TOPSAIL BEACH

North Carolina Coastal Zone Management Office

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FEASIBILITY REPORT AND ENVIRONMENTAL IMPACT STATEMENT ON HURRICANE PROTECTION AND BEACH EROSION CONTROL

West Onslow Beach and New River Inlet, North Carolina (Topsail Beach)

DRAFT

ıber 1988

DEPARTMENT OF THE ARMY
WILMINGTON DISTRICT, CORPS OF ENGINEERS
P.O. BOX 1890
WILMINGTON, NORTH CAROLINA 28402-1890

Draft

FEASIBILITY REPORT AND ENVIRONMENTAL IMPACT STATEMENT ON HURRICANE PROTECTION AND BEACH EROSION CONTROL

WEST ONSLOW BEACH AND NEW RIVER INLET, NORTH CAROLINA (TOPSAIL BEACH)

SYLLABUS

The purpose of this study was to investigate hurricane protection and beach erosion control needs at Topsail Island and develop the most suitable plan of protection for this area. Topsail Island is a barrier island located on the central North Carolina coast. It includes the communities of Topsail Beach, Surf City, and West Onslow Beach.

This study discloses that the most practicable plan of protection for Topsail Island is a berm and dune project extending along approximately 3 miles of the oceanfront at Topsail Beach. Topsail Beach is located on the southern end of Topsail Island, near New Topsail Inlet. This is the only section of the 21.7-mile-long shoreline of Topsail Island where Federal improvements are economically justified.

The recommended plan of improvement consists of an artifical sand dune constructed to an elevation of 13 feet above mean sea level, fronted by a storm berm constructed to an elevation of 9 feet above mean sea level. The berm and dune project will extend along a reach of 17,400 feet. This length includes 10,250 feet for the main fill and 7,150 feet for a transition at the northern end of the project. At the south end of the fill, near New Topsail Inlet, a terminal groin will be constructed to control sediment losses from the fill.

The principal project accomplishment is the reduction of hurricane and storm damages. In addition, the project will enhance the quantity and quality of the beach strand available for recreation use.

First costs of the project are currently estimated at $12,480,000. Average annual costs are estimated at $1,616,000. With average annual benefits estimated at $2,401,400, the project benefit-cost ratio is 1.5.

The recommended plan of improvement is considered to be environmentally acceptable. Impacts on fish and wildlife resources will be negligible. However, Topsail Island is known to be a nesting area for the threatened loggerhead sea turtle, and this species could be affected by project construction and maintenance. Therefore, construction and maintenance activities will be timed, to the extent practicable, to avoid the turtle nesting season. If construction or maintenance occurs during the loggerhead sea turtle nesting season (1 May through 15 November), a nest monitoring and relocation program will be implemented to avoid impacts on this species.

This report was prepared in full compliance with four congressional resolutions, which pertain to West Onslow Beach, Topsail Beach, Surf City, and New River Inlet. Navigation needs at New River Inlet have been addressed under the Chief of Engineers' Continuing Authorities Program. Studies pertaining to New River Inlet have been reported in a Detailed Project Report, and are not included in this document.

DRAFT FEASIBILITY REPORT AND ENVIRONMENTAL IMPACT STATEMENT
ON HURRICANE PROTECTION AND BEACH EROSION CONTROL

WEST ONSLOW BEACH AND NEW RIVER INLET, NORTH CAROLINA
(TOPSAIL BEACH)

Table of Contents

Table of Contents--continued

List of Tables

List of Figures

List of Plates

DRAFT ENVIRONMENTAL IMPACT STATEMENT

(follows main report and report plates)

List of Appendixes

FEASIBILITY REPORT AND ENVIRONMENTAL IMPACT STATEMENT ON HURRICANE PROTECTION AND BEACH EROSION CONTROL

WEST ONSLOW BEACH AND NEW RIVER INLET, NORTH CAROLINA (TOPSAIL BEACH)

SECTION I - INTRODUCTION

The purpose of this study was to investigate hurricane protection and beach erosion control needs along Topsail Island and develop the most suitable plan of protection for this area. Topsail Island is a barrier island located on the central North Carolina coast. The beachfront along the southern portion of Topsail Island, which includes the resort community of Topsail Beach, is rapidly eroding. Several structures in this area have already been lost to erosion or relocated. Also, with no natural dune protection, Topsail Beach is highly vulnerable to hurricane overwash. A storm of moderate intensity could breach Topsail Beach in this badly eroded area, severing the island and creating a new inlet in an area which is now heavily developed. This study discloses that the most practicable improvement for beach erosion control and hurricane protection is a berm and dune project along the southern two miles of Topsail Beach. This is the only section of the 21.7-mile-long shoreline of Topsail Island where Federal improvements were determined to be economically justified. As discussed below, the authorizing resolutions also direct studies of navigation needs at New River Inlet. Navigation needs at New River Inlet have been investigated under the Chief of Engineers' Continuing Authority program, and are reported in the Detailed Project Report pertaining to that study.

