5		SILT, gray, to brown, organic (OL) thin lenses of peat	50	DISCARDED SAMPLES	2" I.D. Spoon Pushed
	9.5		SAND, gray, very silty, shelly (SM)			3 / 1
			CLAY, gray, thin lenses of organic material (CH)	80		" " Pushed
				50		Pushed; " "
	30.5			50		Pushed
	32.5		SAND, gray, very clayey, slightly shelly (SC)			1 / 3
			Drilled in 2.0' of water at about mid tide.			300# Hammer w/18" Drop Used on 2" I.D. Spoon

ENG FORM 1836 1 MAR 61 (EM 1110-1-1801) TRANSLUCENT PREVIOUS EDITION MAY BE USED UNTIL EXHAUSTED.

PROJECT Jax Beach Fill HOLE NO. Pablo CB-11

HOLE NO. Pablo-CB-12

DEPARTMENT OF THE ARMY
DIVISION Corps of Engineers
INSTALLATION Jacksonville, Florida

DRILLING LOG

1. PROJECT: Jax Beach Fill
SHEET 1 OF 2
2. LOCATION (Coordinates or Station)
3. DRILLING AGENCY: Corps of Engineers
4. HOLE NO. (As shown on drawing title and file no.): CB-12 Pablo
5. NAME OF DRILLER: Wilbert D. Roppel
6. DIRECTION OF HOLE: ☑ VERTICAL ☐ INCLINED; DEGREES FROM VERTICAL
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE: 53'
10. SIZE AND TYPE OF BIT: See remarks
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
12. MANUFACTURER'S DESIGNATION OF DRILL: Sprague & Henwood 40C
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED; UNDISTURBED
14. TOTAL NO. CORE BOXES: 1/2
15. ELEV. GROUND WATER
16. DATE HOLE: STARTED 2/6/64; COMPLETED 2/6/64
17. ELEV. TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING (%): 90
19. SIGNATURE OF INSPECTOR: Geologist
Charles F. Dreves, Jr.

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
						Bit & Barrel — Bls/Ft
	0.0					
			PEAT, brown to black, fibrous (PT)	40	1	Pushed; 2" I.D. Spoon
	5.5					
			SAND, fine, quartz, light gray, slightly clayey (SP-SC)	50	2	Pushed; " " — 1, 3, 6, 9
	10.0					
			SAND, fine, quartz, light gray (SP)	100	3	Bailed; " " — 10, 16
			becomes dark gray and slightly silty below 19.0'	100	4	Bailed; " " — 9, 15
				100	5	Bailed; " " — 3, 7, 10
	28.0			100	6	Bailed; " " — 3, 7, 10
			SAND, very fine, quartz, dark gray, very clayey (SC)	100	7	Bailed; " " — 3, 5, 6
	37.5			100	8	Bailed; " " — 1, 3, 4
			SAND, fine to coarse, quartz, and broken shell, light gray, slightly silty (SP)	100	9	Bailed; " " — 3, 9, 10

DEPARTMENT OF THE ARMY
DIVISION Corps of Engineers
INSTALLATION Jacksonville, Florida

DRILLING LOG

1. PROJECT: Jax Beach Fill
SHEET 2 OF 2
2. LOCATION (Coordinates or Station)
3. DRILLING AGENCY
4. HOLE NO. (As shown on drawing title and file No.)
5. NAME OF DRILLER
6. DIRECTION OF HOLE: ☐ VERTICAL ☐ INCLINED; DEGREES WITH VERTICAL
7. THICKNESS OF OVER-BURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE
10. SIZE AND TYPE OF BIT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
12. MANUFACTURER'S DESIGNATION OF DRILL
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED; UNDISTURBED
14. TOTAL NO. CORE BOXES
15. ELEV. GROUND WATER
16. DATE HOLE: STARTED; COMPLETED
17. ELEV. TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING (%)
19. SIGNATURE OF INSPECTOR

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	SAMPLE NO.	REMARKS (drilling time, water loss, depth of weathering, etc., if significant)
						Bit & Barrel Bls/Ft
	44.0					Bailed
			SAND and SHELL, gray, very silty	100	10	2" I.D. Spoon 6
						10
						13
						14
						Bailed
			SILT, calcareous, light gray, lenses of limestone (ML)	100	11	" " 4
	52.5					6
	53.0					46
						300# Hammer w/18" Drop Used on 2" I.D. Spoon

DEPARTMENT OF THE ARMY
DIVISION Corps of Engineers
INSTALLATION Jacksonville, Florida

DRILLING LOG

1. PROJECT: Jax Beach Fill
SHEET 1 OF 2
2. LOCATION (Coordinates or Station)
3. DRILLING AGENCY: Corps of Engineers
4. HOLE NO. (As shown on drawing title and file No.): Pablo CB-13
5. NAME OF DRILLER: Wilbert D. Roppel
6. DIRECTION OF HOLE: ☑ VERTICAL ☐ INCLINED; DEGREES WITH VERTICAL
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE: 55'
10. SIZE AND TYPE OF BIT: See remarks
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
12. MANUFACTURER'S DESIGNATION OF DRILL: Sprague & Henwood 40C
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED; UNDISTURBED
14. TOTAL NO. CORE BOXES: 1/2
15. ELEV. GROUND WATER
16. DATE HOLE: STARTED 2/10/64; COMPLETED 2/10/74
17. ELEV. TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING (%): 90
19. Geologist: Charles F. Dreves, Jr.

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (drilling time, water loss, depth of weathering, etc., if significant)	Blows/Ft
	0.0					Bit & Barrel	
	4.7		PEAT, brown to black (PT) lenses of organic silt	40	1	2" I.D. Spoon	Pushed
	24.5		SAND, fine, quartz, slightly silty, black and organic stained above 10.0, light gray and verysslightly silty below 10.0 (SP)	100	2	" "	Bailed 5 7 7
				100	3	" "	Bailed 6 7 8
				100	4	" "	Bailed 7 16 24
				100	5	" "	Bailed 4 11 8
	30.5		SAND, very fine, quartz light green, slightly silty (SP-SM)	100	6	" "	Bailed 3 2 2
			SAND, fine, quartz, dark gray, slightly clayey (SP-SC)	100	7	" "	Bailed 4 7 10

HOLE NO. CB-13 Pablo

DEPARTMENT OF THE ARMY
DIVISION Corps of Engineers
INSTALLATION Jacksonville, Florida

DRILLING LOG

1. PROJECT: Jax Beach Fill
SHEET 2 OF 2
2. LOCATION (Coordinates or Station)
3. DRILLING AGENCY
4. HOLE NO. (As shown on drawing title and file no.)
5. NAME OF DRILLER
6. DIRECTION OF HOLE: ☐ VERTICAL ☐ INCLINED; DEGREES WITH VERTICAL
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE
10. SIZE AND TYPE OF BIT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
12. MANUFACTURER'S DESIGNATION OF DRILL
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED; UNDISTURBED
14. TOTAL NO. CORE BOXES
15. ELEV. GROUND WATER
16. DATE HOLE: STARTED; COMPLETED
17. ELEV. TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING (%)
19. SIGNATURE OF INSPECTOR

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)	Blows/Ft
						Bit & Barrel	Bls/Ft
	36.0						Bailed
			SAND, fine, light gray, fine quartz and shell fragments, very clayey (SC)	100	8	2" I.D. Spoon	3
							6
	40.3						8
			LIMESTONE, loosely cemented, very shelly, 50% unconsolidated	50	9	" "	5
	43.0						16
							16
			SAND, fine to medium, dark green, quartz, slightly clayey (SP-SC)				9
							7
							6
				100	10	" "	10
							27
							36
							55
							Bailed
				100	11	" "	6
							36
							54
	55.0						65
			"Drilled in 0.2' of water at low tide.			300# Hammer w/18" Drop Used on 2" I.D. Spoon	

ENG FORM 1836 1 MAR 61 (EM 1110-1-1801) TRANSLUCENT PREVIOUS EDITION MAY BE USED UNTIL EXHAUSTED.

PROJECT Jax Beach Fill HOLE NO. Pablo CB-13

HOLE NO. CB-Pablo-14

DEPARTMENT OF THE ARMY
DIVISION Corps of Engineers
INSTALLATION Jacksonville, Florida

DRILLING LOG

1. PROJECT: Duval Co. Beach Erosion Study — SHEET 1 OF 2
2. LOCATION (Coordinates or Station):
3. DRILLING AGENCY: Corps of Engineers
4. HOLE NO. (As shown on drawing title and file No.): CB-Pablo-14
5. NAME OF DRILLER: D. L. Loadholtz
6. DIRECTION OF HOLE: ☑ VERTICAL ☐ INCLINED; DEGREES WITH VERTICAL:
7. THICKNESS OF OVERBURDEN:
8. DEPTH DRILLED INTO ROCK:
9. TOTAL DEPTH OF HOLE: 60'
10. SIZE AND TYPE OF BIT: See remarks
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MSL
12. MANUFACTURER'S DESIGNATION OF DRILL: Sprague & Henwood 40C
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED; UNDISTURBED
14. TOTAL NO. CORE BOXES: 1
15. GROUND WATER DEPTH: 3.6
16. DATE HOLE: STARTED 3/26/64; COMPLETED 3/27/64
17. ELEV. TOP OF HOLE:
18. TOTAL CORE RECOVERY FOR BORING (%): 70
19. Joe S. Gentile Geologist

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (drilling time, water loss, depth of weathering, etc., if significant)	Bls/Ft
						Bit & Barrel	
	0.0						
			SAND, fine to medium, very silty, organic material, dark brown-gray (SM)	75	1	2" I.D. Spoon	1 3 2 3 14
	6.0						
			SAND, fine to medium, quartz, silty, brown-gray (SP)	65	2	" "	23 21 20 21 20
				65	3	" "	15 22 28 23 15
			Very silty, gray (SM) from 15.0 to 17.0 Brown-gray slightly silty from 17.0 to 21.0	70	4	" "	12 18 25 26 32
			Gray, clean, from 21.0 to 25.0	50	5	" "	1 24 28 26 36
				80	6	" "	8 13 24 33 32
	31.0		Silty from 29.5 to 31.0				
			SAND, fine to medium, quartz, very silty, very clayey, shelly dark gray (SM)	85	7	" "	8 3 5 5 6
	35.0						

ENG FORM 1836 1 MAR 61 (EM 1110-1-1801) TRANSLUCENT — PREVIOUS EDITION MAY BE USED UNTIL EXHAUSTED.

PROJECT Duval Co. Beach Erosion Study — HOLE NO. CB-Pablo-14

HOLE NO. CB-Pablo-14

DEPARTMENT OF THE ARMY
DIVISION Corps of Engineers
INSTALLATION Jacksonville, Florida

DRILLING LOG

1. PROJECT: Duval Co. Beach Erosion Study — SHEET 1 OF 2
2. LOCATION (Coordinates or Station):
3. DRILLING AGENCY: Corps of Engineers
4. HOLE NO. (As shown on drawing title and file no.): CB-Pablo-14
5. NAME OF DRILLER: D. L. Loadholtz
6. DIRECTION OF HOLE: ☑ VERTICAL ☐ INCLINED; DEGREES WITH VERTICAL:
7. THICKNESS OF OVERBURDEN:
8. DEPTH DRILLED INTO ROCK:
9. TOTAL DEPTH OF HOLE: 60'
10. SIZE AND TYPE OF BIT: See remarks
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MSL
12. MANUFACTURER'S DESIGNATION OF DRILL: Sprague & Henwood 40C
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED; UNDISTURBED
14. TOTAL NO. CORE BOXES: 1
15. GROUND WATER DEPTH: 3.6'
16. DATE HOLE: STARTED 3/26/64; COMPLETED 3/27/64
17. ELEV. TOP OF HOLE:
18. TOTAL CORE RECOVERY FOR BORING (%): 70
19. Geologist: Joe S. Gentile

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (drilling time, water loss, depth of weathering, etc., if significant)	Bls/Ft
						Bit & Barrel	Bls/Ft
	0.0						
			SAND, fine to medium, very silty, organic material, dark brown-gray (SM)	75	1	2" I.D. Spoon	1 3 2 3 14
	6.0						
			SAND, fine to medium, quartz, silty, brown-gray (SP)	65	2	" "	23 21 20 21 20
				65	3	" "	15 22 28 23 15
			Very silty, gray (SM) from 15.0 to 17.0				
			Brown-gray slightly silty from 17.0 to 21.0	70	4	" "	12 18 25 26 32
			Gray, clean, from 21.0 to 25.0	50	5	" "	1 24 28 26 36
				80	6	" "	8 13 24 33 32
			Silty from 29.5 to 31.0				
	31.0						
			SAND, fine to medium, quartz, very silty, very clayey, shelly dark gray (SM)	85	7	" "	8 3 5 5 6
	35.0						

HOLE NO. CB-Pablo-14

DEPARTMENT OF THE ARMY
DIVISION Corps of Engineers
INSTALLATION Jacksonville, Florida

DRILLING LOG

1. PROJECT: Duval Co. Beach Erosion Study — SHEET 2 OF 2
2. LOCATION (Coordinates or Station)
3. DRILLING AGENCY
4. HOLE NO. (As shown on drawing title and file no.)
5. NAME OF DRILLER
6. DIRECTION OF HOLE: ☐ VERTICAL ☐ INCLINED; DEGREES WITH VERTICAL
7. THICKNESS OF OVER-BURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE
10. SIZE AND TYPE OF BIT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
12. MANUFACTURER'S DESIGNATION OF DRILL
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED; UNDISTURBED
14. TOTAL NO. CORE BOXES
15. ELEV. GROUND WATER
16. DATE HOLE: STARTED; COMPLETED
17. ELEV. TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING (%)
19. SIGNATURE OF INSPECTOR

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (drilling time, water loss, depth of weathering, etc., if significant)	Bls/Ft
						Bit & Barrel	
	35.0						
			SAND, fine to medium, quartz and shell, slightly silty gray (SP) very silty from 35.0 to 36.0, very shelly from 39.0 to 45.0	90	8	2" I.D. Spoon	10 10 20 31 45
				50	9	" "	10 26 50 30 28
	45.0						
			SAND, fine to medium, quartz, very clayey, very silty, very shelly, gray lenses of clay (SC)	60	10	" "	4 6 4 15 12
			Bed of clay (CH) from 46.5 to 48.0 Green, from 52.0 to 60.0	65	11	" "	3 6 17 20 25
				75	12	" "	2 5 5 7 12
	60.0						
						300# Hammer w/18" Drop Used on 2" I.D. Spoon	

ENG FORM 1836 1 MAR 61 (EM 1110-1-1801) TRANSLUCENT PREVIOUS EDITION MAY BE USED UNTIL EXHAUSTED.

PROJECT Duval Co. Beach Erosion Study HOLE NO. CB-Pablo -14

HOLE NO. CB-Pablo-15

DEPARTMENT OF THE ARMY
DIVISION Corps of Engineers
INSTALLATION Jacksonville, Florida

DRILLING LOG

1. PROJECT: Duval Co. Beach Erosion Study — SHEET 1 OF 2
2. LOCATION (Coordinates or Station):
3. DRILLING AGENCY: Corps of Engineers
4. HOLE NO. (As shown on drawing title and file No.): CB-Pablo-15
5. NAME OF DRILLER: D. L. Loadholtz
6. DIRECTION OF HOLE: (X) VERTICAL ( ) INCLINED; DEGREES WITH VERTICAL:
7. THICKNESS OF OVERBURDEN:
8. DEPTH DRILLED INTO ROCK:
9. TOTAL DEPTH OF HOLE: 60'
10. SIZE AND TYPE OF BIT: See remarks
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MSL
12. MANUFACTURER'S DESIGNATION OF DRILL: Sprague & Henwood 40C
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED; UNDISTURBED:
14. TOTAL NO. CORE BOXES: 1
15. GROUND WATER DEPTH: 4.5
16. DATE HOLE: STARTED 3/30/64; COMPLETED 3/30/64
17. ELEV. TOP OF HOLE:
18. TOTAL CORE RECOVERY FOR BORING (%): 63
19. Geologist: Joe S. Gentile

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (drilling time, water loss, depth of weathering, etc., if significant)	Bls/Ft
	0.0					Bit & Barrel	
	3.0	ROAD FILL	SAND, fine to medium, quartz, organic stain from 0.0 to 3.0 road fill, slightly silty, gray brown (SP) very silty from 5.0 to 6.0	50	1	2" I.D. Spoon	4 11 13 13 10
	10.2		Gray, slightly silty from 6.0 to 10.2	50	2	" "	5 11 27 22 15
	20.0		SAND, fine to medium, quartz, very silty, very clayey, shelly, gray (SM)	55	3	" "	5 4 2 3 5
				50	4	" "	11 11 3 4 5
	22.0		SAND, fine to medium quartz, very clayey, gray, shelly (SC)	75.	5	" "	1 12 30
			SAND, fine to medium, quartz, slightly silty, gray-brown (SP)		6		46 32
				60	7	" "	10 13 19 14 28
	35.0		Shelly, slightly silty, gray from 29.0 to 35.0	55	8	" "	20 30 46 53 30

ENG FORM 1836 1 MAR 61 (EM 1110-1-1801) TRANSLUCENT — PREVIOUS EDITION MAY BE USED UNTIL EXHAUSTED.

PROJECT Duval Co. Beach Erosion Study — HOLE NO. CB-Pablo-15

HOLE NO. CB-Pablo-15

DEPARTMENT OF THE ARMY
DIVISION Corps of Engineers
INSTALLATION Jacksonville, Florida

DRILLING LOG

1. PROJECT: Duval Co. Beach Erosion Study — SHEET 2 OF 2
2. LOCATION (Coordinates or Station):
3. DRILLING AGENCY: Corps of Engineers
4. HOLE NO. (As shown on drawing title and file no.): CB-Pablo-15
5. NAME OF DRILLER: D. L. Loadholtz
6. DIRECTION OF HOLE: ☐ VERTICAL ☐ INCLINED; DEGREES WITH VERTICAL:
7. THICKNESS OF OVERBURDEN:
8. DEPTH DRILLED INTO ROCK:
9. TOTAL DEPTH OF HOLE: 60'
10. SIZE AND TYPE OF BIT: See remarks
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MSL
12. MANUFACTURER'S DESIGNATION OF DRILL: Sprague & Henwood 40C
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED; UNDISTURBED
14. TOTAL NO. CORE BOXES:
15. ELEV. GROUND WATER:
16. DATE HOLE: STARTED; COMPLETED
17. ELEV. TOP OF HOLE:
18. TOTAL CORE RECOVERY FOR BORING (%):
19. SIGNATURE OF INSPECTOR:

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (drilling time, water loss, depth of weathering, etc., if significant)	Bls/Ft
						Bit & Barrel	
	35.0						
			SAND, fine to medium, quartz, dark gray, very silty, very clayey, slightly shelly (SM)	60	9	2" I.D. Spoon	1 4 3 1 4
	42.0				10	" "	2 5 17
			CLAY, very sandy, green-gray (CL)	80	11		18 22
	50.5			60	12	" "	10 10 9 4 4
	52.5		SILT, very sandy, clayey, gray, very shelly (ML)	95	13	" "	3 3 9
			SAND, fine to medium, quartz, very clayey, silty, brown-green (SC)		14		20 23
	60.0		Deep green in color, very clayey from 55.0 to 60.0	65	15	" "	5 7 8 10 14

300# Hammer w/18" Drop
Used on 2" I.D. Spoon

HOLE NO. CB-Pablo-16

DEPARTMENT OF THE ARMY
DIVISION Corps of Engineers
INSTALLATION Jacksonville, Florida

DRILLING LOG

1. PROJECT: Duval Co. Beach Erosion Study — SHEET 1 OF 2
2. LOCATION (Coordinates or Station):
3. DRILLING AGENCY: Corps of Engineers
4. HOLE NO. (As shown on drawing title and file no.): CB-Pablo-16
5. NAME OF DRILLER: D. L. Loadholtz
6. DIRECTION OF HOLE: ☑ VERTICAL ☐ INCLINED; DEGREES WITH VERTICAL:
7. THICKNESS OF OVERBURDEN:
8. DEPTH DRILLED INTO ROCK:
9. TOTAL DEPTH OF HOLE: 60'
10. SIZE AND TYPE OF BIT: See remarks
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MSL
12. MANUFACTURER'S DESIGNATION OF DRILL: Sprague & Henwood 40C
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED; UNDISTURBED:
14. TOTAL NO. CORE BOXES: 1
15. [redacted] DEPTH GROUND WATER: 1.5
16. DATE HOLE: STARTED 3/30/64; COMPLETED 3/31/64
17. ELEV. TOP OF HOLE:
18. TOTAL CORE RECOVERY FOR BORING (%): 66
19. [redacted] Geologist: Joe S. Gentile

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (drilling time, water loss, depth of weathering, etc., if significant)	Bls/Ft
						Bit & Barrel	Bls/Ft
	0.0						
			SAND, fine to medium, quartz, very silty, very organic, dark gray (SM)	65	1	2" I.D. Spoon	Pushed 3 11
	5.0		SAND, fine to medium, quartz, gray, slightly silty, from 4.0 to 10.0 slightly clayey, light gray (SP), dark gray	65	2	" "	10 15 20 23 15
				50	3	" "	10 11 12 13 13
			Gray brown, less silty, from 16.0 to 20.0	60	4	" "	8 11 10 17 27
	25.0			75	5	" "	10 16 18 21 23
			SAND, fine to eedium, quartz, Very silty, very clayey, shelly, gray (SM)	65	6	" "	10 13 20 21 7
	29.5		SILT, very sandy, shelly, dark gray (ML)	87	7	" "	1 2 1 2 3
	35.0						

ENG FORM 1836 1 MAR 61 (EM 1110-1-1801) TRANSLUCENT — PREVIOUS EDITION MAY BE USED UNTIL EXHAUSTED.