AUTHORITY AND BACKGROUND

This study was conducted pursuant to four congressional resolutions, pertaining to West Onslow Beach, New River Inlet, Topsail Beach, and Surf City. However, as noted above, the primary study emphasis was directed toward beach erosion control and hurricane protection measures at Topsail Beach. The text of the authorizing resolutions is quoted below.

RESOLUTION ADOPTED 24 JUNE 1970 BY UNITED STATES SENATE

> Resolved by the Committee on Public Works of the United States Senate, That the Board of Engineers for Rivers and Harbors, created under Section 3 of the River and Harbor Act, approved June 13, 1902, be, and is hereby, requested to review the reports of the Chief of Engineers on the Inland Waterway from Beaufort to Jacksonville, N.C., and New River to Jacksonville, published as House Document Numbered 421, Eightieth Congress, on Bogue Inlet to Moore Inlet, North Carolina, published as House Document Numbered 480, Eighty-ninth Congress, and other pertinent reports with a view to determining whether any modification of the existing project is advisable at the present time, particularly for the stabilization and deepening of New River Inlet.

RESOLUTION ADOPTED 2 DECEMBER 1970 BY UNITED STATES HOUSE OF REPRESENTATIVES

> Resolved by the Committee on Public Works of the House of Representatives, United States, that the Board of Engineers for Rivers and Harbors is hereby requested to review the reports of the Chief of Engineers on the Intracoastal Waterway from Beaufort, North Carolina, to the Cape Fear River, published as House Document Numbered 450, 69th Congress, on the Inland Waterway from Beaufort to Jacksonville, North Carolina, and New River to Jacksonville, published as House Document Numbered 421, 80th Congress, on Bogue Inlet to Moore Inlet, North Carolina, published as House Document 480, 89th Congress, and other pertinent reports with a view to determining whether any modification of the existing project is advisable at the present time, particularly for the stabilization and deepening of New River and Bogue Inlet.

RESOLUTION ADOPTED 23 JUNE 1971 BY THE UNITED STATES HOUSE OF REPRESENTATIVES

> 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 of 1982, the Secretary of the Army is hereby requested to direct the Chief of Engineers to make a survey of the shores of West Onslow Beach, Onslow County, North Carolina, and such adjacent shores as may be necessary in the interest of beach erosion control, hurricane protection, and related purposes.

RESOLUTION ADOPTED 14 NOVEMBER 1979 BY UNITED STATES HOUSE OF REPRESENTATIVES

> Resolved by the Committee on Public Works and Transportation of the House of Representatives, United States, that, in accordance with Section 110 of the River and Harbor Act of 1962, the Secretary of the Army is hereby requested to direct the Chief of Engineers to make a survey of Topsail Beach and Surf City, North Carolina, and adjacent beaches and inlets, in the interest of beach erosion control, hurricane protection, and related purposes.

As indicated above, the four resolutions which provide the authority for this study direct investigations of New River Inlet, Bogue Inlet, Topsail Beach, Surf City, and West Onslow Beach (see figure 1, facing page). Studies for navigation improvement at Bogue Inlet, directed by the resolution adopted 2 December 1970 and cited above, were combined with other congressional authorities related to Bogue Banks and Bogue Inlet. A Federal project at Bogue Inlet has been constructed under the Chief of Engineers' continuing authority (Section 107 of the River and Harbor Act of 1960).

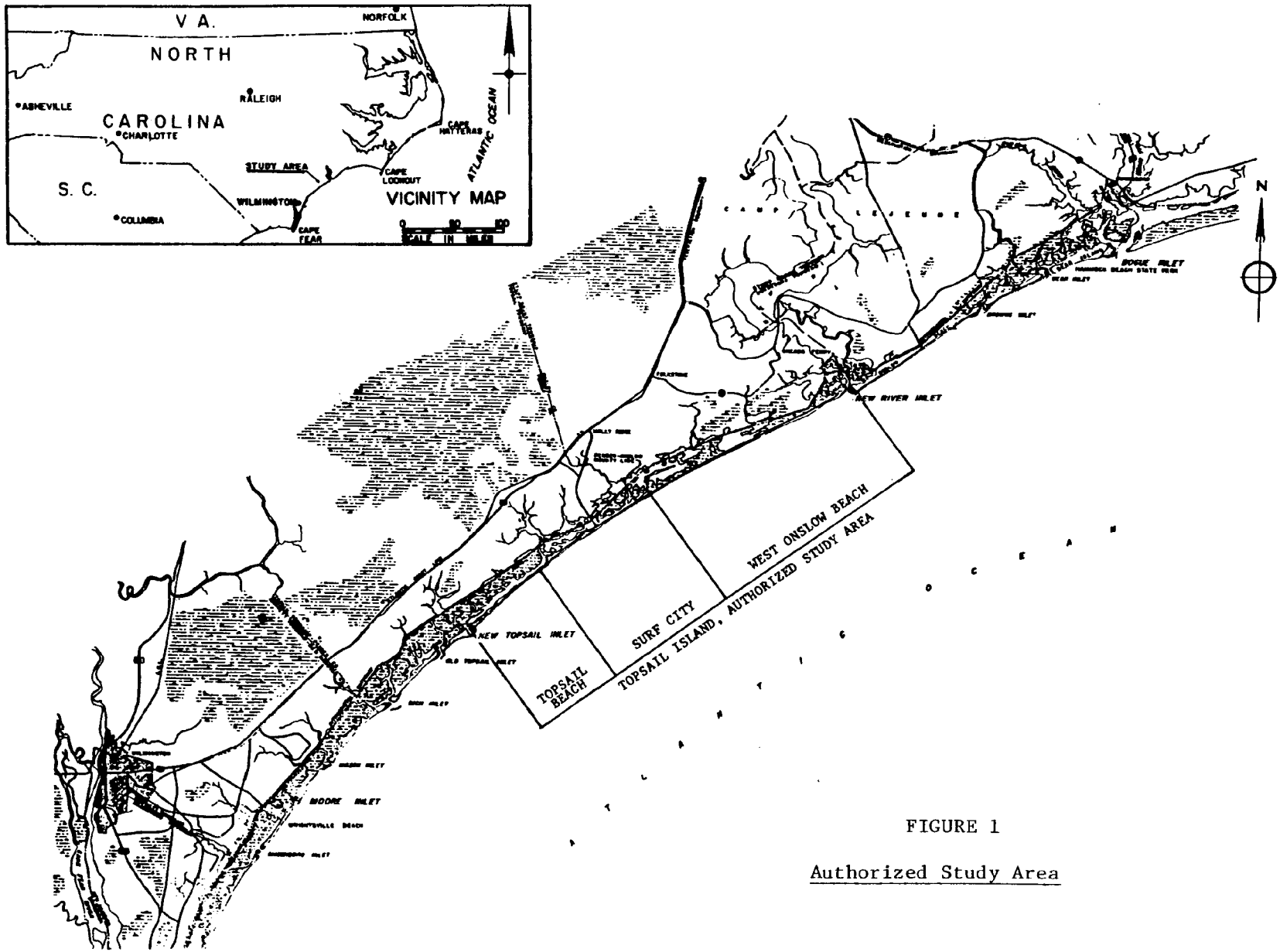


FIGURE 1

Authorized Study Area

The remaining study authorities, pertaining to West Onslow Beach, New River Inlet, Topsail Beach, and Surf City, were combined in 1980 at the direction of the Chief of Engineers, and designated the "West Onslow Beach and New River Inlet, North Carolina" general investigation study. Like Bogue Inlet, navigation needs at New River Inlet were determined to be most appropriately addressed under the Continuing Authority Program. A Detailed Project Report was prepared under this authority and is now undergoing review. This report recommends an 8-foot-deep by 150-foot-wide channel across the ocean bar at New River Inlet (see "Prior Studies," below).

SCOPE OF THE STUDY

This report presents the results of studies conducted to address the needs for erosion control and hurricane protection for Topsail Island, including the incorporated areas of Topsail Beach and Surf City and the unincorporated area of West Onslow Beach. The authorized study area is shown on figure 1, preceding page. Primary study emphasis was placed on hurricane protection and erosion control measures at Topsail Beach. This is the only location in the authorized study area where Federal improvements for these purposes appeared to be economically justified. As noted above, portions of the study authority relating to navigation at New River Inlet have been addressed under the Continuing Authority Program. Therefore, navigation needs at New River Inlet will not be discussed further in this report. This report is submitted in full compliance with the four resolutions quoted in the "Study Authority" section of this document.