PROJECT Duval Co. Beach Erosion Study — HOLE NO. CB-Pablo-16

HOLE NO. CB-Pablo-17

DEPARTMENT OF THE ARMY
DIVISION Corps of Engineers
INSTALLATION Jacksonville, Florida

DRILLING LOG

1. PROJECT: Duval Co. Beach Erosion Study — SHEET 1 OF 2
2. LOCATION (Coordinates or Station):
3. DRILLING AGENCY: Corps of Engineers
4. HOLE NO. (As shown on drawing title and file No.): CB-Pablo-17
5. NAME OF DRILLER: D. L. Loadholtz
6. DIRECTION OF HOLE: ☑ VERTICAL ☐ INCLINED; DEGREES WITH VERTICAL:
7. THICKNESS OF OVERBURDEN:
8. DEPTH DRILLED INTO ROCK:
9. TOTAL DEPTH OF HOLE: 60'
10. SIZE AND TYPE OF BIT: See remarks
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MSL
12. MANUFACTURER'S DESIGNATION OF DRILL: Sprague & Henwood 40C
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED; UNDISTURBED
14. TOTAL NO. CORE BOXES: 1
15. DEPTH GROUND WATER: 8.5
16. DATE HOLE: STARTED 4/1/64; COMPLETED 4/1/64
17. ELEV. TOP OF HOLE:
18. TOTAL CORE RECOVERY FOR BORING (%): 75
19. Geologist: Joe S. Gentile

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (drilling time, water loss, depth of weathering, etc., if significant)	Bls/Ft
						Bit & Barrel	
	0.0						
			SAND, fine to medium, quartz, brown, silty (SP)	65	1	2" I.D. Spoon	2 3 8 20 15
				70	2	" "	8 10 19 30 34
	10.0		SAND, fine to medium, quartz, very clayey, very silty, light gray (SM)	75	3	" "	3 6 18 17 13
	14.5		SAND, fine to medium, quartz, very clayey, silty, gray-green (SC)	60	4	" "	4 8 12 22 22
	21.0		SAND, fine to medium, quartz, slightly clayey, slightly silty, gray-green (SP) Very clayey, from 25.0 to 26.0	65	5	" "	12 25 44 75 50
	26.0		CLAY, very sandy, dark gray (CL)	55	6	" "	12 3 1 3
	29.0		SAND, fine to medium, quartz, very clayey, gray (SC)		7		50
	30.5		SAND, fine to medium, quartz, gray, light brown, slightly silty, (SP) shelly	60	8	" "	30 35 54 42 34

HOLE NO. CB-Pablo-17

DEPARTMENT OF THE ARMY
DIVISION Corps of Engineers
INSTALLATION Jacksonville, Florida

DRILLING LOG

1. PROJECT Duval Co. Beach Erosion Study — SHEET 2 OF 2
2. LOCATION (Coordinates or Station)
3. DRILLING AGENCY
4. HOLE NO. (As shown on drawing title and file no.)
5. NAME OF DRILLER
6. DIRECTION OF HOLE: ☐ VERTICAL ☐ INCLINED; DEGREES WITH VERTICAL
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE
10. SIZE AND TYPE OF BIT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
12. MANUFACTURER'S DESIGNATION OF DRILL
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED; UNDISTURBED
14. TOTAL NO. CORE BOXES
15. ELEV. GROUND WATER
16. DATE HOLE: STARTED; COMPLETED
17. ELEV. TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING (%)
19. SIGNATURE OF INSPECTOR

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (drilling time, water loss, depth of weathering, etc., if significant)	bls/Ft
						Bit & Barrel	
				75	9	2" I.D. Spoon	18 28 29 39 22
	39.4		SAND, fine to medium, quartz, very silty, dark gray, slightly shelly (SM) Very shelly from 45.0 to 47.0	70	10	" "	6 7 12 9 10
	47.0				11		2 4
			CLAY, slightly sandy, gray, very plastic (CH)	95	12	" "	6 8 7
			Thin lenses of sand	90	13	" "	2 5 14 13 12
				90	14	" "	3 6 12 20 30
	60.0					300# Hammer w/18" Drop Used on 2" I.D. Spoon	

ENG FORM 1836 1 MAR 61 (EM 1110-1-1801) TRANSLUCENT — PREVIOUS EDITION MAY BE USED UNTIL EXHAUSTED.

PROJECT Duval Co. Beach ~~Erosion Study~~ HOLE NO. CB-Pablo-17

HOLE NO. CB-Pablo-18

DEPARTMENT OF THE ARMY
DIVISION Corps of Engineers
INSTALLATION Jacksonville, Florida

DRILLING LOG

1. PROJECT: Duval Co. Beach Erosion
SHEET 1 OF 1
2. LOCATION (Coordinates or Station)
3. DRILLING AGENCY: Corps of Engineers
4. HOLE NO. (As shown on drawing title and file no.): CB-Pablo-18
5. NAME OF DRILLER: D. L. Loadholtz
6. DIRECTION OF HOLE: ☑ VERTICAL ☐ INCLINED; DEGREES WITH VERTICAL
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE: 38.5'
10. SIZE AND TYPE OF BIT: See remarks
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MSL
12. MANUFACTURER'S DESIGNATION OF DRILL: Sprague & Henwood 40C
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED; UNDISTURBED
14. TOTAL NO. CORE BOXES: 1
15. ELEV. GROUND WATER: Tidal
16. DATE HOLE: STARTED 4/1/64; COMPLETED 4/2164
17. ELEV. TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING (%): 80
19. SIGNATURE OF INSPECTOR: Joe S. Gentile, Geologist

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (drilling time, water loss, depth of weathering, etc., if significant)	Blows/Ft
						Bit & Barrel	Blows/Ft
	0.0						
	2.0	ROAD FILL	SAND, fine to medium, quartz, silty, organic stains, road fill from 0.0 to 2.0 (SP) gray	60	1	2" I.D. Spoon	2 3 9 9 12
	5.0						
			SAND, fine to medium, quartz, very clayey, silty, gray (SC)	45	2	" "	4 6 6 2 3
	13.6			60	.3	" "	4 9 13 20 25
			SAND fine to medium, quartz, white, light gray, clean (SP)	75	4	" "	5 14 17 17 14
	25.0		Slightly silty, clayey from 20.0 to 25.0	80	5	" "	10 10 14 13 12
	29.0		SAND, fine to medium, quartz, very clayey, dark gray, slightly shelly (SC)	85	6	" "	Pushed ↓ 2
			CLAY, very plastic, gray (CH)		7		
				100	8	" "	Pushed ↓ 2 4 5
	37.0		SAND and SHELL, fine to medium quartz and large shell fragments, well compacted,		9	" "	Pushed 30
	38.5		slightly clayey, slightly silty (SP)	100	10		110 150
						300# Hammer w/18" Drop Used on 2" I.D. Spoon	

HOLE NO. CB-Pablo-19

DEPARTMENT OF THE ARMY
DIVISION Corps of Engineers
INSTALLATION Jacksonville, Florida

DRILLING LOG

1. PROJECT: Duval Co. Beach Erosion Study — SHEET 1 OF 2
2. LOCATION (Coordinates or Station):
3. DRILLING AGENCY: Corps of Engineers
4. HOLE NO. (As shown on drawing title and file no.): CB-Pablo-19
5. NAME OF DRILLER: D. L. Loadholtz
6. DIRECTION OF HOLE: ☑ VERTICAL ☐ INCLINED; DEGREES WITH VERTICAL:
7. THICKNESS OF OVERBURDEN:
8. DEPTH DRILLED INTO ROCK:
9. TOTAL DEPTH OF HOLE: 60'
10. SIZE AND TYPE OF BIT: See remarks
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MSL
12. MANUFACTURER'S DESIGNATION OF DRILL: Sprague & Henwood 40C
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED; UNDISTURBED
14. TOTAL NO. CORE BOXES: 1
15. ELEV. GROUND WATER:
16. DATE HOLE: STARTED 4/2/64; COMPLETED 4/3/64
17. ELEV. TOP OF HOLE:
18. TOTAL CORE RECOVERY FOR BORING (%): 70
19. SIGNATURE OF INSPECTOR: Joe S. Gentile, Geologist

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)	
	0.0					Bit & Barrel Bls/Ft	
	5.0		SAND, fine to medium quartz, light brown, slightly silty (SP)	20	1	2" I.D. Spoon	2 6 10 15 13
	9.0		SAND, very silty, light brown (SM)	50	2	" "	5 7 10 12 16
	15.0		SAND, fine to medium quartz, very silty, very clayey, light gray (SC) Organic stain, dark brown - black from 14.0 to 15.0	60	3	" "	7 10 11 14 16
			SAND, fine to medium, quartz, very silty, dark brown (SM)	75	4	" "	6 10 15 19 23
			Very clayey, green-gray from 19.0 to 31.0	65	5	" "	6 6 10 9 15
			Dark gray-green, shelly from 31.0 to 33.5	70	6	" "	4 6 6 5 5
	33.5		CLAY, very sandy, green (CL)	95	7	" "	Pushed 2
	35.0				8		9 20

ENG FORM 1836 1 MAR 61 (EM 1110-1-1001) TRANSLUCENT — PREVIOUS EDITION MAY BE USED UNTIL EXHAUSTED.

PROJECT Duval Co. Beach Erosion Study — HOLE NO. CB-Pablo-19

HOLE NO. CB-Pablo-19

DEPARTMENT OF THE ARMY
DIVISION Corps of Engineers
INSTALLATION Jacksonville, Florida

DRILLING LOG

1. PROJECT: Duval Co. Beach Erosion Study — SHEET 2 OF 2
2. LOCATION (Coordinates or Station)
3. DRILLING AGENCY
4. HOLE NO. (As shown on drawing title and file no.)
5. NAME OF DRILLER
6. DIRECTION OF HOLE: ☑ VERTICAL ☐ INCLINED; DEGREES WITH VERTICAL
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE
10. SIZE AND TYPE OF BIT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
12. MANUFACTURER'S DESIGNATION OF DRILL
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED — UNDISTURBED
14. TOTAL NO. CORE BOXES
15. ELEV. GROUND WATER
16. DATE HOLE: STARTED — COMPLETED
17. ELEV. TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING (%)
19. SIGNATURE OF INSPECTOR

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (drilling time, water loss, depth of weathering, etc., if significant)	Bls/Ft
						Bit & Barrel	
	35.0						
	37.0		SAND, fine to medium, quartz, very clayey, green (SC)		9	2" I.D. Spoon	23 40
				80			80
					10		120 250
			SAND, fine to medium, quartz, clean, light gray, slightly shelly (SP) Very clayey from 43.0 to 45.0				35
				80	11	" "	35 36
	45.0						43 48
			SAND, fine to medium, quartz, very silty, slightly calcareous (Partly consolidated), light gray (SM)				7
				85	12	" "	8 7
	51.0						21 29
			SAND, fine to medium, quartz, very clayey, silty, dark green-gray (SC)				3
				90	13	" "	4 7
							25 48
							18
				80	14	" "	23 40
	60.0						110 150
						300# Hammer w/18" Drop Used on 2" I.D. Spoon	

ENG FORM 1836 1 MAR 61 (EM 1110-1-1801) TRANSLUCENT — PREVIOUS EDITION MAY BE USED UNTIL EXHAUSTED.

PROJECT Duval Co. Beach Erosion Study — HOLE NO. CB-Pablo-19

HOLE NO. CB-Pablo-20

DEPARTMENT OF THE ARMY
DIVISION Corps of Engineers
INSTALLATION Jacksonville, Florida

DRILLING LOG

1. PROJECT: Duval Co. Beach Erosion Study — SHEET 1 OF 2
2. LOCATION (Coordinates or Station)
3. DRILLING AGENCY: Corps of Engineers
4. HOLE NO. (As shown on drawing title and file no.): CB-Pablo-20
5. NAME OF DRILLER: D. L. Loadholtz
6. DIRECTION OF HOLE: ☑ VERTICAL ☐ INCLINED; DEGREES WITH VERTICAL:
7. THICKNESS OF OVERBURDEN:
8. DEPTH DRILLED INTO ROCK:
9. TOTAL DEPTH OF HOLE: 60'
10. SIZE AND TYPE OF BIT: See remarks
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MSL
12. MANUFACTURER'S DESIGNATION OF DRILL: Sprague & Henwood 40C
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED; UNDISTURBED:
14. TOTAL NO. CORE BOXES: 1
15. ELEV. GROUND WATER:
16. DATE HOLE: STARTED 4/3/64; COMPLETED 4/6/64
17. ELEV. TOP OF HOLE:
18. TOTAL CORE RECOVERY FOR BORING (%): 68
19. [illegible] ROCK: Geologist — Joe S. Gentile

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (drilling time, water loss, depth of weathering, etc., if significant)	Blows/Ft
						Bit & Barrel	Blows/Ft
	0.0						
			SAND, fine to medium, quartz, slightly silty, brown-gray (SP)	20	1	2" I.D. Spoon	2 4 6 7 13
	5.0						
			SAND, fine to medium, quartz, very clayey, light gray-yellow (SC)	70	2	" "	1 2 3 6 7
	9.7						
			SAND, fine to medium, quartz, light brown (SP)	50	3	" "	6 9 16 18 15
			Slightly silty, slightly clayey from 15.0 to 19.0	75		" "	4 5 8 12 15
			Gray, from 19.0 to 25.0	85	4	" "	2 12 20 23 20
	25.0						
			SAND, fine to medium, quartz, very silty, very clayey, dark gray (SM) slightly shelly from 29.0 to 29.5	80	6	" "	2 2 3 3 1
	29.5						
			CLAY, very plastic, fat, gray (CH)	95	7	" "	Pushed 2 2 3

HOLE NO. CB-Pablo-20

DEPARTMENT OF THE ARMY
DIVISION Corps of Engineers
INSTALLATION Jacksonville, Florida

DRILLING LOG

1. PROJECT: Duval Co. Beach Erosion Study
SHEET 2 OF 2
2. LOCATION (Coordinates or Station)
3. DRILLING AGENCY
4. HOLE NO. (As shown on drawing title and file no.)
5. NAME OF DRILLER
6. DIRECTION OF HOLE: ☐ VERTICAL ☐ INCLINED; DEGREES WITH VERTICAL
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE
10. SIZE AND TYPE OF BIT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
12. MANUFACTURER'S DESIGNATION OF DRILL
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED; UNDISTURBED
14. TOTAL NO. CORE BOXES
15. ELEV. GROUND WATER
16. DATE HOLE: STARTED; COMPLETED
17. ELEV. TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING (%)
19. SIGNATURE OF INSPECTOR

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (drilling time, water loss, depth of weathering, etc., if significant)	Bls/Ft
						Bit & Barrel	
	38.5			70	8	2" I.D. Spoon	1 2 3 25 30
	44.7		SAND, fine to medium, quartz, light gray, slightly shelly (SP)	40	9	" "	30 132 100 35 28
	49.6		SAND, fine to medium, quartz, very silty, very clayey, gray, very shelly from 45.0 to 47.0 (SM)	85	10	" "	10 12 8 9 17
	55.0		SAND, fine to medium, quartz, slightly silty, slightly calcareous, thin lenses poorly consolidated sandstone, light gray (SP)	80	11	" "	19 30 28 20 28
	60.0		SAND, very clayey, dark green (SC)	65	12	" "	25 50 85 190 200
						300# Hammer w/18" Drop Used on 2" I.D. Spoon	

ENG FORM 1836 1 MAR 61 (ER 1110-1-1801) TRANSLUCENT PREVIOUS EDITION MAY BE USED UNTIL EXHAUSTED.

PROJECT Duval Co. Beach Erosion Study HOLE NO. CB-Pablo-20

HOLE NO. CB-Pablo-21

DEPARTMENT OF THE ARMY
DIVISION Corps of Engineers
INSTALLATION Jacksonville, Florida

DRILLING LOG

1. PROJECT: Duval Co. Beach Erosion Study
SHEET 1 OF 2
2. LOCATION (Coordinates or Station)
3. DRILLING AGENCY: Corps of Engineers
4. HOLE NO. (As shown on drawing title and file No.): CB-Pablo-21
5. NAME OF DRILLER: D. L. Loadholtz
6. DIRECTION OF HOLE: ☑ VERTICAL ☐ INCLINED; DEGREES WITH VERTICAL
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE: 60'
10. SIZE AND TYPE OF BIT: See remarks
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MSL
12. MANUFACTURER'S DESIGNATION OF DRILL: Sprague & Henwood 40C
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED; UNDISTURBED
14. TOTAL NO. CORE BOXES: 1
15. DEPTH GROUND WATER: 2.1'
16. DATE HOLE: STARTED 4/6/64; COMPLETED 4/6/64
17. ELEV. TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING (%): 62
19. [redacted] Geologist: Joe S. Gentile

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (drilling time, water loss, depth of weathering, etc., if significant)	Bls/Ft
						Bit & Barrel	
	0.0						
	2.0	ROAD FILL	SAND, fine to medium, quartz, gray, silty, clayey, 2.0' road fill on top (SP)				2
				50	1	2" I.D. Spoon	5
	5.0						8
			SAND, very silty (SM)				14
							16
							6
				10	2	" "	6
	10.0						5
							4
							5
			ORGANIC CLAY, dark brown, some fiberous material, (OH) sandy from 13.0 to 15.0				1
				60	3	" "	Pushed
	14.8						1
							1
							2
			CLAY, organic stain, blue-gray slightly sandy (CL)				Pushed
				80	4	" "	↓
	19.5						2
			SAND, fine to medium, quartz, gray-white, slightly silty, (SP)				4
				70	5	" "	12
	25.0						16
							18
							21
			SAND, fine to medium, quartz, dark gray, very silty (SM)				6
				65	6	" "	6
	30.0						8
							7
							7
			SAND, fine to medium, quartz, very clayey, gray (SC)				1
				70	7	" "	2
	34.3						4
							5
							8
			CLAY, green-gray, very sandy, (SC)				6
				50	8	" "	10
	40.0						13
							30
							21

ENG FORM 1 MAR 61 1836 (EM 1110-1-1801) TRANSLUCENT PREVIOUS EDITION MAY BE USED UNTIL EXHAUSTED.

PROJECT Duval Co. Beach Erosion Study HOLE NO. CB-Pablo-21

HOLE NO. CB-Pablo-21

DEPARTMENT OF THE ARMY
DIVISION Corps of Engineers
INSTALLATION Jacksonville, Florida

DRILLING LOG

1. PROJECT: Duval Co. Beach Erosion Study
SHEET 2 OF 2
2. LOCATION (Coordinates or Station)
3. DRILLING AGENCY
4. HOLE NO. (As shown on drawing title and file no.)
5. NAME OF DRILLER
6. DIRECTION OF HOLE: ☑ VERTICAL ☐ INCLINED; DEGREES WITH VERTICAL
7. THICKNESS OF OVER-BURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE
10. SIZE AND TYPE OF BIT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
12. MANUFACTURER'S DESIGNATION OF DRILL
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED; UNDISTURBED
14. TOTAL NO. CORE BOXES
15. ELEV. GROUND WATER
16. DATE HOLE: STARTED; COMPLETED
17. ELEV. TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING (%)
19. SIGNATURE OF INSPECTOR

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)	Bls/Ft
						Bit & Barrel	Bls/Ft
	40.0						
			CLAY, gray-green, fat, slightly sandy (CH)	95	9	2" I.D. Spoon	2 3 6 8 10
	46.0						
			CLAY, very sandy, gray-green (CL)	75	10	" "	5 7 8
	48.0						
			SAND, fine to medium, quartz, very silty, light gray (SM) shelly		11		11 11
			Very shelly, silty, gray from 50.0 to 53.0	85	12	" "	6 6 16 40 60
	56.0						
			SAND, gray-green, very clayey (SC)	40	13	" "	45 70 100 130 90
	60.0						
						300# Hammer w/18" Drop Used on 2" I.D. Spoon	

ENG FORM 1836 1 MAR 61 (EM 1110-1-1801) TRANSLUCENT PREVIOUS EDITION MAY BE USED UNTIL EXHAUSTED.

PROJECT Duval Co. Beach Erosion Study HOLE NO. CB-Pablo-21

BEACH EROSION CONTROL STUDY

DUVAL COUNTY, FLA.

APPENDIX C

STORMS AND THEIR EFFECTS; SHORELINE AND OFFSHORE CHANGES

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BEACH EROSION CONTROL STUDY

DUVAL COUNTY, FLA.

APPENDIX C

STORMS AND THEIR EFFECTS; SHORELINE AND OFFSHORE CHANGES

I. STORMS AND THEIR EFFECTS

1. Hurricanes.--Since 1830 a storm of hurricane intensity has passed within 150 miles of Duval County at an average frequency of one every 3 years. During the same period hurricanes have passed within 50 miles of Duval County at an average frequency of one every 7 years. Specific hurricanes and their effects on the shores of Duval County are discussed briefly in paragraphs 2-7 following.

2. September-October 1920.--That hurricane originated in the Gulf of Mexico and approached Florida from the southwest, moving inland at Cedar Key. The storm crossed the State and entered the Atlantic Ocean near St. Augustine. Damage to seawalls, piers, and docks was reported.

3. October 13-21, 1944.--That hurricane originated in the western Caribbean Sea and entered the west coast of Florida near Sarasota. The storm then followed a northeasterly course, passed southeast of Jacksonville into the Atlantic Ocean, and reentered the coast near Savannah. High winds extended 200 miles to the east and 100 miles to the west. Extremely high tides occurred on the southwestern and northeastern coasts of Florida. Storm damages were estimated to be about $63,000,000 in Florida. Eighteen persons lost their lives from drowning. The shoreline of Duval County south of St. Johns River was eroded landward approximately 150 feet and as much as 3 feet vertically. High-water elevations up to about 10 feet were observed at Jacksonville Beach, undermining the boardwalk and flooding streets as far inland as Third Street.

4. September 12-19, 1945.--That storm entered Florida over Key Largo, passed over the central part of the State with greatly diminishing force, and reentered the Atlantic Ocean north of St. Augustine. This storm caused about $54 million damages in southeast Florida but very little elsewhere in the State.

5. October 15-19, 1950.--That was a small but violent storm. The storm moved from the Caribbean Sea across Cuba, Miami, and parallel to and along the entire length of the Atlantic coast of Florida. Total losses in the State were estimated at about $28 million. Low areas in St. Augustine were flooded. The hurricane caused some damage to Duval County beaches and seawalls. High tides and waves overtopped seawalls and rolled up the ramps leading from the street to the beach, flooding many low areas along the beachfront. Most of the flooding was the result of water rolling up the ramps.

6. August 26-28, 1964.--Hurricane Cleo entered Florida at Miami and traveled generally northward to about St. Augustine where it started to moderate. By the time it crossed Duval County in its northerly course winds were reduced to gale force. Damages in southeast Florida were estimated to exceed $100 million, and were largely attributable to wind. Beach damages were relatively insignificant, the maximum reported shoreline recession being 10 feet.

7. September 9-11, 1964.--Hurricane Dora approached Cape Kennedy on a westerly course that changed to northwest, and then back to west as the storm crossed the shore between St. Augustine and Jacksonville Beach September 10. Damages were severe in Volusia, Flagler, St. Johns, Duval, and Nassau Counties, and the President authorized emergency repair work under Public Law 875. High tides and waves caused damages to development and protective structures in Duval County of about $4 million. Winds caused very heavy damages to power and communication facilities.

8. Northeast storms occur along the east coast of Florida on an annual basis. In the past such storms have been more damaging than hurricanes. Effects of specific northeast storms are described briefly in paragraphs 9-13 following.

9. The 1925 northeast storm destroyed most of the timber bulkheads that had been constructed in Duval County during the Florida boom. Little information is available on that storm except that it was the most severe experienced up to that time.

10. The 1932 northeast storm was one of the most severe to occur along the Florida coast. A damage survey made by the Jacksonville District in 1932 indicated that exceptionally heavy damage had occurred from north Florida to Palm Beach. In Duval County the storm was accompanied by unusually high tides (2 feet above normal) and large waves which reached the shore in advance of the high winds. Waves were reported to have reached a greater height than at any time during the preceding 60 years. Wind velocities were reported to have

reached a maximum of about 50 miles an hour at the beaches. Many houses were undermined, ramps were destroyed, the beach dropped about 3 feet in elevation, and many of the timber seawalls which had been constructed since the 1925 storm were destroyed.

11. The 1947 northeast storm began about September 24 and was accompanied by exceedingly high winds and tides and large waves. The storm was exceptional not only for its severity but for its unusual duration. Destruction and erosion during that 13-day storm was evaluated at $1,400,000 on 1947 price level. About 5,760 linear feet of concrete seawalls were destroyed, and 6,800 linear feet were damaged. The beach was lowered as much as 5 feet, several dwellings were lost, others damaged, and 6 ramps were damaged or destroyed.

12. The 1956 northeast storm.--The damage during the 2-5 November 1956 storm was caused chiefly by wave action on top of high tides generated by winds from a storm center which later developed into hurricane Greta. The winds blew generally from the northeast at sustained velocities of 20 to 30 miles an hour for about 4 days. The winds generated tides as much as 4 feet above normal, with fairly heavy seas. Damages sustained were primarily to seawalls, ramps, and foundations.