PRIOR STUDIES

There have been several prior studies of Topsail Beach and adjacent waters by the Wilmington District. These studies, listed below, include one report on hurricane protection and beach erosion control, and several studies pertaining to navigation.

HURRICANE PROTECTION AND BEACH EROSION CONTROL

House Document No. 480, 89th Congress, "Topsail Beach and Surf City, North Carolina." This report, approved by Congress in 1966, presents the results of an investigation of Topsail Island conducted during the period 1963 - 1965 as part of a comprehensive study of shore protection needs for the segment of North Carolina coast extending between Bogue and Moore Inlets. With approval of this report, Congress authorized hurricane protection and beach erosion control projects for the towns of Topsail Beach and Surf City. Improvements along the northernmost 10.5 miles of Topsail Island, referred to as West Onslow Beach, were determined to be economically infeasible. The improvements authorized by this report were not constructed, and the project was deauthorized 5 August 1977. The reason for this deauthorization was that there was no apparent non-Federal interest in the project following authorization.

NAVIGATION

House Document No. 450, 69th Congress, "Inland Waterway, Beaufort-Cape Fear River." This house document, approved by Congress in 1927, authorized construction of the Atlantic Intracoastal Waterway from Beaufort to the Cape Fear River, with dimensions of 12 feet by 90 feet.

House Document No. 421, 80th Congress, "Inland Waterway from Beaufort to Jacksonville, NC and New River to Jacksonville." This house document, approved by Congress in 1948, authorized construction of a 12-foot by 90-foot channel in New River. However, the project was deferred for restudy and has not been constructed. The natural river channel is considered adequate for existing river traffiB and no improvements are being considered.

House Document 691, 75th Congress, "Channel to New River Inlet." This House Document, approved by Congress 20 June 1938, authorized construction of a 6-foot-deep by 90-foot-wide channel from the Atlantic Intracoastal Waterway through New River Inlet to the Atlantic Ocean.

"Detailed Project Report on Improvement of Navigation, New Topsail Inlet and Connecting Channels." This report, approved by the Chief of Engineers 7 April 1966, authorized construction of a channel 8 feet wide by 150 feet deep through New Topsail Inlet. A connecting channel through Banks Channel to the Atlantic Intracoastal Waterway was also authorized.

"Detailed Project Report on Improvement of Navigation, Bogue Inlet, May 1983." This report by the Wilmington District addresses navigation needs at Bogue Inlet. The recommended improvements, consisting of a channel 8 feet deep and 150 feet wide across the ocean bar, have been constructed.

"Detailed Project Report on Improvement of Navigation, New River Inlet, December 1987." This report by the Wilmington District addresses that portion of the study authority concerning navigation at New River Inlet. The report recommends deepening of the authorized navigation channel from 6 to 8 feet and widening from 90 to 150 feet. This report is now (January 1989) under review by higher authority.

EXISTING FEDERAL PROJECTS

As a result of the studies cited above, Federal navigation projects have been constructed on the watercourses which, along with the Atlantic Ocean, border Topsail Island. These existing Federal projects are summarized below and are shown on figure 2.

- Atlantic Intracoastal Waterway--Channel from Norfolk, Virginia to St. Johns River Florida, varying widths with depth of 12 feet; Beaufort to Cape Fear River Section authorized by HD 450/69/1.

- New River Inlet--Channel 6 feet deep and 90 feet wide through New River Inlet to Atlantic Intracoastal Waterway.

- New Topsail Inlet and Connecting Channels--Channel 8 feet deep and 150 feet wide through New Topsail Inlet, with connecting channels 7 feet deep and 80 feet wide to the Atlantic Intracoastal Waterway.