13. The 1962 northeast storm was a severe coastal storm with winds of 60 to 70 miles an hour within 100 miles of the center. The storm remained within 300 to 500 miles of the Duval County beaches for several days. Sustained northeast winds over a fetch of several hundred miles generated waves over 20 feet high with periods of about 11 seconds in the ocean. When those waves broke in the shallow water near shore, they caused water levels to rise about 7 feet above mean low water. Damages were so severe that the area was declared an emergency disaster area and temporary relief measures were provided with Federal funds. Total damages, which were estimated at $2,580,000, were distributed as follows:

Mayport Naval Station	$50,000
Atlantic Beach	100,000
Neptune Beach	1,300,000
Jacksonville Beach	1,100,000
Emergency expenses	30,000

II. SHORELINE AND OFFSHORE CHANGES

14. General.--Comparative positions of the mean-high-water shoreline over the period of record are shown on plates 2-4. The bases for comparison are surveys made by the United States Coast and Geodetic Survey in 1858, 1923-24, 1951-54, 1958-59, and by the Corps of Engineers in October-December 1963. In addition to the October-December 1963 survey, the Corps of Engineers made the following surveys: January 1963 and June 1963 at Neptune Beach and Jacksonville Beach; and August 1963, January 1964, and April 1964 at Mayport Naval Station. Due to the limited coverage of the above surveys, generally extending only from the seawall or dune to mean low water, their use was limited.

15. Mean-high-water shoreline changes are tabulated in table C-1. The data indicate both advance and recession throughout the county shoreline. The ocean shore of Little Talbot Island, between Nassau Sound and Fort George Inlet, advanced considerably during the period of record. For the period 1923-24 to 1963, that shoreline advanced about 650 feet, or about 16 feet annually. South of Fort George Inlet and adjacent to the north jetty of St. Johns River the shoreline advanced about 330 feet between 1923-24 and 1963. The reach from the south jetty to the south county line receded about 270 feet, advanced about 34 feet, and receded about 72 feet for the northerly one-third, middle one-third, and southerly one-third, respectively, during the period 1858 to 1923-24. During the period 1923-24 to 1958-59 there was an average recession of 106 feet for the northerly two-thirds of the reach between the jetties and the south county line, and an average advance of 52 feet for the southerly one-third. For the short-term period of 1958-59 to 1963, data for the 14 profiles south of the jetties show both advance and recession in almost equal distribution. Analysis for the period 1923-24 to 1963 indicated an average recession of 79 feet from the south jetty 6.5 miles southward and an average advance of 56 feet for the remaining distance of about 3.5 miles to the south county line. Changes in the Neptune Beach-Jacksonville Beach area reflect the emergency restoration carried out there in 1963 at the direction of the Federal Office of Emergency Planning. As a result of Hurricane Dora (September 1964), the entire shoreline of the county has receded over the period of record.

16. Shoreline changes at Little Talbot Island.--In 1853 the south end of Little Talbot Island was near the confluence of Fort George River and Simpson Creek. Immediately south of the island a long sand bar was covered during high tide. (See United States Coast and Geodetic Survey hydrographic and topographic sheets H-351 and T-411.)

TABLE C-1

Mean-high-water shorelin

Profile	Advance	Recession	Advance	Recession (feet)
				LITTLE TALBOT ISLA
	1858 to 1923-24		1923-24 to 1951-54	
1	Not available			150
2	Do.		550	
3	Do.		700	
4	Do.		1,060	
4A	Do.			1,180
5	Do.		130	
				ST. JOHNS RIVER TO SOUTH C
	1858 to 1923-24		1923-24 to 1958-59	
6	Not available		460	
7		400		70
8		220 (1) 270		110
9		190		110
10	30			140 (1) 106
11	30			60
12	60 (1) 34			90
13	10			120
14	40			150
15		80	20	
16		60	80	
17		70 (1) 72	50 (1) 52	
18		100	60	
19		50	50	

NOTE: (1) Average change for bracketed reach.

TABLE C-1

Mean-high-water shoreline changes

ance	Recession (feet)	Advance	Recession	Advance	Recession
LITTLE TALBOT ISLAND					
1923-24 to 1951-54		1951-54 to 1963		1923-24 to 1963	
	150	380		230	
		350 (1) 390		900	
		440		1,140 (1) 645	
			750	310	
	1,180		480		1,660
		200		330	
ST. JOHNS RIVER TO SOUTH COUNTY LINE					
1923-24 to 1958-59		1958-59 to 1963		1923-24 to 1963	
			60	400	
	70	55			15
	110		10		120
	110	110			No change
	140 (1) 106		20		160 (1) 79
	60		No change		60
	90	30			60
	120	20 (1) 28			100
	150	35			115
			No change	20	
			20	60	
(1) 52			30	20 (1) 56	
		50		110	
		20		70	

By 1872 the south end of the island had moved south about 1,000 feet and seaward 400 feet. By 1924 the south end of Little Talbot Island had built up to a maximum width of about 3,000 feet and had extended south an additional 10,000 feet. By 1934 the south end extended southward an additional 1,000 feet and seaward about 500 feet; the total southward extension between 1853 and 1934 was 12,000 feet. From 1934 to 1958-59 the south end of the island moved northward 2,500 feet, and from 1958-59 to 1963 it moved northward an additional 500 feet. Therefore, the south end of Little Talbot Island in 1963 is about 9,000 feet south of its position in 1853. The southerly extension of Little Talbot Island thus forced a southerly migration of Fort George Inlet.

17. Offshore depth changes.--Comparisons of offshore depth changes are based on the surveys of 1874-75, 1923-24, 1953-54, 1958-59, and 1963. The results of those surveys are shown on plates 2-7. Changes in the position of offshore depth contours from 1874-75 to 1923-24, 1923-24 to 1953-54 (north of St. Johns River), 1923-24 to 1958-59 (south of St. Johns River), 1953-54 to 1963 (north of St. Johns River), and 1958-59 to 1963 (south of St. Johns River) are given in table C-2. The 6- and 12-foot depth contours on Little Talbot Island advanced during the period 1923-24 to 1953-54 and receded during the period 1953-54 to 1963. The net average change of the 6-foot depth contour was about 900 feet of recession; that of the 12-foot depth contour was about 890 feet of recession. The 18-foot depth contour on Little Talbot Island advanced 1,660 feet during the period 1923-24 to 1953-54 but receded 340 feet from 1953-54 to 1963. Data for the 30-foot depth contour on Little Talbot Island are limited. The 6-, 12-, and 18-foot depth contours in the reach south of the St. Johns River receded for the periods 1874-75 to 1923-24, 1923-24 to 1958-59, and 1958-59 to 1963, the average net change from 1923 to 1963 being about 320 feet for the 6-foot contour, 250 feet for the 12-foot contour, and 330 feet for the 18-foot contour. The 30-foot depth contour in the reach south of St. Johns River receded during the periods 1923-24 to 1958-59 and 1958-59 to 1963, the net change being about 350 feet of recession from 1923 to 1963. As may be seen in table C-2 and in the above discussion, the trend of offshore contour movement is predominantly recessive, especially south of St. Johns River.

18. Volumetric accretion and erosion.--Details of volumetric changes in the study area are given in tables C-3, C-4, and C-5. Table C-3 shows the changes, the net change, and the average annual change from 1923-24 to 1953-54 at Little Talbot Island, and from 1923-24 to 1958-59 for the reach south of St. Johns River. Table C-4 shows the same data from 1953-54 to 1963 at Little Talbot Island and from 1958-59 to 1963 for the reach south of the St. Johns River.

12-foot contour

Advance		Recession		Advance		Recession		Advance		Recession	
1923-24 to 1953-54				1953-54 to 1963				1923-24 to 1963			
3,720					3,740				20		
1,280	(1) 1,438				500			780			
750				320		(1) 1,855		1,070			(1) 894
		No change			3,500				3,500		
		Not available		Not available					2,800		
100					1,800				1,700		
1923-24 to 1958-59				1958-59 to 1963				1923-24 to 1963			
		Not available		2,580				Not available			
		400		190				590			
		110		100				210			
		80		80				160			
		220		170		(1) 438		390			
		40	(1) 120	500				540			
		100		40				140			
44		20		20				40		(1) 248	
		No change		660				660			
		110		40				150			
		Not available						60			
		do.						No change			
		do.						100			
		do.						180			

(Continued)

TABLE C-2

Offshore depth changes

6-foot contour							
Advance	Recession	Advance	Recession	Advance	Recession	Advance	Recession
				(feet)			
				LITTLE TALBOT ISLAND			
1923-24 to 1953-54		1953-54 to 1963		1923-24 to 1963		1874-75 to 1923-24	
		3,700		100		Not available	
		330		540		do.	
(1) 1,598		240	(1) 1,694	810	(1) 906	do.	
		3,400		2,530		do.	
2,450		800		3,250		do.	
480		300		180		do.	
				ST. JOHNS RIVER TO SOUTH COUNTY LINE			
1923-24 to 1958-59		1958-59 to 1963		1923-24 to 1963		1874-75 to 1923-2	
Not available		100		Not available		Not available	
20		100		120		3,430	
70		10		80		340	
80	(1) 82	310		390		80	
90		300	(1) 260	390		60	
150		220		370		100	
No change		300		300	(1) 316	130	
do.		350		350		120	(1)
		480		360		30	
		430		270		50	
Not available		Not available		200		130	
do.		do.		220		190	
do.		do.		560		230	
do.		do.		500		40	

Profile	Advance	Recession	Advance	6-foot Recessi
	1874-75 to 1923-24		1923-24 to 1953-54	
1	Not available		3,600	
2	Do.		870	(1) 1,598
3	Do.		1,050	
4	Do.		870	
4A	Do.			2,450
5	Do.			480
	1874-75 to 1923-24		1923-24 to 1958-59	
6	Not available		Not available	
7	3,900		20	
8	300		70	
9	160		80	(1)
10	160	(1) 701	90	
11	60		150	
12	260		No change	
13	190		do.	
14	Not available		120	
15	Do.		160	
16	Do.		Not available	
17	Do.		do.	
18	Do.		do.	
19	Do.		do.	

30-foot contour					
Advance	Recession	Advance	Recession	Advance	Recession
1923-24 to 1953-54		1953-54 to 1963		1923-24 to 1963	
290		Not available		Not available	
	Not available	do.		Do.	
	do.	do.		Do.	
630		do.		Do.	
	do.	do.		Do.	
80			950		870
1923-24 to 1958-59		1958-59 to 1963		1923-24 to 1963	
	Not available	300		Not available	
	do.		1,000	Do.	
	do.	300		Do.	
600			200	400	
	300		390		690
	320		560		880
200			370		170
	100		550		650
	220		300		520
	580		100		680
	Not available	Not available			240
	do.	do.		No change	
	do.	do.			240
	do.	do.			160

(1) 103

(1) 353

(1) 348

TABLE C-2--Continued

18-foot contour							
Advance	Recession	Advance	Recession	Advance	Recession	Advance	Recession
			(feet)				
			LITTLE TALBOT ISLAND				
1923-24 to 1953-54		1953-54 to 1963		1923-24 to 1963		1874-75 to 1923-24	
(1) 1,660		No change 850 10 500	(1) 340	3,900 280	60 500	Not available do. do. do.	
No change		Not available		Not available		do.	
Not available		400		880		do.	
480							
			ST. JOHNS RIVER TO SOUTH COUNTY LINE				
1923-24 to 1958-59		1958-59 to 1963		1923-24 to 1963		1874-75 to 1923-24	
Not available 1,030 800 90 70 100 50 140 30 200	(1) 279	110 790 500 No change 150 90 50 40 170 10	(1) 159	Not available 1,820 1,300 90 220 190 No change 180 200 210	(1) 328	Not available do. do. do. do. do. do. do. do.	
Not available		Not available		40		do.	
do.		do.		No change		do.	
do.		do.		260		do.	
do.		do.		160		do.	

Profile	1874-75 to 1923-24		1923-24 to 1953-54	18-
	Advance	Recession	Advance	Rece
1	Not available		3,900	
2	Do.		790	(1) 1,660
3			290	
4	Do.			No change
4A	Do.			Not available
5	Do.			480

	1874-75 to 1923-24		1923-24 to 1958-59
6	Not available		Not available
7	800		1,030
8	490		800
9	940		90
10	50		70
11	100		100
12	20	(1) 345	50
13	490		140
14	190		30
15	200		200
16	150		Not available
17	400		do.
18	300		do.
19	360		do.

NOTE: (1) Net average change for bracketed reach.

Profile	Landward of -18 ft. m.l.w. (1)				Change
	Total period		Average annual		
	Accretion	Erosion	Accretion	Erosion	
1	5,615	438	187	15	
2	7,547	0	252	0	
3	4,566 (2) 18,367	0	152 (2) 613	0	
4	1,516	209	51	7	
4A	114	344	4	11	
5	21	135	1	5	
6		Not available			
7	70	1,198	2	34	
8	44	560	1	16	
9	43	611	1	18	
10	25	381	1	11	
11	0	415 (2) 2,691	0	12	(2)
12	127	34	4	1	
13	200	25	6	1	
14	42	158	1	4	
15	162	22	5	1	
16					
17					
18					
19					

NOTES: (1) Approximate elevation; division is at or near natural break in the
(2) Total net change for bracketed reach.

TABLE C-3

Volumetric accretion and erosion

Change								
ft. m.l.w. (1)			Seaward of -18 ft. m.l.w. (1)					
Average annual			Total period		Average annual			T
Accretion		Erosion	Accretion	Erosion	Accretion	Erosion		Accretion
			(1,000 cubic yards)					
			LITTLE TALBOT ISLAND					
			1923-24 to 1953-54					
187		15		Not available				
252		0		Do.				
152	(2) 613	0		Do.				
51		7		Do.				
4		11		Do.				
1		5	0	98	0	3		
			ST. JOHNS RIVER TO SOUTH COUNTY LINE					
			1923-24 to 1958-59					
			Not available					Not a
2		34	1,339	291	38	8		
1		16	0	809	0	23		
1		18	0	646	0	19		
1		11	0	450	0	13		
,691 0	(2) 77	12	0	302	(2) 1,174 0	9	(2) 35	
4		1	0	0	0	0		93
6		1	98	0	3	0		273
1		4	0	128	0	4		
5		1	68	53	2	2		155
			Not available					
			Do.					
			Do.					
			Do.					

s at or near natural break in the profile.
ach.

BLE C-3

retion and erosion

				Net change			
	Seaward of -18 ft. m.l.w. (1)			Total profile			
period		Average annual		Total period		Average annual	
	Erosion	Accretion	Erosion	Accretion	Erosion	Accretion	Erosion
	cubic yards)						
ALBOT ISLAND							
to 1953-54							
	Not available						
	Do.						
	Do.						
	Do.						
	Do.						
98		0	3		212		7
TO SOUTH COUNTY LINE							
to 1958-59							
lable				Not available			
291		38	8	80		2	
309		0	23	1,325		38	
346		0	19	1,214		36	
450		0	13	806		23	
302	(2) 1,174	0	9	(2) 35	717	(2) 3,865	21	(2) 112
0		0	0	93		3	
0		3	0	273		8	
128		0	4		244		7
53		2	2	155		4	
lable							

Profile	Change					
	Landward of -18 ft. m.l.w. (1)					
	Total period			Average annual		
	Accretion	Erosion		Accretion	Erosion	
1	0	6,566		0	657	
2	1,383	3,446		138	345	
3	1,657	372	(2) 10,888	166	37	(2) 1,0
4	156	3,649		16	365	
4A	325	376		33	38	
5	80	328		8	33	
						S
6	3	1,265		1	253	
7	0	1,025		0	205	
8	0	235		0	47	
9	469	134		94	27	
10	0	675	(2) 4,847	0	135	(2) 969
11	15	283		3	57	
12	45	294		9	59	
13	0	472		0	94	
14	0	496		0	99	
15	0	500		0	100	
16						
17						
18						
19						

NOTES: (1) Approximate elevation; division is at or near natural break in the pr
(2) Total net change for bracketed reach.

TABLE C-4

Volumetric accretion and erosion

Change							
-18 ft. m.l.w. (1)			Seaward of -18 ft. m.l.w. (1)				
Average annual			Total period		Average annual		Tot
Accretion	Erosion		Accretion	Erosion	Accretion	Erosion	Accretion
(1,000 cubic yards)							
LITTLE TALBOT ISLAND							
1953-54 to 1963							
0	657			Not available			
138	345			Do.			
166	37	(2) 1,089		Do.			
16	365			Do.			
33	38			Do.			
8	33		0	367	0	37	
ST. JOHNS RIVER TO SOUTH COUNTY LINE							
1958-59 to 1963							
1	253		865	0	173	0	
0	205		762	0	152	0	
0	47		866	0	173	0	631
94	27		0	0	0	0	335
0	135	(2) 969	0	(2) 906 575	0	(2) 181 115	
3	57		0	292	0	58	
9	59		0	0	0	0	
0	94		0	140	0	28	
0	99		0	229	0	46	
0	100		0	351	0	70	
				Not available			
				Do.			
				Do.			
				Do.			

or near natural break in the profile.

BLE C-4

retion and erosion

					Net change			
Seaward of -18 ft. m.l.w. (1)					Total profile			
period		Average annual			Total period		Average annual	
	Erosion	Accretion	Erosion		Accretion	Erosion	Accretion	Erosion
cubic yards)								
ALBOT ISLAND								
54 to 1963								
	Not available							
	Do.							
	Do.							
	Do.							
	Do.							
	367	0		37		615		62
TO SOUTH COUNTY LINE								
59 to 1963								
	0	173		0		397		79
	0	152		0		263		53
	0	173		0	631		126	
	0	0		0	335		67	
06	575	0	(2) 181	115		1,250	(2) 3,941	250 (2) 788
	292	0		58		560		112
	0	0		0		249		50
	140	0		28		612		122
	229	0		46		725		145
	351	0		70		851		170
available								
Do.								
Do.								
Do.								

Table C-5 is a summary of tables C-3 and C-4, showing the changes, the net change, and the average annual change for the 40-year period 1923 to 1963. Data in the tables are divided to show changes in the profiles landward and seaward of the 18-foot depth. The quantities presented are based on comparative profiles prepared from surveys of 1923-24, 1953-54, 1958-59, and 1963 (plates 1-10, map file No. 24-28,620, on file in the office of the District Engineer).

19. At Little Talbot Island, landward of the 18-foot depth, the average annual net change from 1923-24 to 1953-54 was 613,000 cubic yards of accretion. For the period 1953-54 to 1963 the average annual net change at the island was over 1 million cubic yards of erosion. That amount of erosion at Little Talbot Island is not considered indicative of actual conditions over the entire island since much of the amount was due to channel shifting and realinement at the north and south ends of the island. Incorporating the changes for the above two periods, the net average annual change at Little Talbot Island for the period 1923-24 to 1963 becomes 188,000 cubic yards of accretion.

20. South of the St. Johns River, for the period 1923-24 to 1958-59, the average annual erosion rates were 77,000 cubic yards landward of the 18-foot depth and 35,000 cubic yards seaward of the 18-foot depth, or a total of 112,000 cubic yards over the entire length of profiles. For the period 1958-59 to 1963, the average annual changes were 969,000 cubic yards erosion landward of the 18-foot depth and 181,000 cubic yards accretion seaward of the 18-foot depth, or a total net change over the entire length of the profiles of 788,000 cubic yards erosion. As indicated by the comparative profiles, average annual net changes from the St. Johns River to the Duval-St. Johns County line for the period 1923-24 to 1963 were 191,000 cubic yards erosion landward of the 18-foot depth and 47,000 cubic yards erosion seaward of the 18-foot depth, or a total of 238,000 cubic yards erosion for the entire length of the profiles.

21. Volumetric changes based on 1963 survey data in the reach south of St. Johns River require adjustment due to artificial fill placed on the beach at Mayport Naval Station, Neptune Beach, and Jacksonville Beach (see paragraph 42 of the basic report). Computed losses in the reach south of the St. Johns River for the period 1923-24 to 1963 equal 9,627,000 cubic yards. Adding 321,000 cubic yards for artificial fill at Jacksonville Beach and Neptune Beach, and 282,000 cubic yards at Mayport Naval Station, the total losses for the period of record (1923-1963) become 10,230,000 cubic yards, or 256,000 cubic yards annually. That adjusted average annual erosion rate, rounded to 260,000 cubic yards, was used as the basis for estimating the future nourishment requirement for the reach from St. Johns River to the south county line. Costs of periodic nourishment would be based on delivery of a greater amount to the beach in order that material lost by the handling process or because of excessive fines would be offset.

Profile	Change						
	Landward of -18 ft. m.l.w. (1)						
	Total period			Average annual			
	Accretion		Erosion	Accretion		Erosion	
1	5,615		7,004	140		175	
2	8,930		3,446	223		86	
3	6,223	(2) 7,479	372	156	(2) 188	9	
4	1,672		3,858	42		96	
4A	439		720	11		18	
5	101		463				
6		Not available					
7	70		2,223	2		56	
8	44		795	1		20	
9	512		745	13		19	
10	25		1,056	1		26	
11	15		698	0		17	
12	172		328	4		8	
13	200		497	5		12	(2)
14	42		654	1		16	
15	162		522	4		13	
16	43		207	1		5	
17	22		310	1		8	
18	63		579	2		15	
19	221		691	6		17	

NOTES: (1) Approximate elevation; division is at or near natural break in the
(2) Total net change for bracketed reach.

TABLE C-5

Volumetric accretion and erosion

1923-24 to 1963

Change								
-18 ft. m.l.w. (1)			Seaward of -18 ft. m.l.w. (1)					
	Average annual		Total period		Average annual			
ion	Accretion	Erosion	Accretion	Erosion	Accretion	Erosion		Accre
	(1,000 cubic yards)							
			LITTLE TALBOT ISLAND					
	140	175			Not available			
	223	86			Do.			
	156 (2) 188	9			Do.			
	42	96			Do.			
	11	18			Do.			
			0	465	0	76		
			ST. JOHNS RIVER TO SOUTH COUNTY LINE					
					Not available			
	2	56	2,101	291	53	7		
	1	20	866	809	22	20		
	13	19	0	646	0	16		
	1	26	0	1,025	0	26		
	0	17	0	594	0	15		
	4	8	0	0	0	0		
) 7,714	5	12 (2) 191	98	140	(2) 1,913 2	4	(2) 47	
	1	16	0	357	0	9		
	4	13	68	404	2	10		
	1	5	91	0	2	0		
	1	8	76	0	2	0		
	2	15	0	851	0	21		
	6	17	0	96	0	2		

n is at or near natural break in the profile.
reach.

BLE C-5

retion and erosion

24 to 1963

				Net change			
Seaward of -18 ft. m.l.w. (1)				Total profile			
period		Average annual		Total period		Average annual	
Erosion		Accretion	Erosion	Accretion	Erosion	Accretion	Erosion
cubic yards)							
ALBOT ISLAND							
	Not available						
	Do.						
	Do.						
	Do.						
	Do.						
465		0	76	827		129	
TO SOUTH COUNTY LINE							
	Not available				Not available		
291		53	7	343		8	
809		22	20	694		17	
646		0	16	879		22	
,025		0	26	2,056		51	
594		0	15	1,277		32	
0		0	0	156		4	
140	(2) 1,913	2	4	(2) 47	339	(2) 9,627	9	(2) 238
357		0	9	969		24	
404		2	10	696		17	
0		2	0	73		2	
0		2	0	212		5	
851		0	21	1,367		34	
96		0	2	566		13	

22. Effects of St. Johns River jetties.--Local interests have long insisted that erosion problems south of St. Johns River have been intensified by the improvement of the river for navigation--specifically the two jetties and the deepened channel. Definitive surveys before the beginning of the improvements in 1879 are lacking for the entire problem area, and are limited to the area just south (about a mile) of the river. Available pertinent data are shown on figures C-1 and C-2 following. It may be noted that in the reach represented by the data the shoreline just south of the river receded from 1823 to 1879, advanced from 1879 to 1900, and receded again to 1923. Since that time the shore in that limited area has been relatively stable from a long-term consideration. The data do not show what happened between surveys, and are not necessarily representative of what has happened farther south in the developed areas of Atlantic Beach, Neptune Beach, and Jacksonville Beach.

23. As may be noted from the above discussion, data are insufficient to reach a firm conclusion as to what have been the effects of the St. Johns River improvements on adjacent shores. However, littoral drift in the area is from north to south, and it would be most unusual were the jetties and the deep channel not a contributing factor to the erosion problems of the shores of Duval County to the south. A qualitative determination of the extent of the contribution cannot be made from available data.

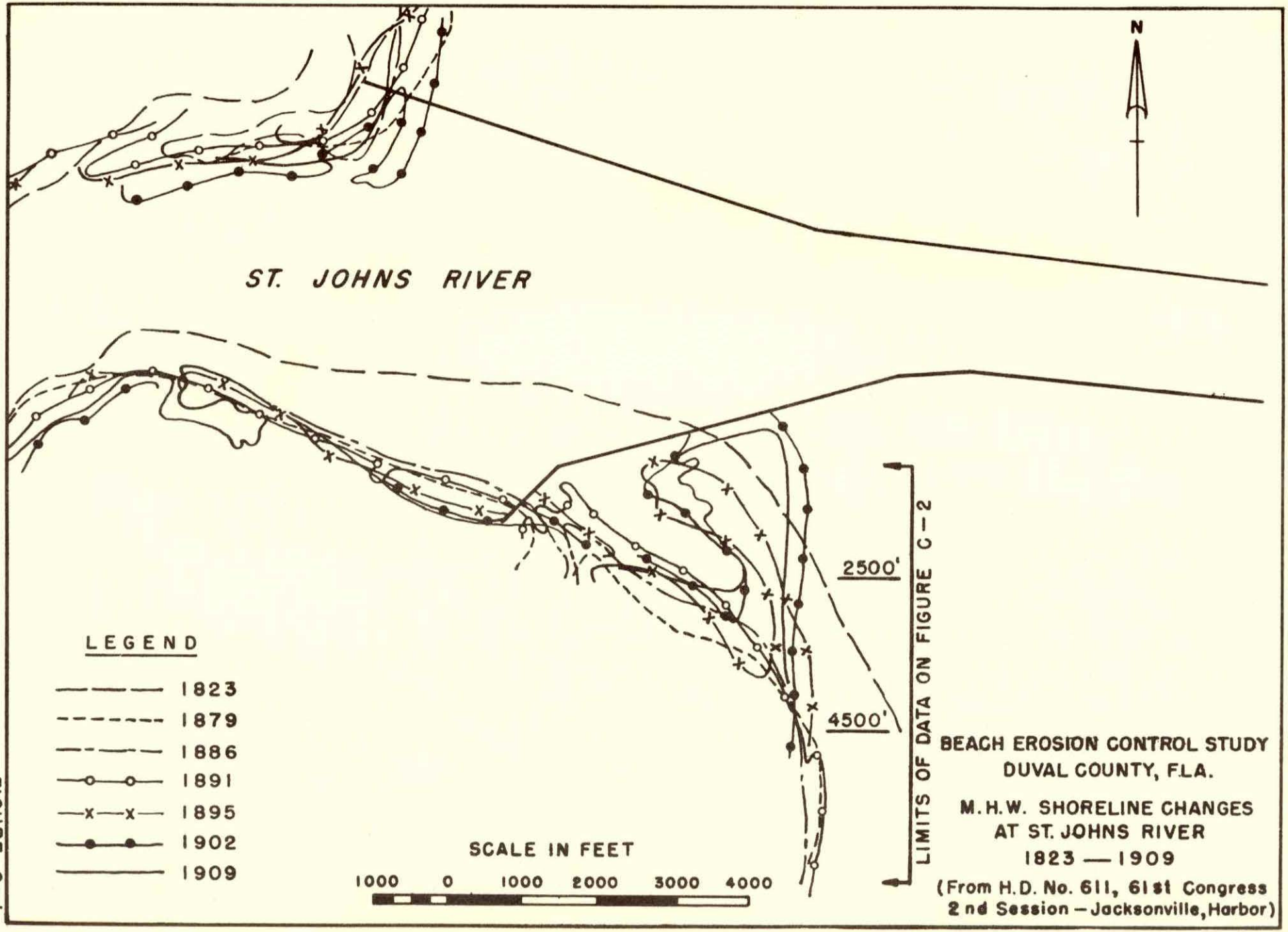
N
ST. JOHNS RIVER
2500'
4500'
LIMITS OF DATA ON FIGURE C-2
LEGEND
1823
1879
1886
1891
1895
1902
1909
SCALE IN FEET
1000 0 1000 2000 3000 4000
BEACH EROSION CONTROL STUDY
DUVAL COUNTY, FLA.
M.H.W. SHORELINE CHANGES
AT ST. JOHNS RIVER
1823 — 1909
(From H.D. No. 611, 61st Congress
2nd Session – Jacksonville, Harbor)

FIGURE C-1

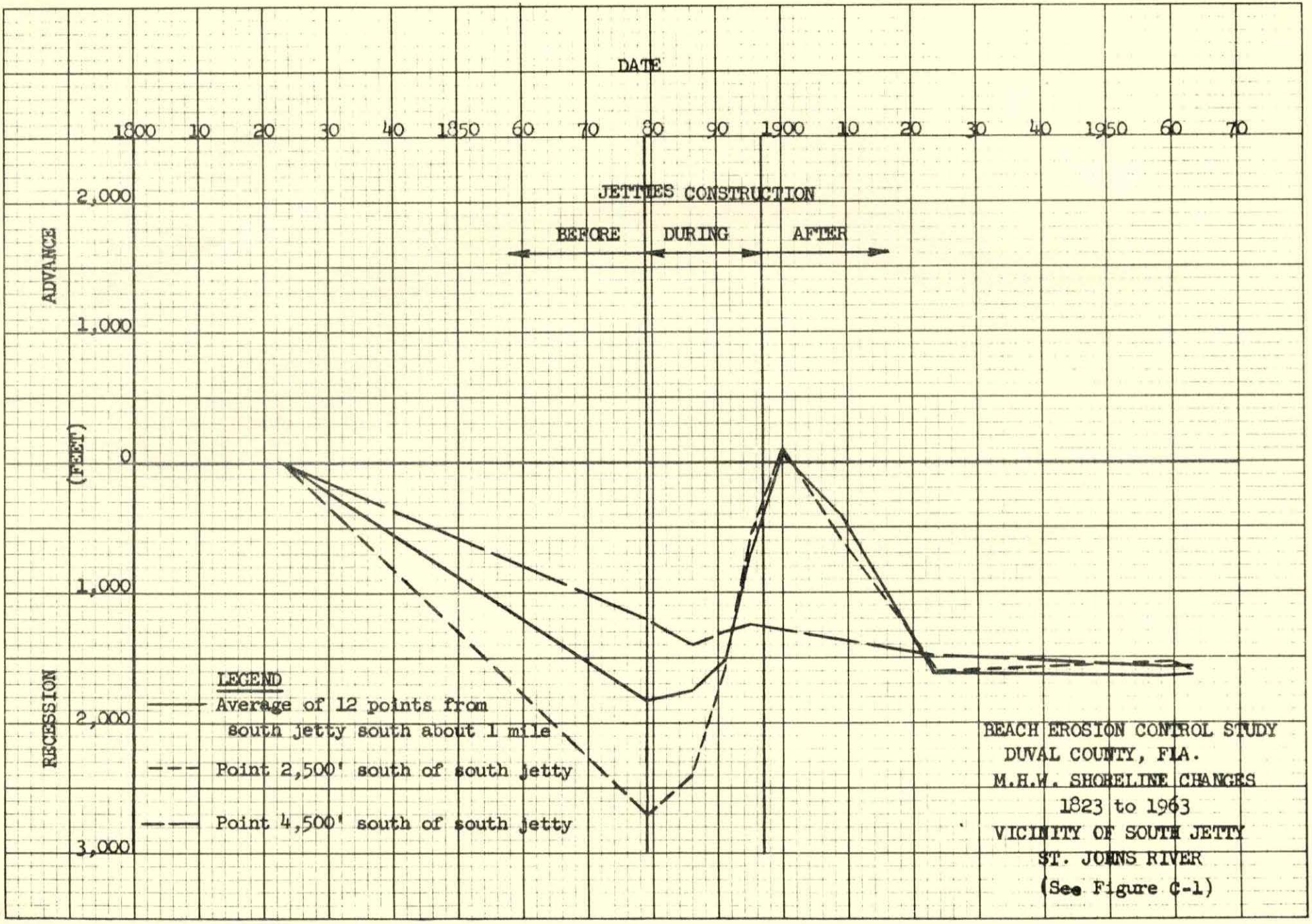
DATE
1800 10 20 30 40 1850 60 70 80 90 1900 10 20 30 40 1950 60 70
JETTIES CONSTRUCTION
BEFORE
DURING
AFTER
ADVANCE
(FEET)
RECESSION
2,000
1,000
0
1,000
2,000
3,000
LEGEND
Average of 12 points from south jetty south about 1 mile
Point 2,500' south of south jetty
Point 4,500' south of south jetty
BEACH EROSION CONTROL STUDY
DUVAL COUNTY, FLA.
M.H.W. SHORELINE CHANGES
1823 to 1963
VICINITY OF SOUTH JETTY
ST. JOHNS RIVER
(See Figure C-1)

FIGURE C-2

BEACH EROSION CONTROL STUDY

DUVAL COUNTY, FLA.

APPENDIX D

PRIOR CORRECTIVE ACTION AND EXISTING STRUCTURES

TABLE OF CONTENTS

LIST OF FIGURES

BEACH EROSION CONTROL STUDY
DUVAL COUNTY, FLA.

APPENDIX D

PRIOR CORRECTIVE ACTION AND EXISTING STRUCTURES

1. General.--Corrective action relative to protection of property and development from the ocean has been primarily limited to construction, maintenance, and replacement of seawalls and bulkheads. Until 1962, most destroyed or damaged seawalls were replaced by walls of the same type. After the November-December 1962 storm, granite revetments were installed and artificial nourishment was undertaken. More granite revetment was added after Hurricane Dora in September 1964. Data on structures along the Duval County coast and on nourishment are presented in the following paragraphs. Figure F-2 of appendix F shows the location of existing structures.

2. Jetties at the entrance to St. Johns River.--Prior to construction of the jetties at St. Johns River, there was an offshore bar across the river entrance, traversed by a shifting channel with maximum depths of 6 to 8 feet. A survey report to Congress in 1879 recommended twin converging jetties; 9,400-foot north jetty and 6,800-foot south jetty. The jetties were to be of riprap stone on foundation mattresses of logs and brush. The outer ends were to be built up to half-tide level; the inner sections were to have their crests 3 feet below mean low water. The crests were to be 20 feet wide. Construction of the south and north jetties was begun in 1879-80 and 1882, respectively. The jetties have been extended seaward and landward and their crests raised since their original conception in 1879. The north and south jetties are now 14,200 feet and 11,192 feet long, respectively. For 4,022 feet from their seaward ends they are 1,600 feet apart and parallel. The crests of the jetties are, in general, about 10 feet wide and vary considerably in elevation. The crest of the north jetty varies from 5 to 13 feet above mean low water. The crest of the south jetty ranges from mean low water to 11 feet above mean low water.

3. Early timber seawalls.--Extensive timber bulkheads and seawalls were constructed in the 1920's during the Florida boom. Some of those walls were located as far north as Mayport. A northeast storm in 1925 destroyed most of the timber walls. They were rebuilt to be destroyed again during the 1932 storm.

4. Concrete seawalls.--In the years immediately after the storm of 1932, Atlantic Beach, Neptune Beach, and Jacksonville Beach constructed, with Federal aid, concrete seawalls to replace the old timber seawalls destroyed or damaged during that storm. Seawalls in the three communities are continuous, except for ramps and for gaps resulting from failures during the 1962 northeast storm and the 1964 hurricane (Dora). The gaps in the seawalls have either been closed or are being closed with granite revetments.

5. Atlantic Beach seawall.--This begins at the north corporate limit of that community and extends south about 6,000 feet to Atlantic Boulevard. It was originally built by the town of Atlantic Beach and the Public Works Administration in 1934 and 1935. It is a reinforced concrete superstructure of the roll-away or wave-return type resting on a substructure of supporting piles, supplemented by a longitudinal concrete cutoff wall under the toe, extending about 4 feet below mean low water. The cap of the seawall is at about elevation 13 feet above mean low water.

6. Neptune Beach Seawall.--This was originally constructed by Neptune Beach and the Works Progress Administration in 1936. It is about 6,200 feet long and is of precast reinforced concrete sheet piles. The wall is vertical and the cap is at about elevation 13 feet above mean low water.

7. Jacksonville Beach seawall.--This was originally constructed by the Civil Works Administration, the Works Progress Administration, and Jacksonville Beach in the 1930's. The northern 3,430 feet connecting with the Neptune Beach seawall are of the same construction and detail as that wall. The next 3,300-foot long section along the boardwalk area to Pablo Avenue on the south, was constructed of precast reinforced concrete sheet piles, with cap elevation at 15.3 feet above mean low water. A concrete widewalk 22 feet wide was constructed along the entire length of this section. The section south of Pablo Avenue to about Thirty-seventh Avenue, South, is about 10,500 feet long. This section was built by the Works Progress Administration and Jacksonville Beach in 1936 and is of the same construction and detail as the seawall along Neptune Beach and the north end of Jacksonville Beach. Along the northern 280 feet of the seawall is an extension of the 22-foot-wide boardwalk; thence south for 1,380 feet the boardwalk is 8 feet wide. Between Thirty-seventh Avenue, South, and the south city limit there is a precast concrete seawall about 3,000 feet long, built by a private concern in 1938. The cap elevation is about 12 feet above mean low water.

8. The shore of the unincorporated area north of Atlantic Beach, for about 4,600 feet, is partially protected by seawalls of various lengths, types, and construction, intermittently spaced.

9. Since the construction of the concrete seawalls in Jacksonville Beach, Neptune Beach, and Atlantic Beach, the three communities, on numerous occasions, have had to rebuild or repair many sections of the walls with local funds. The exceptions to the above were in 1963, when Federal aid was provided at Neptune Beach and Jacksonville Beach, and in 1964, when Federal aid was provided at Jacksonville Beach, Neptune Beach, Atlantic Beach, and the unincorporated area north of Atlantic Beach. (See paragraphs 13 and 14 of this appendix.)

10. Ramps.--There are 13 vehicular ramps at various street ends in Jacksonville Beach, Neptune Beach, and Atlantic Beach, providing public access to the beach. For various reasons (safety, traffic control, etc.) some of the ramps have been closed to vehicles. However, they are open to pedestrians and there are sufficient open vehicular ramps in the area to afford complete access to the beach. The ramps are mostly of concrete construction, and are tied in with the adjacent seawall by concrete returns or wingwalls. The Board of Commissioners of Duval County have provided four pedestrian access ramps and one vehicular ramp at Chosen Beach (Seminole Beach), the unincorporated area between Mayport Naval Station and Atlantic Beach.

11. Groins.--There are no groins on the Duval County shoreline, except for a few permeable structures composed of cabbage-palm piling spaced as much as 3 feet apart in Atlantic Beach.

12. Piers.--There are three fishing piers on the Duval County ocean shore. One pier is on Little Talbot Island, near its southerly end. Another is at Atlantic Beach and is of timber construction. The third pier is at Jacksonville Beach and is of recent construction, replacing a former pier a few hundred feet north. The pier at Atlantic Beach was destroyed and the piers at Jacksonville Beach and Little Talbot Island were damaged by Hurricane Dora in September 1964.

13. Emergency Federal construction (1962 storm).--a. General.--The November-December 1962 northeast storm caused such extensive and severe damages at Jacksonville Beach and Neptune Beach that the President declared the two communities disaster areas. The Corps of Engineers, early in 1963 and at the request and authorization of the Office of Emergency Planning, provided emergency relief measures at the two communities, consisting of granite revetment, ramps, and boardwalk repair, and sand nourishment.

b. Granite revetment.--About 7,000 linear feet of granite revetment in 24 segments was provided at Jacksonville Beach and Neptune Beach in 1963. The revetments were installed where the existing seawall was destroyed or severely damaged. The revetments were constructed of 150-pound to 4,000-pound riprap stone on upper and lower

stone filters. The revetments are in good condition and have functioned as intended. The location, lengths, and typical section of the revetments are shown on drawing No. 24-28,163 on file in the office of the District Engineer. The photograph of figure D-1 shows the 1963 revetments and the beach at low tide.

c. Ramps and boardwalk repair.--Five ramps, which were destroyed during the storm, were repaired to a usable condition. Also, some minor boardwalk repairs were made.

d. Sand nourishment.--About 320,000 cubic yards of sand were placed on the beach at Jacksonville Beach and Neptune Beach in 1963. The fill was placed on the beach by trucks hauling sand from inland borrow areas. The limited amount of fill, which was placed as a temporary measure, provided a limited degree of protection and a recreational beach. The condition of the fill after one summer and one winter is shown by the 1963 profile survey made for this study.

14. Emergency Federal construction (1964 storm).--The President declared northeast Florida a disaster area after Hurricane Dora, in September 1964, caused severe and extensive damages. The Corps of Engineers, as in 1963 and at the request and authorization of the Office of Emergency Planning, is providing emergency relief measures at the affected areas. As an emergency relief measure, granite revetment for about 25,750 feet of shore is being provided at Jacksonville Beach, Neptune Beach, Atlantic Beach, and the fully developed area north of Atlantic Beach. Except for ramps and for places revetted after the 1962 storm, the revetment would be continuous from about 4,600 feet north of the north limit of Atlantic Beach to about 4,000 feet north of the Duval-St. Johns County line. The estimated cost of the 1964 work is about $1,700,000.

15. Mayport Naval Station beach restoration.--At the request of the Navy and with Navy funds, the Corps of Engineers constructed a Protective beach at the United States Naval Station in Mayport. About 282,000 cubic yards of sand were dredged from a body of water on Navy property onto about 4,400 feet of beach in 1963. Plans are currently underway for further nourishment of that beach by use of maintenance dredging material from the entrance channel to the carrier basin at Mayport and to Jacksonville Harbor. About 200,000 cubic yards of material are to be placed on the beach at Mayport Naval Station

GRANITE REVETMENT AT JACKSONVILLE BEACH (1963)

FIGURE D-1

BEACH EROSION CONTROL STUDY
DUVAL COUNTY, FLA.

APPENDIX E

ESTIMATES OF COSTS

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LIST OF TABLES

BEACH EROSION CONTROL STUDY
DUVAL COUNTY, FLA.

APPENDIX E

ESTIMATES OF COSTS

I. FIRST COST

1. General.--The following estimate of first cost is for the plan of improvement considered for beach erosion control and protection in Duval County, south of St. Johns River. The plan of improvement is presented in detail in paragraph 55 of the report, on plate 8, and briefly below.

2. Beach restoration and nourishment.--The plan is for provision of a protective and recreational beach having a level berm 60 feet wide at elevation 11 feet, mean low water, along the Duval County shore from the south jetty of St. Johns River to the Duval-St. Johns County line, and for periodic nourishment of that beach where and when needed. The total length of beach initially restored is 53,000 feet, and the estimated volume of fill is 3,750,000 cubic yards gross, including losses due to the hydraulic dredge process. The total length of shore which would be nourished periodically when needed is also 53,000 feet. The slopes of the protective beach as would be expected to be shaped by wave action are 1 on 20 from the seaward crest of the berm to mean high water, 1 on 30 from mean high water to mean low water, and 1 on 45 from mean low water to intersection with the existing bottom.

3. Bases of estimates.--Estimates of cost of beach fill for the initial restoration are based on the use of borrow areas located in the Pablo Creek marshes east of the Intracoastal Waterway. The estimates are based on use of a pipeline dredge for the initial restoration. Source-of-material investigations including availability, location, depth, and grain-size of material are presented in detail in appendix B. It is considered desirable to place a 4-year advance supply of nourishment in connection with the initial beach restoration to avoid the possibility of excessive narrowing of the beach prior to beginning of subsequent nourishment operations. Since material for nourishment so placed in advance would reduce future nourishment requirements during project life, estimates of initial costs do not include the cost of that advance supply of nourishment. The advance supply of nourishment would be in the form of a feeder beach at or near the northern part of the problem area.

(R 2-12-65)

4. Unit costs are based on operating costs of equipment suited to the work and include allowances for insurance costs and for reasonable profit. Plant capacities and time factors are based on known performance of contractor's equipment operating under similar conditions. All prices reflect fall 1964 price level.

5. Local interests would be required to provide all necessary lands, easements, and rights-of-way required with the improvement, at no cost to the United States.

6. Estimate of first cost of the plan of improvement is given in table E-1 following. All initial construction would be by the Corps of Engineers. The amount provided for contingencies allows for possible extension and/or modification of existing storm sewer drain pipes if needed. The pipes presently terminate at the seawalls within the considered beach fill.

TABLE E-1

Estimated first cost

Item	Quantity (cu.yd.)	Unit Cost	Total
Placement of beach fill----------	3,750,000	$0.80	$ 3,000,000
Contingencies----------			800,000
Subtotal----------			3,800,000
Engineering and design----------			110,000
Supervision and administration----------			180,000
Subtotal----------(1)			4,090,000
Lands, easements, and rights-of-way----------			50,000
Total first cost----------			$ 4,140,000

(Fall 1964)

NOTE: (1) Amount subject to apportionment. Does not include $54,300 preauthorization costs (survey report).

(R 2-12-65)

II. ANNUAL COSTS

7. General.--The life of the project is considered to be 50 years and to cover the period 1965-2015. Interest and amortization charges are based on an interest rate of 3-1/8 percent. It is assumed that all local expenditures on the project would be financed by a non-Federal public agency.

8. Periodic nourishment.--The 53,000 feet of restored beach for the reach between the south jetty of St. Johns River and the Duval-St. Johns County line would require periodic nourishment if it is to be preserved to a width adequate for protective and recreational purposes. Periodic nourishment would be provided when needed. Future periodic nourishment requirements are based on past losses from the entire length of profile surveyed (30-foot depth). For the period 1923-1963, the total loss for the reach between St. Johns River and the south county line as shown by the comparative profile, was 9,627,000 cubic yards. In addition, 321,000 cubic yards were artificially placed on the beach at Jacksonville Beach and Neptune Beach, and 282,000 cubic yards were artificially placed on the beach at Mayport Naval Station before the 1963 surveys were made. Therefore, the total actual loss for the period of record is 10,230,000 cubic yards, or 256,000 cubic yards annually. The future annual nourishment requirement is 260,000 cubic yards (rounded) for the entire reach, or about 90,000 cubic yards net from the south jetty at St. Johns River to the northerly limit of Atlantic Beach, and 170,000 cubic yards for Atlantic Beach, Neptune Beach and Jacksonville Beach.

9. Periodic nourishment cost estimates are based on obtaining 100,000 cubic yards (90,000 cubic yards required and 10,000 cubic yards losses) annually from shoaling in the Pilot Town and Bar Cuts of the Federal navigation project St. Johns River, Jacksonville to the ocean. That amount would be used to nourish the reach between the south jetty and the northern limit of Atlantic Beach. Use of that shoal material would result in reduction of maintenance dredging in the navigation channel and thus provide Federal benefits, and at the same time provide the most economical source of supply for nourishment of the north end of the area. Cost estimates for periodic nourishment of the beach at Atlantic Beach, Neptune Beach and Jacksonville Beach are based on truck haul of material to the beach (170,000 cubic yards required annually) from borrow areas in and adjacent to the Pablo Creek marshes. Nourishment from the shoal in St. Johns River and by truck haul would be accomplished when needed.

10. Estimates.--Estimated annual costs are given in table E-2. There are no charges for interest during construction as the construction period would be less than 2 years, and benefits would accrue as construction progressed.

TABLE E-2

Estimated annual costs

Item	Amount
Initial investment----------	(1) $4,140,000
Annual costs	
Interest at 3-1/8 percent----------	129,400
Amortization at 3-1/8 percent for 50 years---------	35,400
Periodic beach nourishment:	
100,000 cubic yards from St. Johns River shoals-	109,000
170,000 cubic yards by truck haul----------	291,000
Total annual cost----------	564,800
Round to	565,000

NOTE: (1) Estimated first cost, including $50,000 for lands, easements, and rights-of-way.