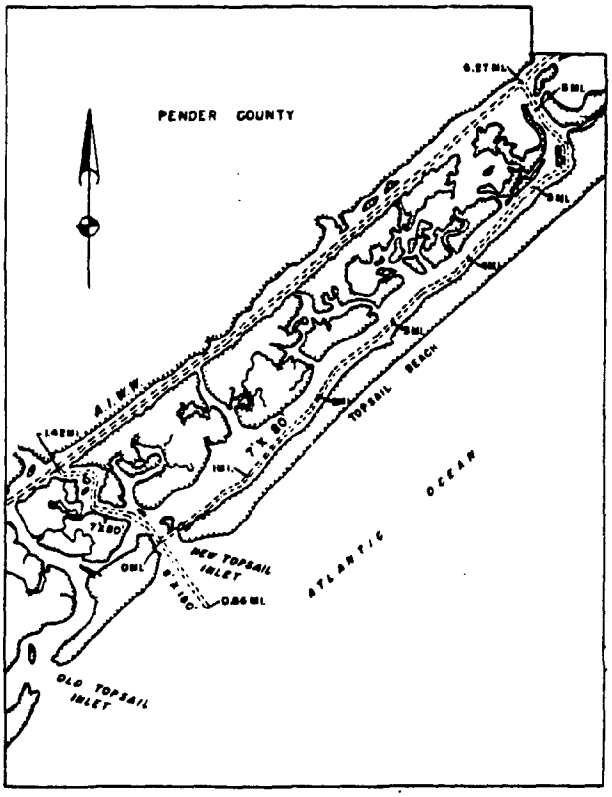


FIGURE 2A. New Topsail Inlet

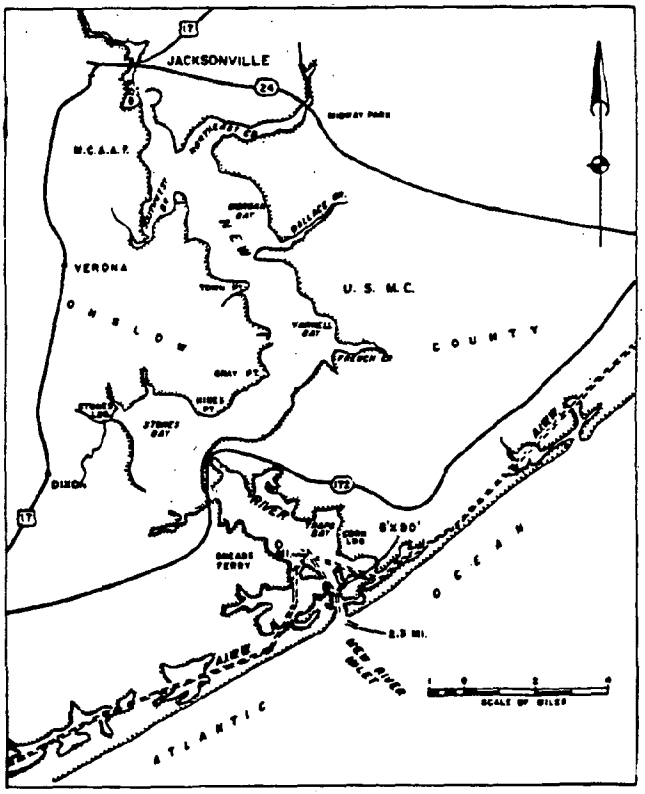


FIGURE 2B. New River Inlet

FIGURE 2. EXISTING FEDERAL PROJECTS, TOPSAIL ISLAND AND ADJACENT WATERS

STUDY PARTICIPANTS AND COORDINATION

This study has been, and will continue to be, coordinated with various Federal, State, and local agencies having concerns about hurricane protection, beach erosion control, and the environmental impacts of potential improvements. To date, coordination has consisted of informal contacts with local interests and conferences and correspondence with elected officials (see "Pertinent Correspondence," appendix A). Environmental coordination has been conducted with the U.S. Fish and Wildlife Service and the National Marine Fisheries Service. The Fish and Wildlife Service's Coordination Act Report is attached as appendix B. Coordination with these and other agencies, as well as the State of North Carolina, will continue with circulation of the draft Environmental Impact Statement which is included in this report.

SECTION II - PROBLEM IDENTIFICATION

The purpose of this report section is to identify problems, needs, and opportunities which can be adressed by the Federal Government under the authorizing resolutions (see page 1). This report section includes the following (1) an analysis of public concerns, which presents the concerns of local interests, Federal agencies, and others having interests in the study; (2) a statement of the National Objective, which outlines the criteria for Federal participation in water resources developments; (3) an assessment of Federal interest, which identifies concerns in the study area which the Federal Government can address under this objective; and (4) specification of Problems, Needs, and Opportunities, which presents a discussion of those problems for which Federal solutions appear to be potentially justified.