III. APPORTIONMENT OF COSTS

11. Apportionment between Federal and non-Federal interests.--The apportionment of first cost and annual costs of the recommended improvement between Federal and non-Federal interests is based on present Federal law and policy governing beach erosion control (shore protection) improvement. The basis for apportioning the costs is presented in the following paragraphs.

12. The policy of Federal aid in the restoration and protection of shores against erosion is set forth in Public Law 826, 84th Congress, approved July 28, 1956, as amended by Public Law 87-874 of the River and Harbor Act approved October 23, 1962. Under that law, Federal contribution toward cost of construction of protective works along publicly owned shores is authorized up to one-half of the cost, except as follows. Federal participation in the cost of a project for restoration and protection of State, county and other publicly owned shore parks and conservation areas may be, in the discretion of the Chief of Engineers, not more than 70 percent of the total cost exclusive of land costs, when such areas meet the following requirements: (1) Include a zone which excludes permanent human habitation; (2) include but are not limited to recreation beaches; (3) satisfy adequate criteria for conservation and development of the natural resources of the environment; (4) extend landward a sufficient distance to include, where appropriate, protective dunes, bluffs, or other natural features which serve to protect the uplands from damage; and (5) provide essentially full park facilities for appropriate public use, all of which shall meet with the approval of the Chief of Engineers. Costs allocated to the restoration and protection of Federal property shall be borne fully by the Federal Government. Privately owned shores are eligible for Federal aid if there is benefit such as that arising from public use or from the protection of nearby public property, or if the benefits to the shores are incidental to the project, and the Federal contribution to the project is adjusted in accordance with the degree of such benefits.

13. Periodic nourishment of the restored beach is considered to be the most suitable and economical method of providing continued protection, and such nourishment should be construed as construction eligible for Federal aid. Furthermore, it is considered that such aid should be limited to a period of 10 years to permit benefits and beach erosion control techniques to be reevaluated.

14. The shore considered for restoration is publicly owned. The frontage of the Mayport Naval Station (5,700 ft.) is Federal property and the costs for improving it are apportioned wholly Federal. The

entire length of ocean beach, east of the seawalls or the toe of dune, from the south limit of Mayport Naval Station to the Duval-St. Johns County line is non-Federal public property. A 1925 Act of the State of Florida legislature declared portions of the beaches of Duval County to be a public highway, but subject to the paramount right of the public to use them for bathing and recreation. Vehicular traffic along the beach is restricted at times in the interest of public safety. In practice and in actuality, all of the beaches in Duval County are open to the general public at all times except for the frontage of the United States Naval Station at Mayport. Unrestricted access to the beach is by ramps, and by numerous street ends which are open to the general public. The Board of County Commissioners of Duval County has furnished its written intent to keep the beaches east of the seawalls or toe of dunes public.

15. The anticipated benefits exceed the estimated costs and therefore the considered improvement is economically justified.

16. Computation of cost apportionment.--a. Project costs subject to apportionment.--

Item	First costs	Annual costs (1)
Beach restoration and nourishment-------	$4,090,000	$563,000
Lands, easements, and rights-of-way-----	50,000	2,000
Total----------	4,140,000	565,000

NOTE: (1) See table E-2 for detailed breakdown of annual costs.

b. Annual project benefits (see appendix F).--

Source	Amount
Beach restoration and nourishment------	$1,051,000

c. Basis of cost apportionment.--Basis of cost apportionment as classified under terms of Public Law 87-874 is shown in Table E-3. Lands, easements, and rights-of-way, including acquisition costs, are local interests' responsibility and shall be provided without cost to the United States. The Federal share of periodic nourishment costs will

be increased over the amount based on Public Law 87-874, due to navigation benefits accruing to an authorized Federal navigation project. Basis for that additional Federal aid is presented in the next subparagraph, following table E-3.

TABLE E-3

Basis of apportionment

Reach	Length (feet)	Percent of improved beach	Percent of Federal participation
	First cost		
Publicly owned Federal---	5,700	10.8	10.8 x 1.0 = 10.8
Publicly owned non-Federal-	47,300	89.2	89.2 x 0.50 = 44.6
Total---------	53,000	100	55.4
	Annual cost		
Publicly owned Federal--	5,700	10.8	10.8 x 1.0 = 10.8
Publicly owned non-Federal-	47,300	89.2	89.2 x 0.50 = 44.6
Total---------	53,000	100	(1) 55.4

NOTE: (1) To be increased due to navigation benefits; see subparagraphs d and e.

d. Reduction of Federal cost of maintaining authorized navigation project.--Obtaining 100,000 cubic yards of material annually for periodic nourishment from shoaling in the Pilot Town and Bar Cuts of the Federal navigation project for Jacksonville Harbor would reduce the annual maintenance dredging costs by an estimated $40,000. The increase in the Federal share of the cost of nourishing the reach represented by the 100,000 cubic yards is determined on a proportionate benefit basis. The total Federal share of the cost (T) for the feature which results in the navigation benefits (100,000 cubic yards of nourishment for 20,400 feet of shore from the south jetty to the northern limit of Atlantic Beach) is computed as a percentage of the total first cost for that feature by application of the following formula:

$$T = \frac{N}{Nt} \times 100 + \frac{(Nt - N)}{Nt} \times T_e$$

where: N = Navigation benefits of feature
Nt = Total benefits of feature
T_e = Federal share of cost of feature which results in navigation benefits in percent computed as in table E-3

The navigation benefits of the feature are $40,000 annually. Beach erosion control benefits in the 20,400-foot reach anticipated as a result of both initial restoration and periodic nourishment are $10,900 from prevention of loss of land, $9,700 from enhancement of property values, $25,000 from prevention of damages, and $197,000 from recreation; or a total of $242,600. Beach erosion control benefits creditable to the feature are those accruing from nourishment only. For the purposes of this computation, it is assumed that each increment of beach fill, whether placed initially during the beach restoration or later as periodic nourishment, would produce an equal amount of benefits. Therefore, beach erosion control benefits of the feature (periodic nourishment) are computed as follows.

Initial restoration (jetties to Atlantic Beach)	=	800,000 cu. yds.	-15.1%
Nourishment (50 yrs. x 90,000 cu. yds.)	=	4,500,000 cu. yds.	-84.9%
Total		5,300,000 do.	100%

84.9% x $242,600 = $206,000

Total benefits of the feature (Nt) are $206,000 + $40,000, or $246,000. The Federal share of the cost of the feature computed as in table E-3 is:

Public property (Federal)	5,700	27.9% x 1.00 =	27.9%
Public property (non-Federal)	14,700	72.1% x 0.50 =	36.1%
Total	20,400		64.0%

Application in the formula results in the total Federal share for the feature:

$$T = \frac{40,000}{246,000} \times 100 + \frac{(246,000 - 40,000)}{246,000} \times 64.0 = 69.9\%$$

e. Adjustment of the Federal share of nourishment costs for the entire reach to reflect the increase due to navigation benefits is as follows:

20,400 feet, or 38.5% of total at 69.9%	=	26.9%
32,600 feet, or 61.5% of total at 50%	=	30.8%
53,000		57.7%

17. Apportionment of first cost.--

Item	First cost subject to apportionment	Non-Federal		Federal	
		Percent	Amount	Percent	Amount
Beach restoration----------	$4,090,000	44.6	$1,824,000	55.4	$2,266,000
Land, easements, and rights-of-way----------	50,000	100	50,000	0	0
Total-------	4,140,000	45.3	1,874,000	54.7	2,266,000

18. Apportionment of annual nourishment costs.--

Item	Annual cost subject to apportionment	Non-Federal		Federal	
		Percent	Amount	Percent	Amount
Periodic beach nourishment---	$400,000	42.3	$169,000	57.7	(1)$231,000

NOTE: (1) This Federal share would be for the first 10 years of project life, after which benefits and techniques would be reevaluated.

BEACH EROSION CONTROL STUDY

DUVAL COUNTY, FLA.

APPENDIX F

ESTIMATES OF BENEFITS

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BEACH EROSION CONTROL STUDY
DUVAL COUNTY, FLA.

APPENDIX F

ESTIMATES OF BENEFITS

1. General.--Sections of the beaches of Duval County have eroded severely in the past 100 years. The problem is one of restoring some sections to a semblance of their former dimensions and preserving or protecting others, thereby protecting existing shore structures and upland property, and of providing adequate beach areas for recreational purposes. Benefits computed herein are based on the partial restoration and preservation of the beaches, and thereby the protection of existing shore structures and upland property, the promotion and encouragement of the healthful recreation of the people, and, incidentally, on the improvement of shore property and increased values resulting therefrom. Estimates of monetary benefits are based on fall 1964 price level. Analysis is as prescribed by paragraph 1-111 of Part CI, Chapter 1, Engineering Manual for Civil Works Construction; and Engineering Manual 1120-2-108, Beach Erosion Control Benefits; and is based on the plan of improvement described in paragraph 55 of the report. All evaluated benefits would occur in Duval County.

2. Benefits from prevention of damages.--Damages or losses due to shore erosion include loss of recreation beach area, loss of unprotected land and loss of or damage to development features, such as seawalls, buildings, roads, access ramps to the beach, and other structures. Benefits which would result from prevention of those damages are discussed in the following paragraphs.

3. Loss of land.--Benefits credited to the plan would consist of direct prevention of loss of unprotected land due to erosion. Erosion is occurring throughout the reach of county shores south of St. Johns River. The upland property west of the public beach at Atlantic, Neptune, and Jacksonville Beaches is protected by a nearly continuous seawall or revetment. Benefits from prevention of loss of land from the public beach seaward of the existing seawall are not claimed as that would duplicate recreational benefits accruing to that zone and evaluated in succeeding paragraphs of this appendix. Benefits from prevention of loss of land in the unincorporated area between the Mayport Naval Station and Atlantic Beach are claimed due to the fact that the land is unprotected, and privately-owned land is being lost from the dunes west of the public beach. The general

public is restricted from usage of the Mayport Naval Station beaches and, therefore, loss-of-land benefits are claimed in lieu of recreational benefits.

4. The area of land which would be lost without the project over the period of evaluation (50 years) was estimated on the basis of the historical rate of shore and dune recession. The anticipated damages due to loss of land were computed as the market value of the average area expected to be lost annually. Land evaluations are based on a limited investigation of county records and discussion with local realtors.

5. Implementation of the plan of initial partial restoration and future periodic nourishment would prevent further loss of land at Mayport Naval Station and at the unincorporated area immediately to the south. The average shore-recession rate of the 5,700-foot ocean frontage of the Mayport Naval Station over the period 1923 - 1963, based on measurement at 1,000-foot intervals, has been 1 foot a year. The average dune-recession rate, based on shoreline recession, for the 10,100-foot reach of unprotected land south of Mayport Naval Station has been 2.9 feet a year. The average land value is $125 a linear foot, based on 300- to 500-foot depths, or $0.31 a square foot. Benefits from prevention of loss of land are therefore 5,700 x 1 x $0.31 = $1,800 annually, public (Federal), and 10,100 x 2.9 x $0.31 = $9,100 annually, private.

6. Damages to development.--Severe northeast storms and, at times, hurricanes have caused great damages to the beaches and oceanfront property in the study area south of St. Johns River. The 1925 storm destroyed most of the timber bulkheads that had been constructed during the Florida boom. During the 1932 storm the beaches dropped in elevation about 3 feet, many houses were undermined, ramps were destroyed, and many of the timber seawalls which had been constructed since the 1925 storm were destroyed. With the loss of houses and oceanfront property, Manhatten Beach--a developed subdivision north of Atlantic Beach--became extinct during that storm. A hurricane in 1944 eroded some of the shoreline landward approximately 150 feet and vertical erosion at Atlantic Beach was as much as 3 feet. Beach sand was washed from under all concrete ramps, rendering most of them unusable. Some concrete seawalls were damaged. The 1947 northeast storm was exceptional, not only for its severity but for its unusual duration (13 days). About 5,760 linear feet of concrete seawalls were destroyed, and 6,800 linear feet of walls were damaged. The beach was lowered as much as 5 feet, several dwellings were lost, and six ramps were damaged or destroyed. It was estimated that the storm eroded about 130,000 cubic yards of fill from back of the seawalls. Damage from the 1956 storm consisted chiefly of lowering the elevation of

the beaches and some structural damage to seawalls, ramps, and foundations. Damages from the 1962 northeast storm were so great that Jacksonville Beach and Neptune Beach were declared disaster areas, and emergency relief measures were provided with Federal funds. Damages from the 1962 storm essentially consisted of beach-material loss and expenditure of Navy labor and equipment at Mayport Naval Station; damage to seawall joints and loss of beach and backfill from Atlantic Beach; destruction of 2,500 feet, severe damage to 2,500 additional feet and minor damage to 1,800 feet of seawall, and loss of beach and backfill at Neptune Beach; and destruction of 3,300 feet, severe damage to 700 feet and minor damage to 12,500 feet of seawall, and loss of beach and backfill at Jacksonville Beach. In addition, emergency labor, equipment, and material expenses were incurred throughout the area.

7. Hurricane Dora, in September 1964, caused such severe and extensive erosion damage that the Duval County beaches were declared a disaster area and are being provided with Federal emergency relief measures. Erosion damages from Hurricane Dora consisted of severe beach and dune material loss from nearly the entire frontage of the county; severe backfill loss and washout; destruction or severe damage to 1,000 linear feet of seawall in the unincorporated area north of Atlantic Beach, 2,250 linear feet in Atlantic Beach, 1,100 linear feet in Neptune Beach and 1,700 linear feet in Jacksonville Beach; destruction of thousands of feet of sidewalks and patios behind the seawalls in the three communities; destruction or severe damage to many dwellings and large commercial establishments in the area; and destruction or severe damage to vehicular access ramps, fishing piers and other structures. Many reaches of seawalls, though still standing, were rendered virtually ineffective. The entire length of shore from near the south limit of Jacksonville Beach to about 1 mile north of Atlantic Beach, except where revetment was provided in 1963, is being revetted with granite revetment under O.E.P. authority for emergency disaster relief.

8. Total estimated damages from the storms of record, escalated to 1964 price level, are given below in chronological order. Damage from the annual northeast storm was estimated at $32,000.

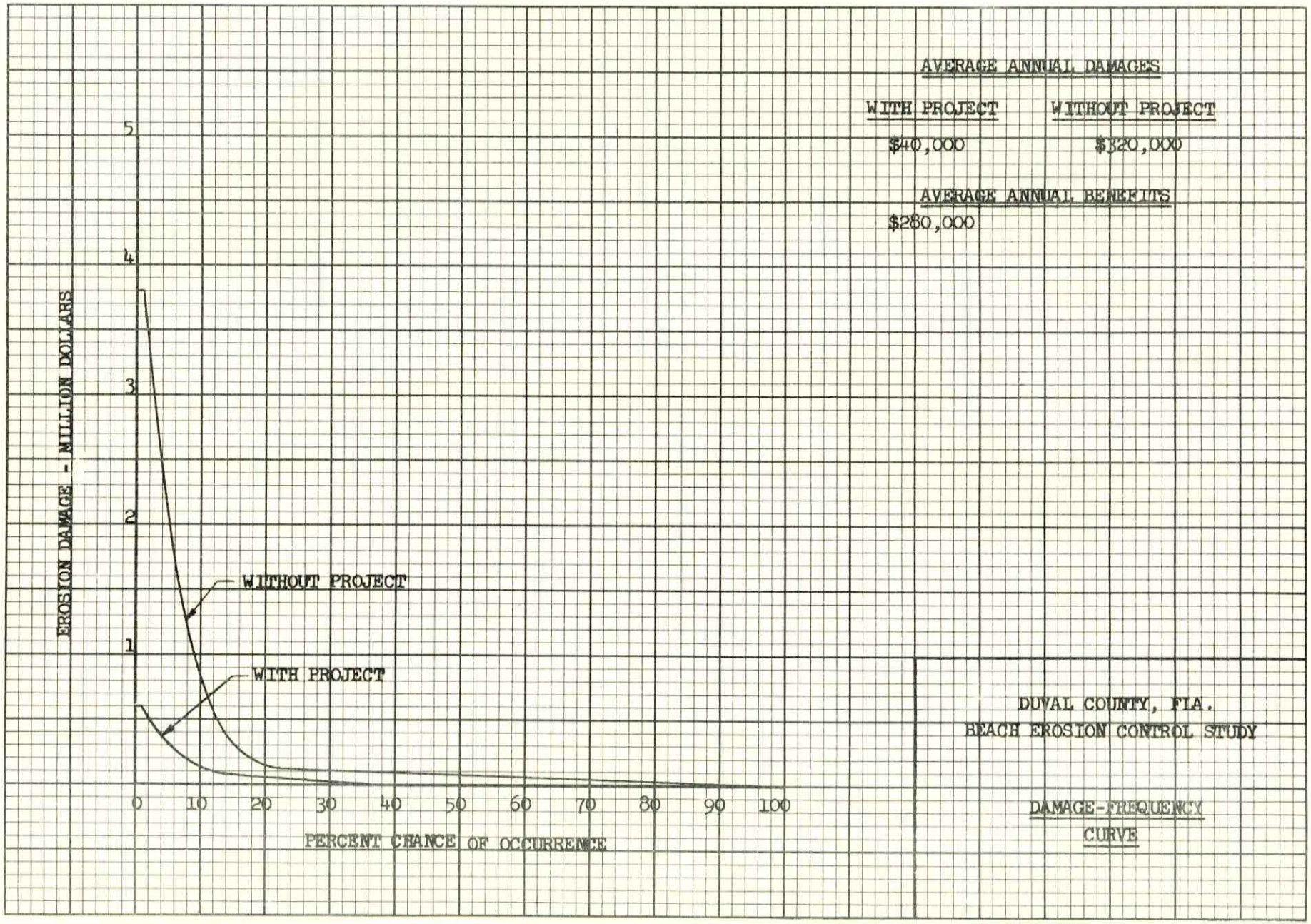
Year	Type	Original damage estimate	Original estimate escalated to 1964 price level
1925	Northeaster	$188,000	$615,000
1932	Do.	500,000	2,145,000
1944	Hurricane	65,000	167,000
1947	Northeaster	1,400,000	2,702,000
1956	Do.	324,000	398,000
1962	Do.	2,580,000	2,580,000
1964	Hurricane	3,800,000	3,800,000
Annual	northeaster	32,000	32,000

9. Damage-frequency curve.--Relationships for damage-frequency curves shown on figure F-1 were established by use of the formula $P = \frac{100\ (n-0.5)}{Y}$, where

P = percent chance of occurrence for each storm
n = number of times storm was equaled or exceeded, and
Y = years of record (in this case, 39 years).

The curves shown are for the reach from St. Johns River to the south county line, and represent nearly all damages in the entire study area; damages north of St. Johns River have not been substantial. One curve shows the total average annual damages that would be expected without the project, based on past storm damages and occurrence and fall 1964 price level. The other curve shows the average annual residual damages with the project (beach restoration and periodic nourishment).

10. Average annual damage-prevention benefits.--Average annual damages without the project equal $320,000. Residual damages with the project equal $40,000. Therefore, the average annual benefits with the project equal $280,000. That amount, considering the physical characteristics of the shore, and public and private property immediately west of the public beach, consists of $20,000 Federal benefits, about $52,000 non-Federal public benefits, and about $208,000 private benefits. About $25,000 in benefits are anticipated from the reach between St. Johns River and Atlantic Beach, and the remaining $255,000 from Atlantic, Neptune, and Jacksonville Beaches.



(R 1-4-65) FIGURE F-1

11. Benefits from enhancement of property values.--Enhancement benefits attributable to the considered improvements are the increased direct primary benefits from use of land for an economically higher state of development than would occur without the improvements. Such benefits would result from higher utilization of land, made feasible by increased safety of investments in improvements or in development. There are about 10,100 linear feet of privately-owned property immediately west of the public beach in the reach between Atlantic Beach and Mayport Naval Station that is now relatively undeveloped and valued at about $125 a linear foot. Full development of the area has been hampered to an extent by excessive dune recession and threat to development during severe storms. Therefore, with the project, it is reasonable to assume that the area will be developed in the future to the extent and value of the adjacent area to the south--Atlantic Beach--at $250 a linear foot. However, it is considered that out of the total increase in value of $125 a linear foot only about 25 percent or $31 a linear foot is attributable to the elimination of the threat of erosion. The increase in land value attributable to the project is 10,100 linear feet x $31 a linear foot, or about $310,000. The annual return on that amount invested at 3-1/8 percent is $9,700, which is the annual private benefit creditable to the project.

12. Recreational benefits.--a. General.--Estimated recreational benefits are based on the preservation of or the increase in the use of shorefront recreational facilities which would be possible and expected if the considered improvements are provided. Evaluated benefits are limited to those accruing to beaches considered for improvement. The public benefits that would be derived from the preservation of or the increase in beach visitations are evaluated in terms of the cost to each patron for that form of recreation, and also in terms of and benefits from competing forms of recreation. A value of $0.75 for each visit to the beaches in the study area, for which benefits were evaluated, was used in accordance with EM 1120-2-108. The basis for assigning a value of $0.75 a visit is presented in subparagraph b, below.

b. Present conditions.--The entire length of the Duval County shore east of the seawalls and east of the toe of dunes is a public beach and, except at Mayport Naval Station, is open to the public for recreation purposes. The Mayport Naval Station beach is used only by Navy personnel and their guests, and recreational benefits thereon were not evaluated. Access to the public beach seaward of the existing seawalls or toe of dunes is provided by numerous street ends, vehicular and pedestrian ramps, and north-south movement along the beach. Available for recreation purposes are: Little Talbot Island State Park, a park and

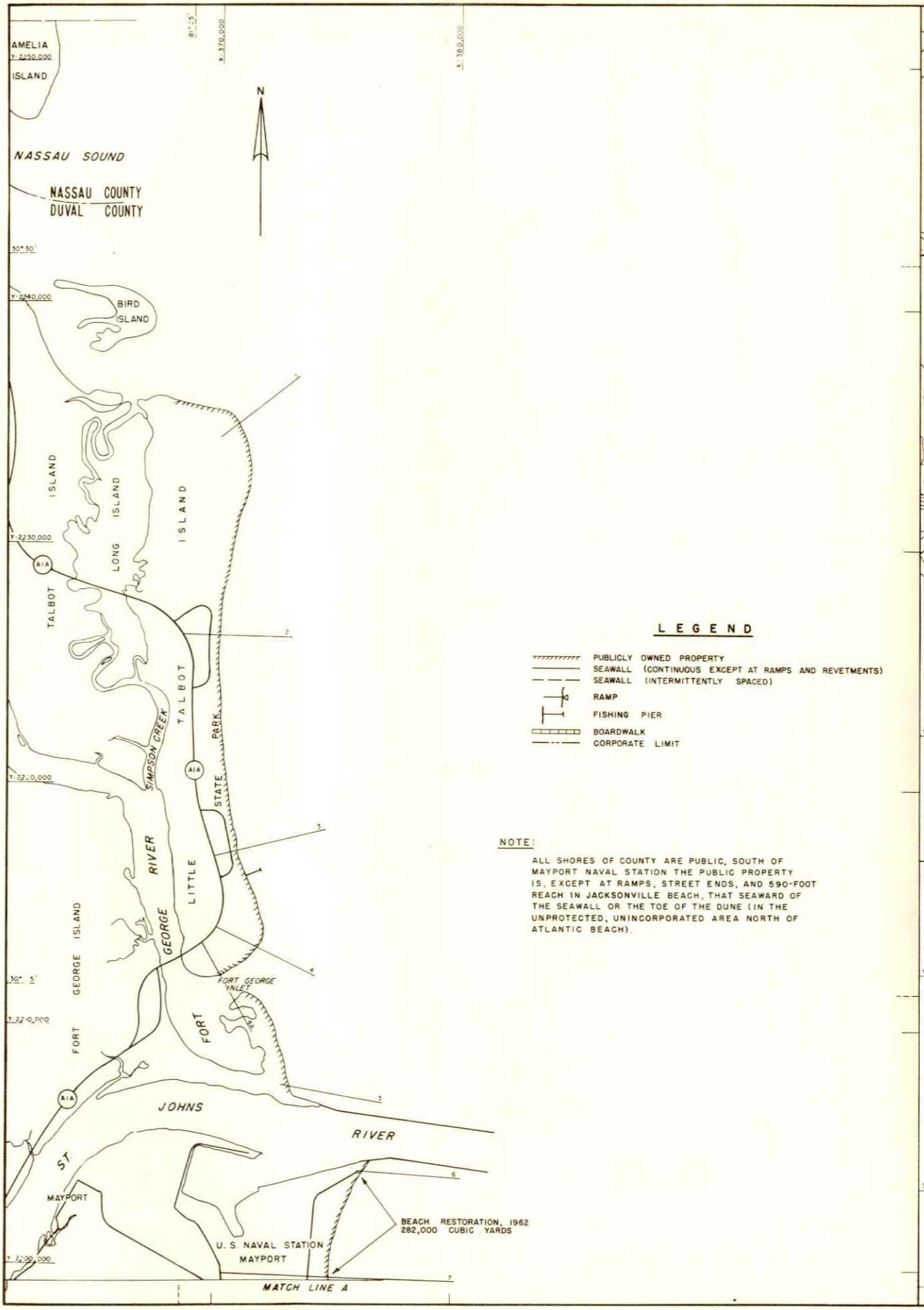
conservation area north of St. Johns River with full facilities; the county beach, in an unincorporated area between Mayport Naval Station and Atlantic Beach, recently improved by provision of access ramps and facilities and designated Chosen Beach; and the beaches of Atlantic Beach, Neptune Beach and Jacksonville Beach. The beaches are highly developed and provide practically every recreational service and convenience, including picnic areas, lifeguards, parking areas, and concession facilities. The Federal, state, county and municipal segments of the shore are shown on Figure F-2.

c. Present beach use and bathing attendance were based on estimates from local officials and lifeguards and on actual beach counts by District personnel. Figure F-3 shows bathing attendance at Jacksonville Beach. Custodians and local officials were interviewed and their views as to present and future needs obtained. Under present conditions the diurnal tide cycle considerably affects peak-crowd attendance.

d. Tributary area.--The Duval County beaches serve the recreational bathing needs of much of south Georgia and north Florida. Also, tourists from the entire eastern seaboard and from Canada frequent the beaches in the study area. The greatest influx of out-of-county and out-of-state visitors occurs during the two summer holidays, Independence Day and Labor Day. The area considered tributary to the beaches was established as comprising all of Duval County and certain percentages of many of the counties in northeast Florida and southeast Georgia. Also, the estimated annual tourist visitation was considered tributary. Figure F-4 shows the population curve of the tributary area.

e. Bases of projections.--Estimates of the future use of the recreational beaches are based on present and past use of the beach and on expected growth of the permanent population of the tributary area and on expected increase in the annual tourist visitation to the area. Estimates are also based on use of the entire length of available beach, south of St. Johns River, including Jacksonville Beach, Neptune Beach, Atlantic Beach, and the county beach (Chosen Beach) south of Mayport Naval Station. Density of bathers during peak crowds has been fixed at a minimum area of 75 square feet of beach for each bather. Due to the fact that some of the beach area is used for parking and driving automobiles on the beach and is therefore not at all times available for public beach use, the available beach areas with and without the project were adjusted to reflect that condition.

f. General Procedure.--Based on the present ratio of annual attendance to the tributary population and the future growth

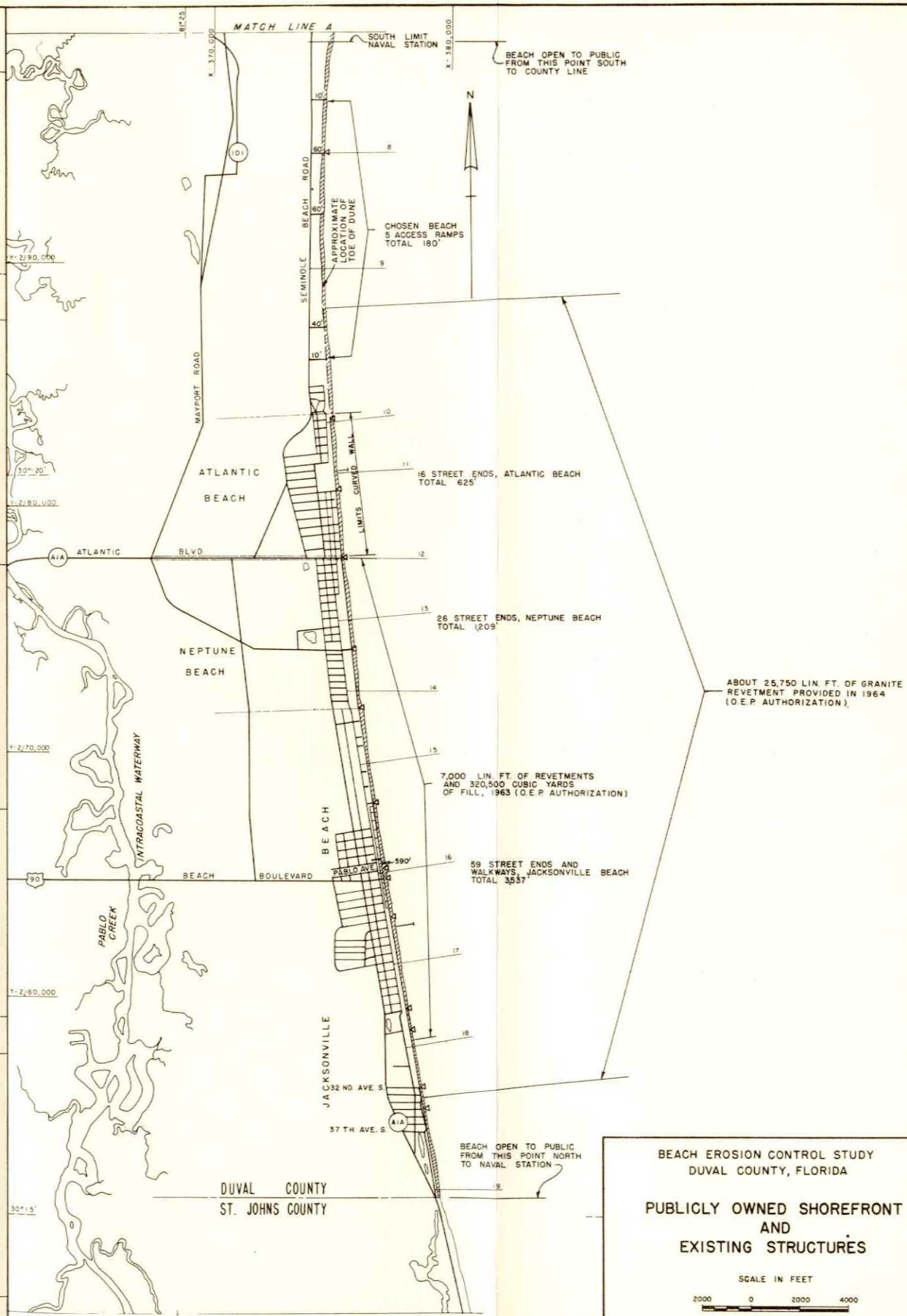


LEGEND

- PUBLICLY OWNED PROPERTY
- SEAWALL (CONTINUOUS EXCEPT AT RAMPS AND REVETMENTS)
- SEAWALL (INTERMITTENTLY SPACED)
- RAMP
- FISHING PIER
- BOARDWALK
- CORPORATE LIMIT

NOTE:

ALL SHORES OF COUNTY ARE PUBLIC, SOUTH OF MAYPORT NAVAL STATION THE PUBLIC PROPERTY IS, EXCEPT AT RAMPS, STREET ENDS, AND 590-FOOT REACH IN JACKSONVILLE BEACH, THAT SEAWARD OF THE SEAWALL OR THE TOE OF THE DUNE (IN THE UNPROTECTED, UNINCORPORATED AREA NORTH OF ATLANTIC BEACH).



BEACH EROSION CONTROL STUDY
DUVAL COUNTY, FLORIDA

PUBLICLY OWNED SHOREFRONT AND EXISTING STRUCTURES

SCALE IN FEET

2000 0 2000 4000

FIGURE F-2

ATTENDANCE AT JACKSONVILLE BEACH
LABOR DAY 1963

FIGURE F-3

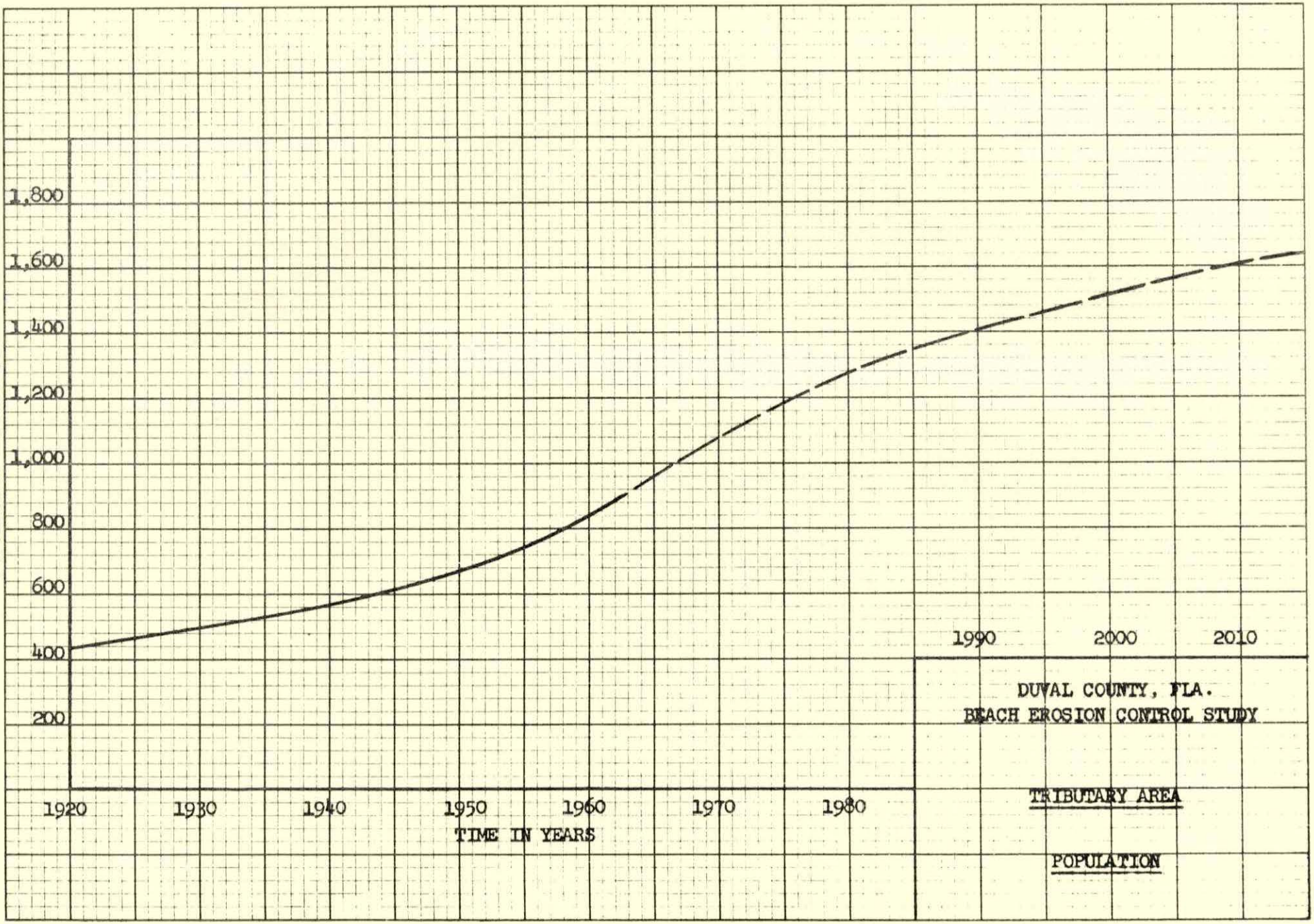

POPULATION - THOUSANDS
1,800
1,600
1,400
1,200
1,000
800
600
400
200
1920
1930
1940
1950
1960
1970
1980
1990
2000
2010
TIME IN YEARS
DUVAL COUNTY, FLA.
BEACH EROSION CONTROL STUDY
TRIBUTARY AREA
POPULATION

FIGURE F-4

of the tributary population, the future maximum possible attendance was projected ($\frac{\text{1960 attendance}}{\text{1960 tributary population}} = \frac{\text{2015 attendance; a direct ratio).}}{\text{2015 tributary population}}$

See curve 1 of Figure 5. That attendance represents the maximum number of bathers that could be expected from the tributary area if available recreational beach area were unlimited and in no way a limiting factor insofar as beach attendance is concerned. The existing beach area and capacity (75 square feet per bather) at mean high water and at mean low water, less space used for parking and driving automobiles on the beach, were determined. Future projected beach areas and capacities at mean high and mean low tide were estimated based on past beach loss rates, and were adjusted to reflect space used for parking and driving automobiles on the beach. Curves were drawn for beach capacity at various stages of tide based on past beach areas and future projected areas. See Figure F-6. In areas where capacity at high tide becomes zero due to erosion at some future date, the elevation of tide at which that condition occurred was established from the surveyed profile and the curve drawn from that point at zero capacity to the appropriate capacity at low tide. It should be pointed out that the capacity curves for the individual communities are based on long-term averages, and it should not be construed that critical short-term conditions could not or would not happen as in 1932, 1947, 1962 and 1964 when the entire beach area was eroded. The individual capacity-versus-tide-height curves were combined to form the total curve for the reach between Mayport Naval Station and the south county line, as shown on Figure F-6.

g. Assuming that present peak-hour crowds (50,000 in 1960 and 54,000 in 1963) and annual attendances (2,360,000 in 1960 and 2,544,000 in 1963) take into account all pertinent factors, such as area restrictions due to unfavorable occurrence of high tide on holidays and Sundays (peak-use time), weather, etc., present peak-hour attendance was placed on the total curve in Figure F-6 (county beach through Jacksonville Beach) and translated at the same tide elevation to the curves of various past and future years to determine peak-hour capacities for those years. The capacities at peak use were in turn used to determine the corresponding theoretical annual attendance based on present peak-hour and annual attendances. Accordingly, projected future attendance declines as the beach erodes. The 1963 peak hour, 54,000, translated to 2015 becomes 17,000. Based on the present ratio of peak-hour attendance to annual attendance $\left(\frac{17{,}000 \times 2{,}544{,}000}{54{,}000}\right)$ the theoretical annual attendance at that time and without the project becomes 800,000. Curve 2 of Figure F-5 was developed on that basis.

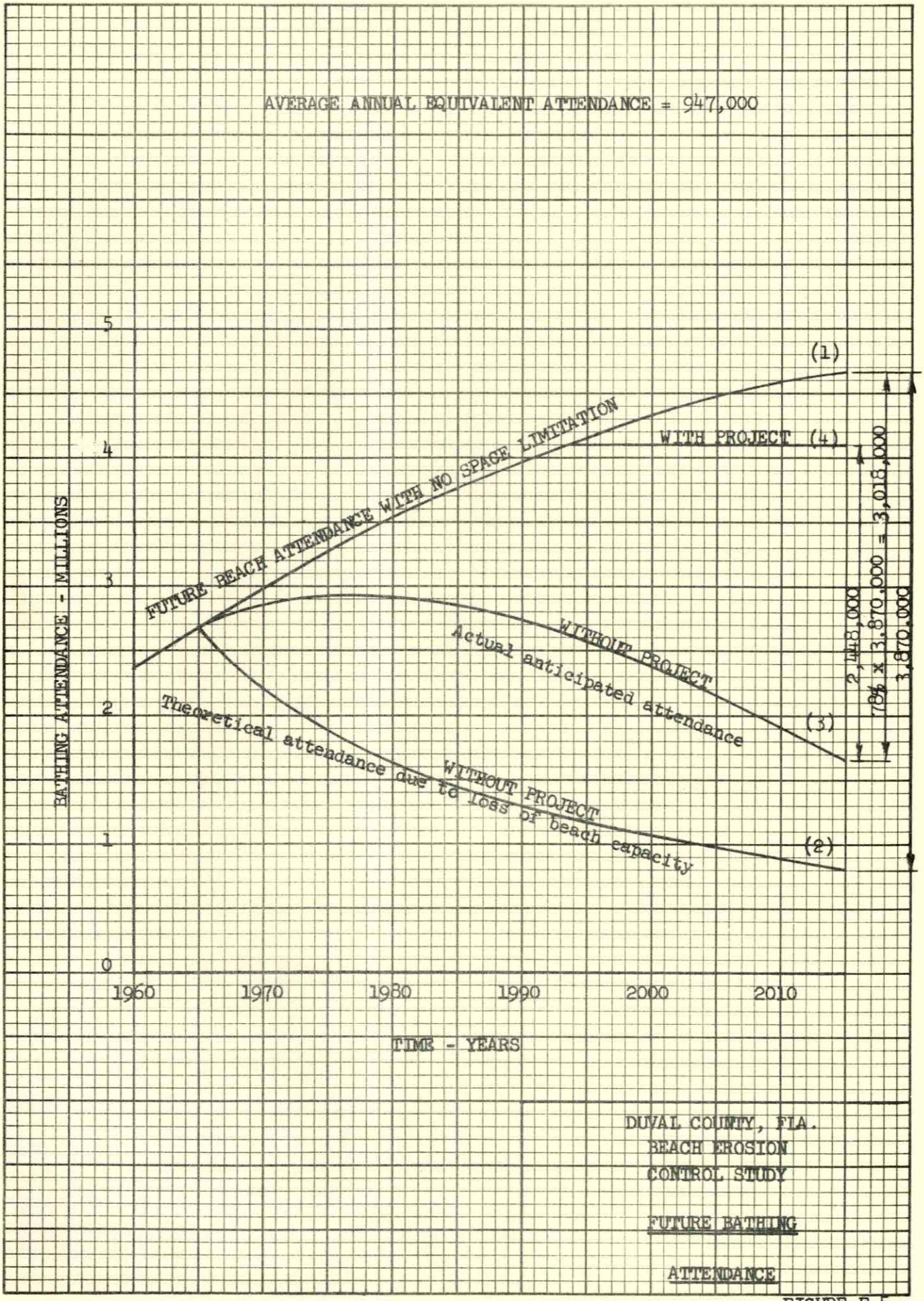
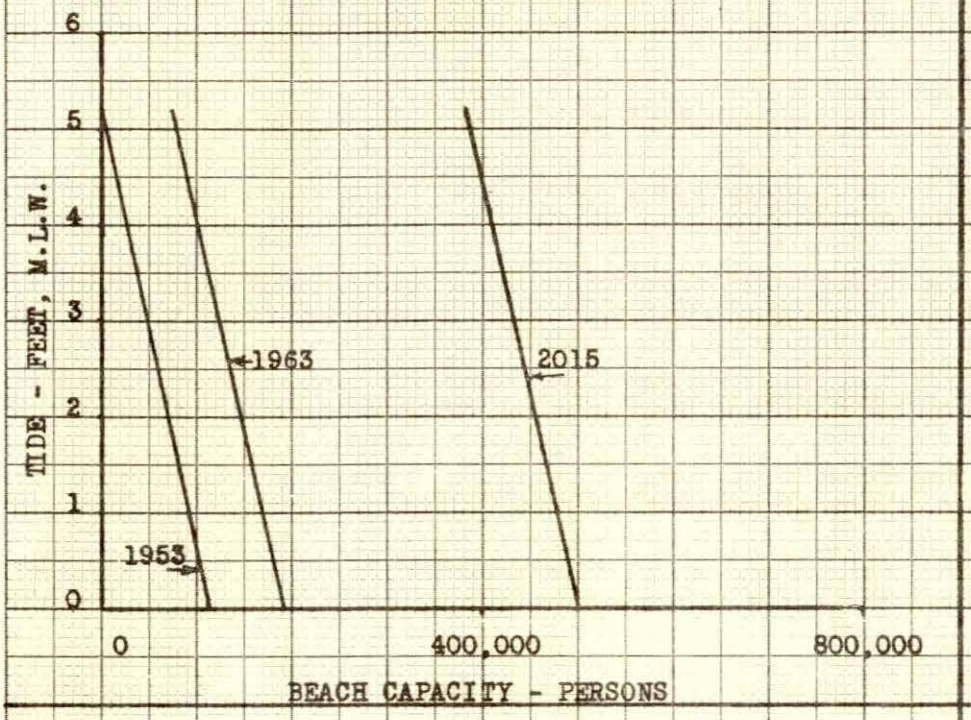
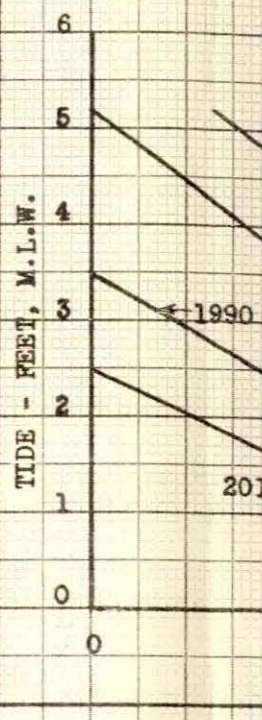

AVERAGE ANNUAL EQUIVALENT ATTENDANCE = 947,000
BATHING ATTENDANCE - MILLIONS
5
4
3
2
1
0
1960
1970
1980
1990
2000
2010
TIME - YEARS
FUTURE BEACH ATTENDANCE WITH NO SPACE LIMITATION
(1)
WITH PROJECT (4)
WITHOUT PROJECT
Actual anticipated attendance
(3)
Theoretical attendance due to loss of beach capacity
WITHOUT PROJECT
(2)
2,448,000
78% x 3,870,000 = 3,018,000
3,870,000
DUVAL COUNTY, FLA.
BEACH EROSION
CONTROL STUDY
FUTURE BATHING
ATTENDANCE