STUDY AREA

The "Authorized Study Area" includes Topsail Island and adjacent waters. Topsail Island, shown on figure 1, is 21.7 miles long. It includes the communities of Topsail Beach, Surf City, and West Onslow Beach. Development on Topsail Island is of fairly recent origin. Prior to 1941, Topsail Island, then called "Ashe Island," was a stock-grazing range, with no development or access to the mainland other than by boat. In 1941, the island was acquired by the U.S. Government and was used as a military reservation until 1947. A paved access road from the mainland, a drawbridge over the Intracoastal Waterway, and a paved road the length of the island were constructed by the military during the time of its occupation. After 1947, the island was returned to private ownership, and, since about 1950, has been extensively developed by private interests as a year-round residential area and a summer resort. Surf City, near the center of the island, and Topsail Beach, along the southerly section, are incorporated towns and are the most highly developed areas on the beach. Surf City covers about 5.5 miles of ocean shoreline, and Topsail Beach extends along a reach of about 4.5 miles. The northern 11.7 miles of shoreline, referred to as West Onslow Beach, are relatively undeveloped. Each of these communities is described briefly below.

TOPSAIL BEACH

Over the past 25 years Topsail Beach has developed as a family-based ocean resort community for outdoor recreation. The 1980 permanent population of Topsail Beach was 264 persons, reflecting growth of 244 percent since 1970. The most recent estimate of summer population, excluding day visitors, is 8,500. Land use is primarily recreation-oriented and residential and commercial, with highest intensity along the oceanfront and Banks Channel. With the exception of some dune areas, the entire town is subject to hurricane flooding.

Today, development at Topsail Beach is more vulnerable than ever to storms and beach erosion. Along the southern 2 miles of Topsail Beach, erosion is progressing at a rate of about 4.5 feet per year, and several structures have already been lost to erosion or relocated. The area most seriously threatened by erosion and hurricane overwash is in the vicinity of three canals on the south end of the island. These canals, shown on figure 3, page 12, were constructed by private interests in the 1970's. At its narrowest point, opposite these canals, the island has a width of only 200 feet. Based on studies conducted during this investigation, this area could be breached by a storm of moderate intensity, resulting in a new inlet being formed through an area which is now heavily developed.

SURF CITY

Like Topsail Beach, Surf City is a heavily developed resort community. This development is also subject to flooding during severe storms, and land losses due to beach erosion have occurred. However, the shoreline at Surf City is now considered generally stable, although a beach erosion hazard does exist during hurricanes and severe northeasters.

WEST ONSLOW BEACH

West Onslow Beach is not incorporated, and is a part of Onslow County; Topsail Beach and Surf City are located in Pender County. Most development on West Onslow Beach occurs on the southern half of the beach. Several condominiums are located adjacent to New River Inlet, on the northern end of the beach. As with Topsail Beach and Surf City, West Onslow Beach is located in a flood prone area. The only road along the northern half of West Onslow Beach is located just landward of the foredunes and is vulnerable to storm overwash and erosion. An obvious beach erosion and hurricane damage potential exists at West Onslow Beach. However, damage potential at West Onslow Beach was not sufficient to justify detailed consideration of Federal hurricane and storm protection and beach erosion control measures at this location.

In addition, most of West Onslow Beach is included within the "Coastal Barrier Resources System." Under current Federal law, Federal expenditures for studies and projects within this system are subject to certain constraints, as discussed below.

The Coastal Barrier Resources Act of 1982, PL 97-348, established the Coastal Barrier Resources System. The Coastal Barrier Resource System is a network of 186 units along the Atlantic and Gulf of Mexico coasts, within which most Federal expenditures are no longer available to promote economic growth or development. The stated purposes of the Act are to minimize the loss of human life, reduce wasteful expenditures of Federal revenues, and reduce the damage to fish and wildlife and other natural resources that can occur when coastal barriers are developed.

With certain exceptions, the Coastal Barrier Resources Act prohibits new Federal expenditures and financial assistance for development within the units of the Coastal Barrier Resources System. This restriction applies to such items and programs as buildings, airports, roads, bridges, causeways, piers, jetties, seawalls, water supply systems, utility lines, flood insurance, VA or FHA loans, and projects to prevent the erosion of, or to otherwise stabilize, any inlet, shoreline, or inshore area.

The major part of West Onslow Beach from New River Inlet to an area southwest of the Highway 210 Bridge across the Atlantic Intracoastal Waterway, is part of the Coastal Barrier Resources System (see plate 5). This area is in unit L06 of the system. The areas included within the Coastal Barrier Resources System are areas that were undeveloped at the time of the passage of the Coastal Barrier Resources Act (October 1982). Federal expenditures in the area of unit L06 (West Onslow Beach) would be prohibited by the Coastal Barrier Resources Act. Therefore, no detailed analyses of the beach erosion and storm damage hazard in this portion of West Onslow Beach were undertaken during this investigation.