FIGURE F-5

AREA 1

LITTLE TALBOT ISLAND

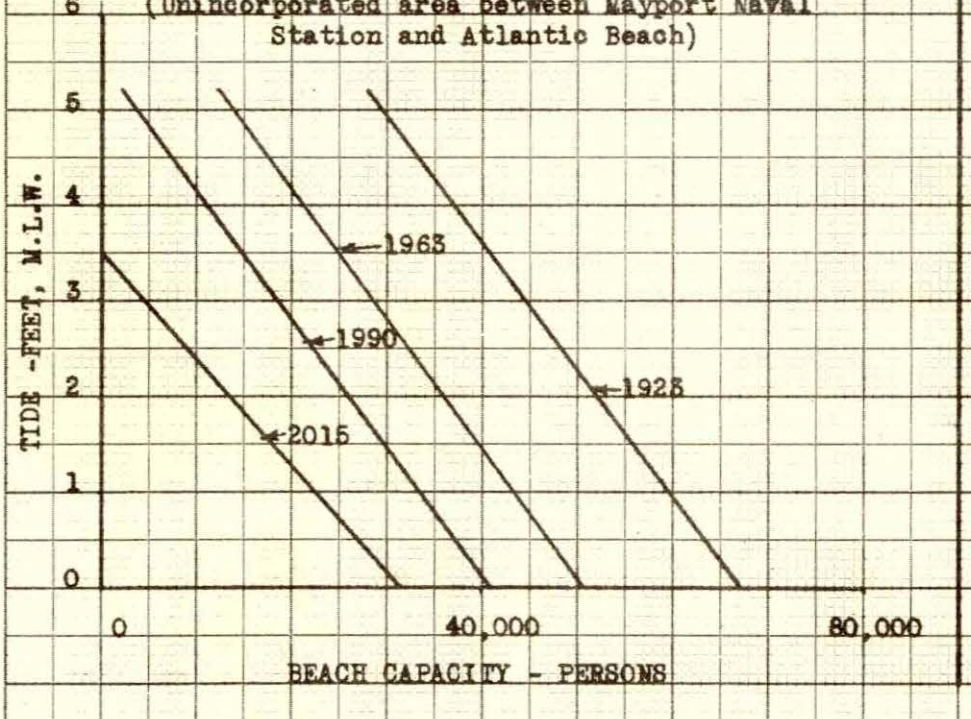


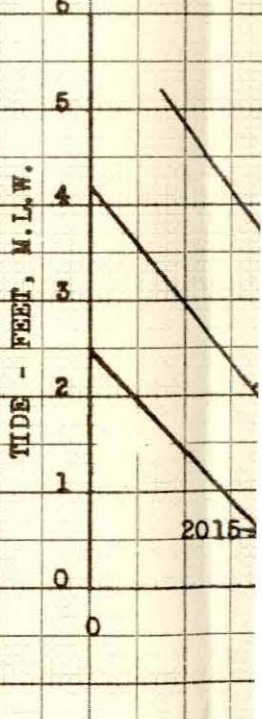


AREA 2

COUNTY BEACH

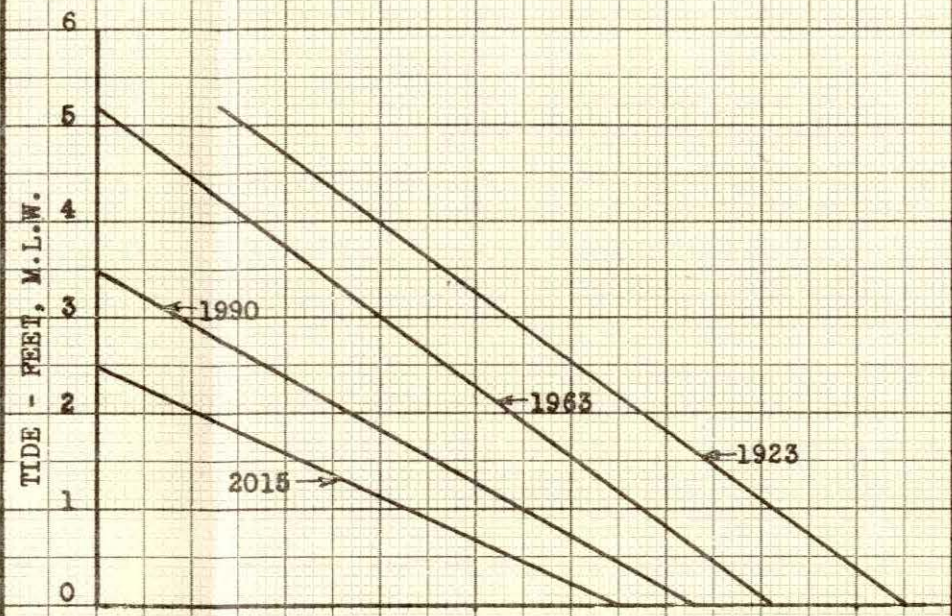
(Unincorporated area between Mayport Naval Station and Atlantic Beach)





AREA 3

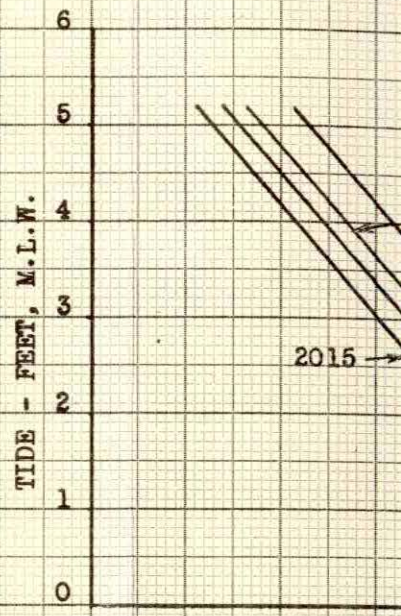
ATLANTIC BEACH



800,000 0 20,000 40,000

BEACH CAPACITY - PERSONS

JACKS



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BEACH CA

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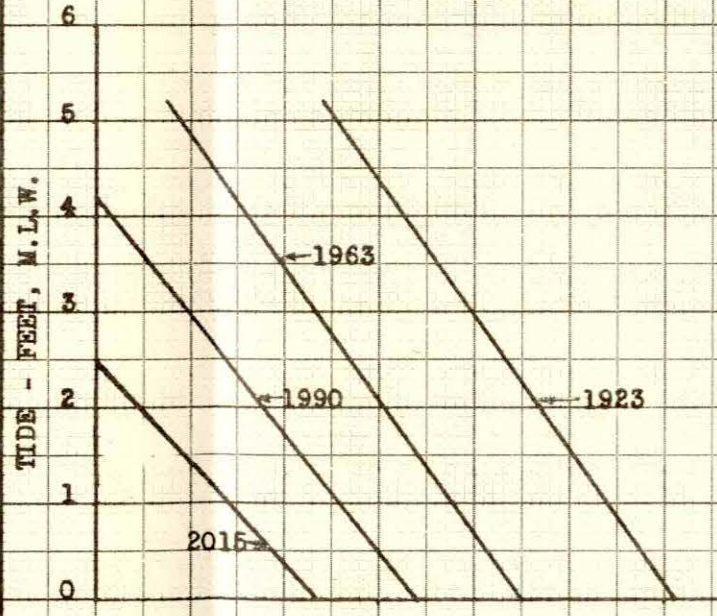
AREA 4

NEPTUNE BEACH

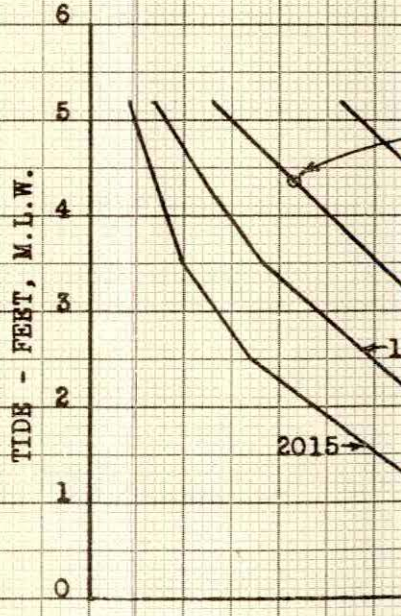


80,000 0 12,000 24,000

BEACH CAPACITY - PERSONS

COUNTY

JACKS



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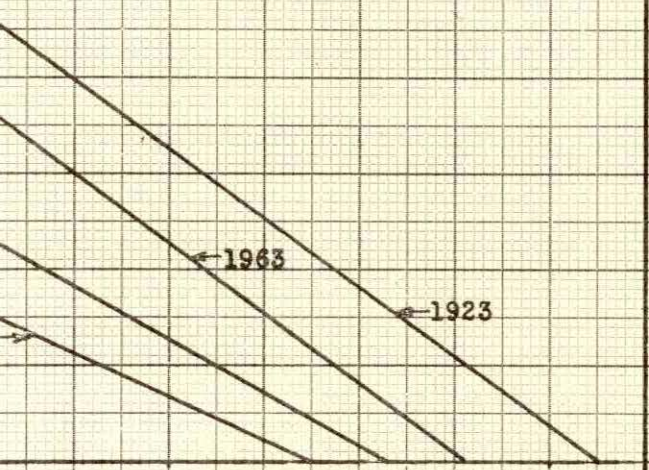
BEACH CA

BEACH CAPACITY VS. TIDE HEIGHT

AREA 3

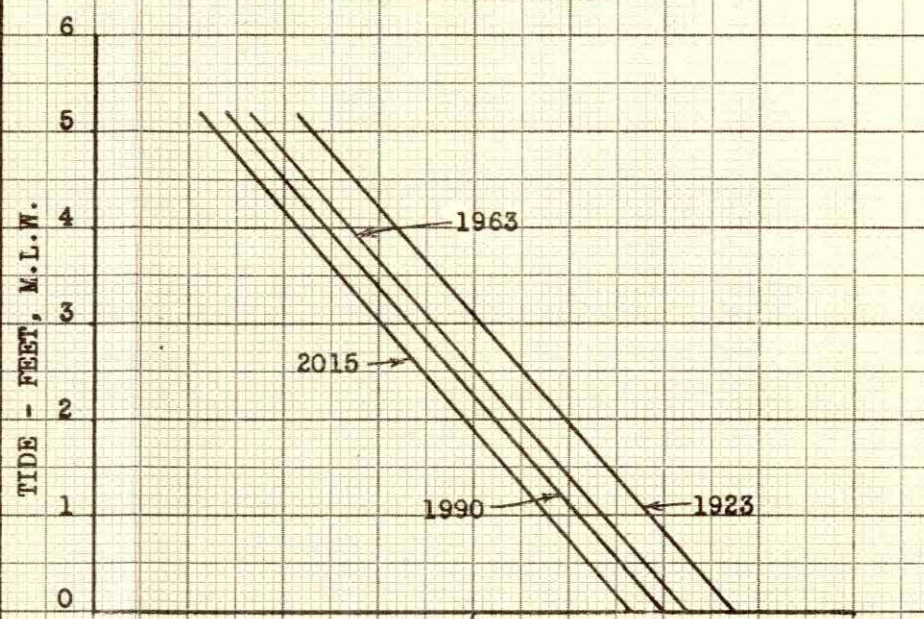
ATLANTIC BEACH



EACH CAPACITY - PERSONS

AREA 5

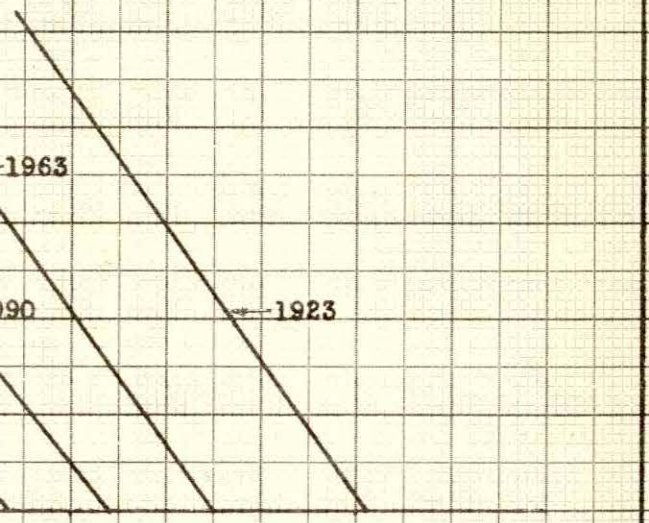
JACKSONVILLE BEACH



BEACH CAPACITY - PERSONS

AREA 4

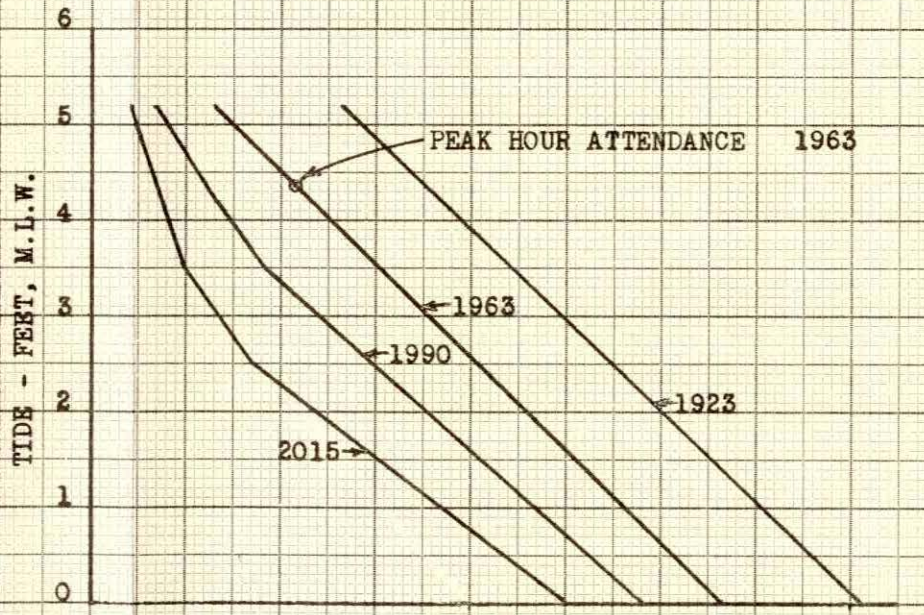
NEPTUNE BEACH



EACH CAPACITY - PERSONS

COUNTY BEACH THROUGH

JACKSONVILLE BEACH



BEACH CAPACITY - PERSONS

CAPACITY VS. TIDE HEIGHT

FIGURE F-6

h. However, due to the length of shore area involved and the varying rates of erosion along the shore, it was considered that the actual attendance would not be decreased to the same theoretical extent as the capacity, in this particular case. Reduction in beach area due to erosion indicates, from a mathematical standpoint based on the present ratio of peak-hour attendance to annual attendance and 75 square feet a bather, a substantial reduction in attendance as seen in curve 2 of Figure F-5. It is very probable that the actual attendance, due to the demand for a recreational beach in Duval County and the rest of the tributary area, would not be decreased to the same extent as shown by curve 2 of Figure F-5. The increase of attendance over the capacity would mean a change in the time pattern for beach visitation. Instead of very large crowds on Sundays and Holidays, the demand for beach visitation, due to the narrow and eroded beach, would be satisfied by smaller crowds at different time intervals.

i. For the reasons given in subparagraph h, the actual anticipated attendance curve without the project, curve 3 on Figure F-5, was determined on the basis of the percent of shore length having usable though reduced beach area after erosion. For instance, in 2015 only about 43 percent of the shore length would have any usable beach area. However, the established public demand for bathing would be such that a redistribution, in time, of bathing attendance would be expected, and the theoretical reduction would not be fully realized. Therefore, the actual reduction in attendance due to erosion (between curves 1 and 3 of Figure F-5) is estimated to be 78 percent of the theoretical reduction between curves 1 and 2 of Figure F-5; 78 percent of (4,670,000 (maximum possible attendance with no space limitation) - 800,000 (theoretical attendance)) = 3,018,000. The actual attendance without project at 2015 is then 4,670,000 less the actual reduction (3,018,000), or 1,652,000.

13. Average annual attendance with project.--To permit realization of the maximum benefit from a beach visit, the maximum attendance creditable to the project for benefits evaluation purposes is limited by the area provided by the project. That limitation is based on providing 75 square feet of beach per bather at time of peak use. The existing dry beach area is 2,560,000 square feet. Due to continuing erosion, the area in 1965 would be about 2,450,000 square feet. The increase in area due to the project would be about 4,800,000 square feet. The total area with the project is 7,250,000 square feet, and the peak-hour capacity, after adjustment for automobiles driven and parked on the beach, is 87,000.

Based on the present ratio of peak-hour attendance to annual attendance, the maximum annual attendance with the project in 2015, based on 75 square feet per bather at peak use, is 4,100,000. See curve 4 of Figure F-5. The difference between with- and without-project conditions (curves 4 and 3 of Figure F-5, respectively) most closely resembles a straight line growth curve; the maximum ordinate is 4,100,000 - 1,652,000, or about 2,448,000. The average annual equivalent attendance based on a 3-1/8-percent discount factor and 50-year life is 2,448,000 x 0.387, or 947,000. Individual benefits therefrom are evaluated at $0.75 a person. Therefore the average annual recreational benefits from the project are $710,000.

14. Benefits to Federal navigation project.--Future periodic nourishment of the restored beach would be obtained from two sources. Out of the total annual nourishment requirement about 90,000 cubic yards annually net (100,000 cubic yards gross) or enough to nourish the reach from St. Johns River to the north limit of Atlantic Beach, would be obtained from shoaling in the Pilot Town and Bar Cut portion of the Federal navigation project at Jacksonville Harbor. Reducing the maintenance dredging requirement in that portion of the navigation project would provide estimated benefits of $0.40 a cubic yard x 100,000 cubic yards, or $40,000 annually.

15. Summary of benefits.--Estimates of annual benefits divided as to type and as to Federal, Non-Federal, public, and private are presented in table F-1.

TABLE F-1

Summary of benefits

St. Johns River to south county line

Type of benefits	Federal	Non-Federal public	Private	Total
Benefits from prevention of loss of land----------	$1,800	-	$9,100	$10,900
Damages-to-development benefits----------	20,000	$52,000	208,000	280,000
Benefits from enhancement of property values-------	-	-	9,700	9,700
Recreational benefits-------	-	710,000	-	710,000
Benefits to Federal navigation project----------	40,000	-	-	40,000
Total----------	61,800	762,000	226,800	1,050,600
Round to----------	62,000	762,000	227,000	1,051,000

BEACH EROSION CONTROL STUDY

DUVAL COUNTY, FLA.

APPENDIX G

COORDINATION WITH OTHER AGENCIES

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE
PEACHTREE-SEVENTH BUILDING
ATLANTA, GEORGIA 30323

September 8, 1964

CE-SE-sf

District Engineer
U. S. Army, Corps of Engineers
Jacksonville, Florida

Dear Sir:

As requested by your letter of May 8, 1964 (SAJWR), we have examined your tentative plan for beach erosion control in Duval County, Florida. Your study was made pursuant to a resolution of the United States Senate Committee on Public Works which was adopted January 7, 1963. Our comments are submitted in accordance with provisions of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.).

The purpose of the proposed project is to provide beach nourishment to the eroded beaches south of the St. Johns River mouth. These public beaches are used for recreation by the metropolitan Jacksonville population.

The plan of development provides for dredging 18 million cubic yards of sand from three borrow areas in the Pablo Creek marshes and pumping it $1\frac{1}{2}$ to 3 miles overland eastward to the beaches (plate 1). Upon completion of the project, the borrow areas will total 500 acres dredged to a maximum depth of 35 feet. The beaches to be restored are Neptune Beach, Atlantic Beach, and the northern two-thirds of Jacksonville Beach. The plan includes provisions for maintenance of these beaches over the life of the project.

A major portion of Pablo Creek is now channelized and is part of the 12-foot-deep Intracoastal Waterway, Jacksonville to Miami. The marsh bordering the creek is typical north Florida salt marsh vegetated mainly by cordgrass and needle rush. Borrow area number 1 is on the highest ground of the three areas. It is 80 to 90 percent vegetated with needle rush and contains some cabbage palm hammocks. Borrow areas numbers 2 and 3 are close together and are 75 to 80 percent vegetated with salt marsh cordgrass; the remaining vegetation is needle rush. All three areas are interlaced with dendritic tidal creeks with bare mud edges and flats which are exposed at low tide. Intertidal areas support tremendous populations of fiddler crabs, which in turn help support populations of clapper rail numbering approximately 2 to 5 birds per acre.

Although the rails are hunted to some extent, the major value of this salt marsh is its contribution of nutrients to the adjacent estuary. Pablo Creek is an excellent fishing area for drum, trout, sheepshead, and other estuarine species. In recent years, research has indicated that the salt marshes contribute much of the nutrient base of the food chain upon which these and other species of fish depend.

Each of the borrow areas will, in effect, become 100 to 200-acre lakes within the salt marsh. With such great depths and very little littoral zone, they will become relatively unproductive brackish water sumps. They will contribute little to the estuarine system except perhaps as a refuge for fishes during extreme cold weather.

We have noted in this and other beach restoration projects which you have studied for the Florida east coast that you almost always plan for borrowing materials from adjacent lagoons, estuaries, and marshes. While we have not objected to beach restoration itself, we are seriously concerned with the continuing damages to fish and wildlife in the borrow areas. With the great length of coast involved, and the fact that rising sea level will make maintenance dredging for beach nourishment necessary at frequent intervals, coastal fish and wildlife resources stand to suffer serious damages over the lives of the several restoration projects. It is our view, therefore, that thought and study should be given to the east coast beaches and inlets as one system, and to other sources of restoration materials. This involves the dual problem of shoaling in inlets and sand transfer south across their mouths. Also to be considered are possibilities for borrowing from offshore. If borrowing from interior bays and marshes continues, the great nursery values of these bays and the nutrient production values of marshes will in time be largely destroyed despite all other efforts to save them.

Many dredging projects are planned for the Jacksonville area, including improvement of the Mayport Turning Basin, deepening of Jacksonville Harbor, and maintenance dredging of the Intracoastal Waterway. Although all of these projects are separate entities, the possibility of using spoil from them for beach restoration purposes in the present project should be explored. Some of the spoil from these projects has already been dug, and more will be dredged in the future (plate 1). Such spoil is a preferable source of sand, since there would be no new damage to fish and wildlife habitat from borrowing. The Jacksonville Harbor maintenance dredging seems to be a particularly good source of material for this Duval County project. The shoals that form in the harbor at Bar Cut, Pilot Town Cut, and Mayport Cut would seem to be an excellent source of sand over the life of the project. Since the primary littoral drift along this reach of coast is southward, transfer of sand from these shoals to the beaches south of the St. Johns River Inlet would take advantage of the natural trend.

We note that pumping distances to the beach from your presently proposed borrow areas greatly exceed your normal limit of one-fourth mile. This would also be true for the materials which might be derived from the other nearby projects, but it would seem possible to bring still greater distances into economic feasibility by a combination of work.

If it is necessary to obtain spoil from the Pablo Creek marshes, there should be sloping edges on each of the borrow pits to provide some littoral zone. It may be that the sand in this area will assume a gradual slope, but if not, the edges should have at the least a one-on-six slope to a depth of 6 feet.

Since project damages to fish and wildlife along the beach are expected to be temporary, we do not object to this aspect of the project.

Therefore, in accordance with the discussion above, we recommend that:

1. A study be made of the possibility of obtaining spoil from either future Corps of Engineers projects, especially maintenance of Jacksonville Harbor, or from piled spoil of previous projects in the immediate area, for both initial beach restoration and maintenance.

2. In the event that the planned borrow areas in Pablo Creek are used, that a gradual slope be left around the edges.

This report has been reviewed by the Bureau of Commercial Fisheries and appropriate State agencies. Copies of letters of concurrence and comment from Director Randolph Hodges of the Florida Board of Conservation and Director A. D. Aldrich of the Game and Fresh Water Fish Commission are attached.

We will appreciate your informing us of your action on our recommendations, and ask that we be advised of the final plan of improvement at the earliest possible time so that we may have opportunity to make any further comments which may be warranted.

Sincerely yours,

W. L. Towns
Acting Regional Director

Attachments 3

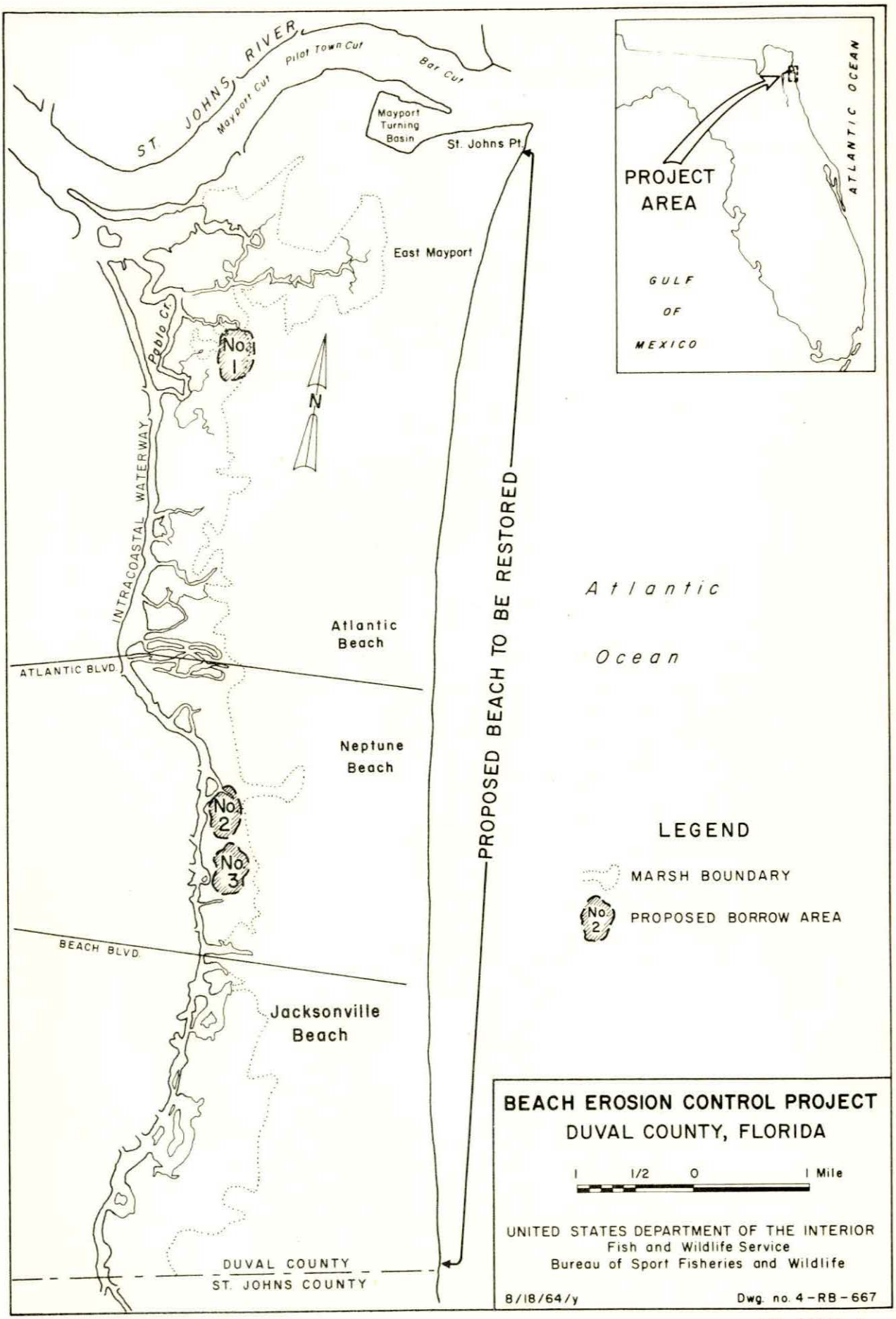

ST JOHNS RIVER
Mayport Cut
Pilot Town Cut
Bar Cut
Mayport Turning Basin
St. Johns Pt.
East Mayport
Pablo Cr.
No. 1
N
INTRACOASTAL WATERWAY
Atlantic Beach
ATLANTIC BLVD.
Neptune Beach
No. 2
No. 3
BEACH BLVD.
Jacksonville Beach
DUVAL COUNTY
ST. JOHNS COUNTY
PROPOSED BEACH TO BE RESTORED
Atlantic Ocean
PROJECT AREA
GULF OF MEXICO
ATLANTIC OCEAN
LEGEND
MARSH BOUNDARY
No. 2
PROPOSED BORROW AREA
BEACH EROSION CONTROL PROJECT
DUVAL COUNTY, FLORIDA
1 1/2 0 1 Mile
UNITED STATES DEPARTMENT OF THE INTERIOR
Fish and Wildlife Service
Bureau of Sport Fisheries and Wildlife
8/18/64/y
Dwg. no. 4-RB-667

PLATE I

STATE OF FLORIDA
GAME AND FRESH WATER FISH COMMISSION
TALLAHASSEE
32304

A. D. Aldrich, DIRECTOR
O. E. Frye, ASS'T. DIRECTOR

September 4
19-Safety-4

Mr. Walter A. Gresh
Regional Director
Bureau of Sport Fisheries & Wildlife
U. S. Fish and Wildlife Service
Peachtree-Seventh Building
Atlanta, Georgia

Dear Mr. Gresh:

We have reviewed the undated draft of your letter report on Beach Erosion Control in Duval County which was transmitted with your letter of August 21, and find that it meets with our complete approval.

Sincerely,

GAME & FRESH WATER FISH COMMISSION

By: A. D. Aldrich

A. D. Aldrich
Director

ADA/jfm

cc: Robert F. Klant

RANDOLPH HODGES, *Director*
TELEPHONE 224-7161

FARRIS BRYANT, *Governor*
TOM ADAMS, *Secretary of State*
[redacted]
RAY E. GREEN, *Comptroller*
J. EDWIN LARSON, *Treasurer*
THOMAS D. BAILEY, *Superintendent of Public Instruction*
DOYLE CONNER, *Commissioner of Agriculture*
JAMES W. KYNES, *Attorney General*

Florida *Board of Conservation*
107 WEST GAINES STREET • TALLAHASSEE 32304

27 August 1964

Mr. Walter A. Gresh
Regional Director
Bureau of Sports Fisheries and Wildlife
U. S. Fish and Wildlife Service
Peachtree-Seventh Building
Atlanta 23, Georgia

Dear Mr. Gresh:

We concur with the U. S. Fish and Wildlife Service Report on Duval County Beach Erosion Control.

Obviously efforts at mitigative measures were indicated from the size of this one project and its portent for the future in other eroded beach areas. Arthur R. Marshall has had several men working on this one. The report issued is a particularly good one because it relates beach erosion and control measures, shoaling, natural sand transfer southerly across inlets, navigational improvements, bay and ocean borrow areas, and spoiling requirements to the fate of valuable estuarine areas. Its perspective goes beyond this one project and area.

Yours very truly,

Randolph Hodges

Randolph Hodges
Director

RH/Ihj

cc: Mr. Arthur R. Marshall
Mr. K. D. Woodburn
Col. H. J. Kelly
Mr. W. T. Carlton

x 32201
SAJWR

13 October 1964

Regional Director
Bureau of Sport Fisheries and Wildlife
U. S. Fish and Wildlife Service
Peachtree-Seventh Building
Atlanta, Georgia 30323

Dear Sir:

Your comments of 8 September 1964 relative to the Duval County beach erosion control study and the considered plan of improvement have been received. You note that the Pablo Creek marshes, in which the proposed borrow areas are located, are major contributors of nutrients to drum, trout, sheepshead, and other fish species in the adjacent estuary. You also note that the proposed borrow areas will become relatively unproductive brackish water sumps and will contribute little to the estuarine system except perhaps as a refuge for fishes during extreme cold weather. You recommend a study of the possibility of obtaining material for beach restoration and nourishment from Corps of Engineers navigation projects in the area. You also recommend in the event the proposed borrow areas are used that a gradual slope of at least 1 on 6 to a depth of 6 feet be left around the edges.

A comprehensive study of the possibility of obtaining material from navigation projects in the area was made before resorting to the Pablo Creek marshes for a substantial part of the borrow. In some instances, as in Martin and Broward Counties, the proximity of a navigation project has made it possible to spoil directly on the beach. Generally speaking, however, the amount of material to be excavated within feasible pumping distances from the navigation project to the beach is quite small in comparison to the amount usually required for adequate beach replenishment. In many instances there appears to be no feasible alternative to using the adjacent lagoons, estuaries, and marshes for borrow purposes, until direct offshore pump-out methods are developed. The Corps of Engineers is continuing an intensive research and development program to enable future use of offshore sand deposits.

SAJWR
Regional Director

13 October 1964

It is now planned that maximum use will be made of shoal material in parts of St. Johns River entrance for beach nourishment. Furthermore, the current maintenance dredging contract in the Mayport Naval Basin calls for pumping material from the basin entrance channel to the beach south of the south jetty. It is expected that this method of disposal will become a regular feature of future maintenance dredging work in the basin entrance channel. Maintenance dredging in the Intracoastal Waterway through Duval County has been relatively insignificant.

In summary, we plan to obtain suitable material for beach nourishment from nearby navigation projects whenever feasible. However, an additional amount of material would still be needed from the proposed areas in the Pablo Creek marsh. Care will be taken, if and when the borrow areas are used, to insure that gradual slopes are left around the perimeter of the borrow areas.

Your comments are appreciated.

Sincerely yours,

JOE J. KOPERSKI
Chief, Engineering Division

Copy furnished:
Sen. Randolph Hodges, Director
Florida Board of Conservation
107 West Gaines St.
Tallahassee, Fla. 32304

Mr. A. D. Aldrich, Director
Game and Fresh Water Fish Commission
Tallahassee, Fla. 32304

GEORGIA
MISSISSIPPI
NORTH CAROLINA
SOUTH CAROLINA
TENNESSEE

U. S. DEPARTMENT OF COMMERCE
BUREAU OF PUBLIC ROADS
REGION THREE
828 Peachtree-Seventh Bldg.
Atlanta, Georgia 30323

May 14, 1964

District Engineer
U.S. Army Engineer District, Jacksonville
P. O. Box 4970
Jacksonville 1, Florida

Ref: SAJWR

Dear Sir:

Your letter of May 8, 1964 discusses a tentative plan for beach erosion control on the shores of Duval County, Florida.

Detailed information is not readily available in this office which indicates how highways on the Federal network might be affected by your proposed plans. Attached is a reproduced copy of your map on which we have shown the approximate location of two Federal-aid routes in the vicinity of your proposed work. The Bureau of Public Roads cooperates with the several State Highway Departments in matters pertaining to public highways. Our operating procedure is for the State Highway Department to initiate plans for construction or improvement of such highways on the approved Federal-aid Highway Systems. These plans are reviewed in our Division offices which are located in the same cities as the State Highway Departments central offices. Our Regional offices and our Washington office are advised of the findings of this review.

We envision that a protective beach described in the letter could provide protection to highways in two ways, (1) prevent waves from impinging upon the highway and, thus, subjecting it to scour, and (2) prevent the ocean waters from inundating the highway and, thus, depositing sand thereon.

Very truly yours,

Rex S. Anderson
Regional Engineer

By E. D. Johnson
Regional Design Engineer

cc: Mr. J. S. Call - Florida

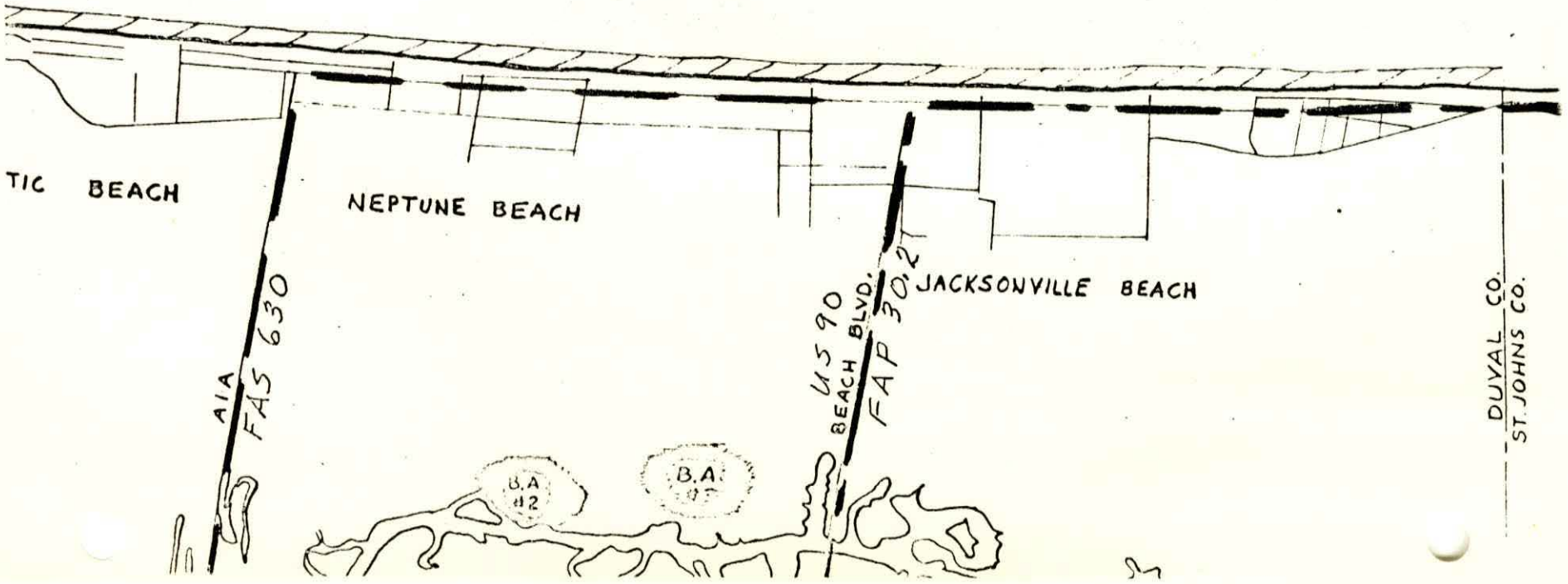
DUVAL COUNTY, FLORIDA

STUDY FOR BEACH EROSION CONTROL AND HURRICANE PROTECTION
PLAN OF PROTECTION UNDER CONSIDERATION

BEACH CONSIDERED FOR RESTORATION AND/OR NOURISHMENT

B.A. #1

POTENTIAL BORROW AREA FOR BEACH FILL. LOCATION AND EXTENT ARE APPROXIMATE.



RANDOLPH HODGES, Director
TELEPHONE 224-7141

FARRIS BRYANT, Governor
TOM ADAMS, *Secretary of State*
RICHARD W. ERVIN, Attorney General
RAY E. GREEN, *Comptroller*
J. EDWIN LARSON, *Treasurer*
THOMAS D. BAILEY, *Superintendent of Public Instruction*
DOYLE CONNER, *Commissioner of Agriculture*
JAMES W. KYNES, *Attorney General*

Florida Board of Conservation

107 WEST GAINES STREET • TALLAHASSEE 32304

May 14, 1964

Colonel H.R. Parfitt
Corps of Engineers
525 Riverside Avenue
Jacksonville, Florida

Dear Colonel Parfitt:

Re: SAJWR

In reference to plan under consideration for beach erosion control for Duval County, the Division of Beaches and Shores has no objection to the tentative plan as presented in your letter of 8 May 1964.

We would be interested, however, in receiving information on alternative plans mentioned in your letter when the same are available.

Thank you for giving us the opportunity to comment on these plans.

Sincerely,

W.T. Carlton

W.T. Carlton
Administrative Assistant
Division of Beaches and Shores

WTC:es

ALABAMA
FLORIDA
GEORGIA
MISSISSIPPI
NORTH CAROLINA
SOUTH CAROLINA
TENNESSEE

U. S. DEPARTMENT OF COMMERCE
BUREAU OF PUBLIC ROADS
REGION THREE

P. O. Box 1079
Tallahassee, Florida

May 18, 1964

REF: SAJWR

District Engineer
U. S. Army Engineer District, Jacksonville
P. O. Box 4970
Jacksonville 1, Florida

Dear Sir:

Your letter of May 8, 1964 discusses a tentative plan for beach erosion control on the shores of Duval County, Florida.

On the basis of the information presented there does not appear to be any conflict between the construction proposed and any existing Federal-aid highway.

Very truly yours,

J. S. Call
Division Engineer

William N. Ryerson
District Engineer
For the Division Engineer

HOUSING AND HOME FINANCE AGENCY
OFFICE OF THE REGIONAL ADMINISTRATOR
645 Peachtree-Seventh Building
Atlanta, Georgia 30323

REGION III

May 18, 1964

Colonel H. R. Parfitt, District Engineer
Corps of Engineers
U. S. Army Engineer District, Jacksonville
575 Riverside Avenue
Jacksonville 2, Florida

Dear Colonel Parfitt:

Subject: Duval County Beach Erosion Control Study

This is to acknowledge receipt of and to thank you for your subject memorandum of May 8, 1964.

Please be advised that the Urban Renewal Division has no urban renewal project activities at this time in the Duval County area which would be affected by the proposals under consideration as outlined in your memorandum. You may wish, however, to bring this notice to the attention of the Jacksonville-Duval County Area Planning Commission. That agency, which is of rather recent establishment, has planning jurisdiction throughout Duval County and may be vitally concerned with your proposals. Any correspondence should be addressed to Mr. Craig W. Lindelow, Executive Director, 712 Lynch Building, Jacksonville, Florida 32202.

Sincerely yours,

E. Bruce Wedge
Regional Director
of Urban Renewal

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

State Office
P. O. Box 162
Gainesville, Florida 32601

Col. H. R. Parfitt
District Engineer
U. S. Army Engineer District, Jacksonville
Corps of Engineers
575 Riverside Avenue
Jacksonville 2, Florida

File No. SAJWR

Dear Col. Parfitt:

We have reviewed your tentative plan for the Duval County Beach Erosion Study as outlined in your notice of May 8, 1964.

This is to advise you that we have no existing or proposed projects in the area; that agricultural interests are not involved; and that we have no objections or unfavorable comments to make.

We appreciate the opportunity to review the proposed works.

Sincerely yours,

J. W. Hammett
State Conservationist

cc: T. B. Chambers

FLORIDA STATE ROAD DEPARTMENT

JOHN R. PHILLIPS
CHAIRMAN

TALLAHASSEE

MEMBERS

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A. MAX BREWER	TITUSVILLE

May 20, 19-Safety-4

District Engineer
U. S. Army Engineer District, Jacksonville
P. O. Box 4970
Jacksonville 1, Florida

Re: SAJWR - Duval County

Dear Sir:

Receipt is acknowledged of notice of progress on your Duval County Beach Erosion Study. The information is being forwarded to Mr. J. A. Brewer, District Engineer, Lake City, for his information.

Very truly yours,

John R. Phillips
Chairman

By: C. J. Schenck
Engineer of Drainage

CJS:om

cc: Mr. J. A. Brewer

PUBLIC HEALTH SERVICE

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
REGIONAL OFFICE IV
Room 404 - 50 Seventh Street, N. E.
Atlanta, Georgia 30323

JUN - 1 1964

District Engineer
U. S. Army Engineer District, Jacksonville
P. O. Box 4970
Jacksonville 1, Florida

Dear Sir:

Reference is made to your letter of May 8, 1964, informing us of beach erosion studies of the shores of Duval County, Florida.

After reviewing the information contained in the letter, we find that the project as proposed will have no adverse effect on water supply and/or waste disposal practices in the area.

The Communicable Disease Center states that "From the mosquito control standpoint, precautionary measures should be taken in connection with the borrow areas. The shoreline of each borrow area should be relatively steep and the entire borrow area should be excavated to a depth that will maintain a minimum of about 3 feet of water in order to discourage the growth of emergent vegetation."

Sincerely yours,

John R. Thoman
Regional Program Director
Water Supply & Pollution Control

cc: South Atlantic Division

BEACH EROSION CONTROL STUDY

DUVAL COUNTY, FLA.

SUPPLEMENT I

Information called for by
Senate Resolution 148, 85th Congress, 1st Session
Adopted January 28, 1958

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SUPPLEMENT I

BEACH EROSION CONTROL STUDY
DUVAL COUNTY, FLA.

Information called for by
Senate Resolution 148, 85th Congress, 1st Session
Adopted January 28, 1958

1. Introduction.--The information in this supplement is furnished in response to Senate Resolution 148, 85th Congress, 1st Session, adopted January 28, 1958. That resolution calls for data in addition to that now presented in support of projects recommended for authorization and on possible alternatives thereto. Emphasis is given to reasons why alternatives are rejected in favor of recommended projects and the effects of alternative standards of evaluation, economic analysis, and cost allocation on project feasibility, scope, and cost-sharing arrangements.

2. Project descriptions and economic life.--Duval County is located on the upper east coast of Florida. The recommended project provides for the protection of the shores of Duval County through restoration of about 10 miles of beach. The reach recommended for restoration is from the St. Johns River jetties to the Duval-St. Johns County line, and would include the shores of the municipalities of Jacksonville Beach, Neptune Beach, and Atlantic Beach. The project would provide for periodic nourishment of the restored beach. In the restored reach a beach having a level berm 60 feet wide at elevation 11 feet, mean low water, would be provided. Estimated economic life is 50 years.

3. Project costs and justification.--Project costs are presented in detail in appendix E of the basic report. Tangible beach erosion control benefits would be derived from prevention of damages, from recreational benefits, from enhancement of property values, and from reduction of maintenance dredging in the Federal navigation project, Jacksonville Harbor. Project costs, benefits, justification, and Federal costs compare as follows for 50-year and 100-year project life.

Item	St. Johns River to south county line	
	50-year life	100-year life
First cost (1)	$4,140,000	$4,140,000
Interest and amortization at 3-1/8 percent	165,000	136,000
Periodic beach nourishment	400,000	400,000
Total annual costs	565,000	536,000
Annual benefits	1,051,000	1,476,000
Benefit-cost ratio	1.9	2.8
Federal share of first cost	2,266,000	2,266,000
Non-Federal share of first cost	1,874,000	1,874,000

NOTE: (1) Does not include preauthorization cost of $54,300.

4. Intangible project effects.--The proposed improvement would have no adverse effects on roads and bridges, urban renewal activities, agricultural interests, water supply, and waste disposal practices, as reported by the various concerned agencies. The Department of Health, Education and Welfare states that from the standpoint of mosquito control, precautionary measures should be taken in connection with the borrow areas. The United States Fish and Wildlife Service suggested obtaining beach fill from navigation projects in the area rather than disturb fish feeding grounds in the Pablo Creek Marshes. The Fish and Wildlife Service recommended that if borrow areas in the Pablo Creek marshes are used a gradual slope be left around the perimeter of the borrow pit. Comments of the various agencies are presented in appendix G.

5. Physical feasibility and cost of providing for future needs.--Study of protective and recreational needs of the area revealed no significant future need for improvement larger than recommended. Lesser improvement would not provide adequate recreational area or protection.

6. Allocation of costs.--Allocation of costs among functions is not involved in this report, the sole function being beach erosion control.

7. Extent of interest in the project.--Duval County, Florida, represented by the Board of County Commissioners, is the local sponsor of this study. The beach municipalities, Jacksonville Beach, Neptune Beach, and Atlantic Beach, have evidenced intense interest in beach improvement, and have assisted the reporting officers' staff on numerous occasions. The Board of County Commissioners has furnished written indication of its intent to implement the recommended project.

8. Repayment schedules.--The basic report proposes Federal construction of all project work. Construction by the Corps of Engineers would be after receipt of the local contribution, either in a lump sum or in installments in accordance with construction schedules as required by the Chief of Engineers. Repayment schedules would not be involved.

9. Effect of project on State and local governments.--The project would have negligible effect on community services and taxes.

10. Alternative designs.--a. During the course of the study, consideration was given to providing some protection by completely revetting the shore of the problem area. Provision of a granite revetment as an emergency relief measure under authority of the Office of Emergency Planning precluded further consideration of that alternative in this report. The revetment is only a partial solution to the problem.

b. Groins.--Available data do not indicate that groins would reduce periodic nourishment requirements sufficiently to justify their expense.

c. Detached breakwater off the south jetty of St. Johns River.--Local interests have requested that consideration be given to providing a current deflector at the seaward end of the south jetty, thereby returning to the shore southerly drifting sand which has been moved offshore by the jetties and the navigation channel. Local interests also requested that tanker ships, large barges or LST ships be utilized in the formation of the breakwater. While it is possible that the use of a number of LST's acting as a detached breakwater of the jetty would direct and deflect the prevailing littoral currents from shore, it is also possible that the breakwater in that position would deflect storm currents which would increase the attack on the beaches immediately south of the St. Johns River jetties. The overall effect of such a breakwater might be to increase erosion rather than alleviate it. Furthermore, the use of tanker ships, large barges or LST ships as structures in the ocean is considered impractical for many obvious reasons.