PUBLIC CONCERNS

Local interests have expressed a need for beach erosion control and hurricane protection measures on Topsail Island. This need appears to be greatest at Topsail Beach, on the south end of the island. In addition, agencies and individuals with interests related to environmental quality have expressed concern that any Federal plan of improvement be implemented in a manner which avoids or minimzes environmental impacts. Concerns in both categories are discussed below.

BEACH EROSION CONTROL AND HURRICANE PROTECTION

The concerns of local interests, as expressed by their elected representatives, are reflected in the authorizing resolutions which are the basis for this study. Correspondence documenting these concerns is included in appendix A, "Pertinent Correspondence." As reflected in this correspondence, hurricane flooding and beach erosion have been persistent public concerns in the communities which occupy Topsail Island. Although these problems exist in all developed areas of Topsail Island, concern is most acute at Topsail Beach, where a severe erosion problem exists and the island's vulnerability to hurricane damages is greatest.

ENVIRONMENTAL QUALITY CONCERNS

The concerns of the U.S. Fish and Wildlife Service are contained in the Service's draft Coordination Act Report, included as appendix B. As discussed in appendix B, the loggerhead sea turtle is of particular interest to the Service, since this threatened species nests on Topsail Island. Identification and resolution of environmental concerns will continue with coordination of the attached environmental impact statement.

THE FEDERAL OBJECTIVE

The Federal Objective in water resources planning is to contribute to the National Economic Development in a manner consistent with protection of the Nation's environment. If hurricane protection and beach erosion control measures at Topsail Beach are economically feasible (benefits exceed costs), and environmentally acceptable, construction of a Federal project for these purposes would contribute to this objective.

FEDERAL INTEREST

In accord with the National Objective, stated previously, any plan of improvement to be recommended for Federal implementation must produce benefits which exceed costs. Therefore, detailed studies were directed toward those areas on Topsail Island where preventable damages due to hurricane-storm action and beach erosion were of a magnitude consistent with the costs of the available engineering solutions. The only technically feasible engineering solutions identified in this study consisted of beachfill and dune construction to arrest erosion and protect against wave action. These measures will be discussed in detail in the subsequent report section on "Plan Formulation."

While the potential for hurricane damages and beach erosion exists at Surf City and West Onslow Beach, preliminary level analyses indicated that the potential economic benefits at these locations were not sufficent to justify detailed investigations of a Federal project. The shoreline at Surf City is now considered stable, without a serious erosion problem, and potential benefits for hurricane protection were not considered sufficient to merit detailed study of a Federal project. At West Onslow Beach a significant erosion problem exists, threatening the only road along the island and development near New River Inlet. However, due to the relatively low level of development at West Onslow Beach and constraints imposed by the Coastal Barrier Resources Act (see page 10), no detailed studies of Federal improvements were made for this portion of Topsail Island. Reference points are shown on figure 1, page 3; areas within the Coastal Barrier Resources System are shown on plate 5, following the main report.

The only area of Topsail Island where a Federal project was determined to be potentially economically feasible is the southern portion of the island at Topsail Beach. This area, including the southern 2 miles of the town of Topsail Beach, will be referred to as the "Primary Study Area" in subsequent report sections. An aerial photo of the Primary Study Area is presented on figure 3, following page.

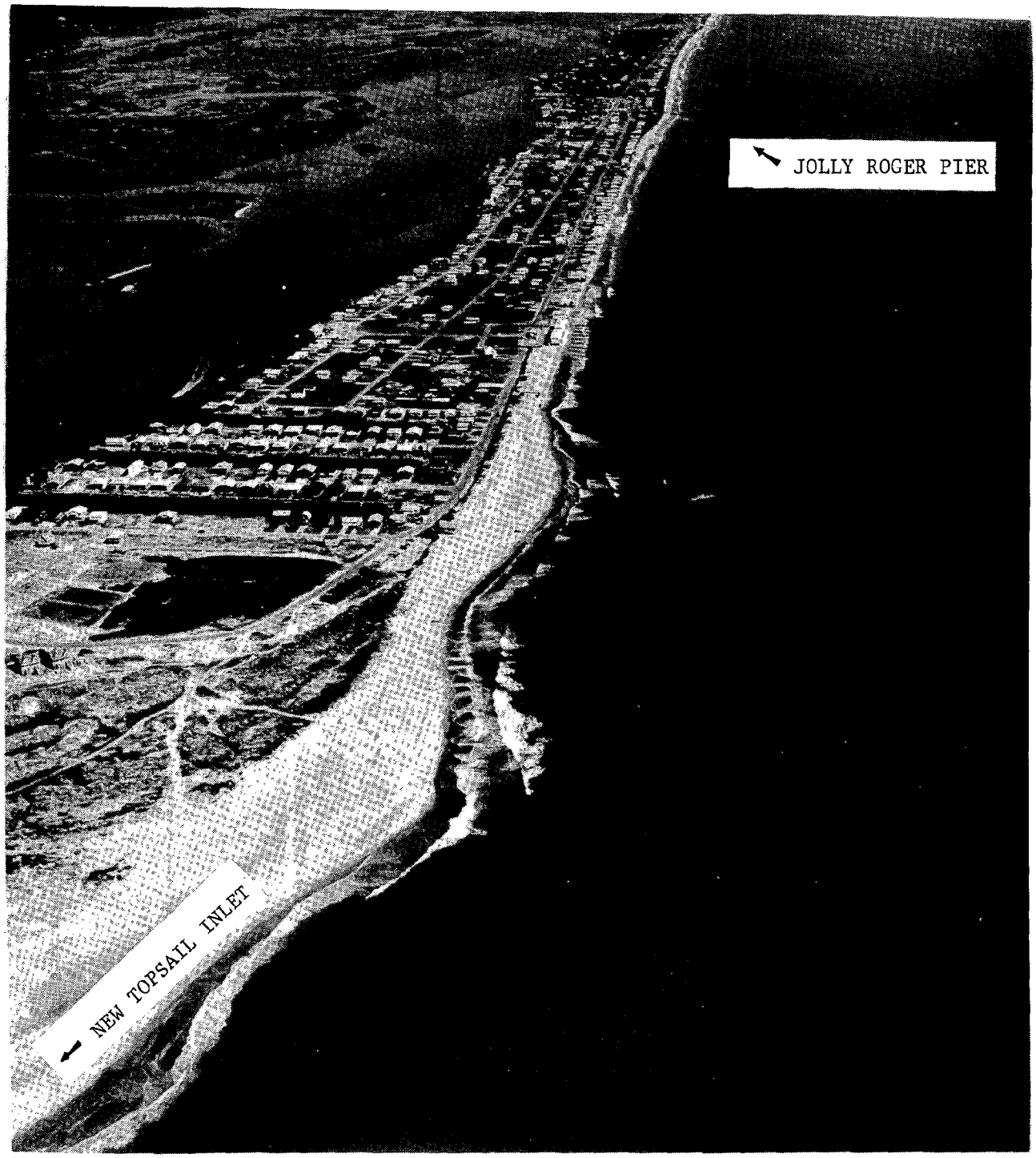


FIGURE 3. PRIMARY STUDY AREA. The photo above shows the southern 2 miles of Topsail Beach, extending from the vicinity of New Topsail Inlet northward about 1,000 feet beyond the Jolly Roger Fishing Pier. This is the only area on Topsail Island where the severity and concentration of potential damages were considered sufficient to merit detailed study of a Federal project.

PROBLEMS, NEEDS, AND OPPORTUNITIES

The primary public concerns identified in the study area are the loss of land due to progresive beach erosion and damages to structures due to storm and wave action. These concerns are discussed below, along with an indication of the possible solutions, which will be discussed in detail in subsequent report sections.

BEACH EROSION CONTROL NEEDS

"Beach erosion" as used in this report section refers to long-term shore processes which can be documented based on shoreline history, and projected to estimate future conditions. Erosion in this sense differs from erosion during storms, which, although devastating to development, is generally of a temporary nature. Following storms, the coastline tends to reshape itself into its former configuration, as sand washed from the beach is returned by wave action and the beach shape conforms to the prevailing wave climate and littoral processes. However, land losses due to progressive erosion processes are essentially permanent, as documented by the shoreline history of Topsail Island. Anlayses of coastal processes conducted during this study indicate that historical erosion trends at Topsail Beach can be expected to continue if no action is taken to stabilize erosion-prone areas. Past and projected future shoreline positions at Topsail Beach are discussed below.

Past Shoreline Positions, Topsail Island. Areas of erosion and accretion along Topsail Island during the period 1963 through 1983 are shown graphically on figure 4, following page. Figure 5 shows shoreline stationing. As shown, the peak erosion occurred just north of New Topsail Inlet. This accelerated erosion has created numerous problems with the oceanfront development along this reach, necessitating the removal of some cottages and threatening the only road that connects the southernmost island development with the rest of the island. Also, the width and quality of the beach available for recreation have diminished.

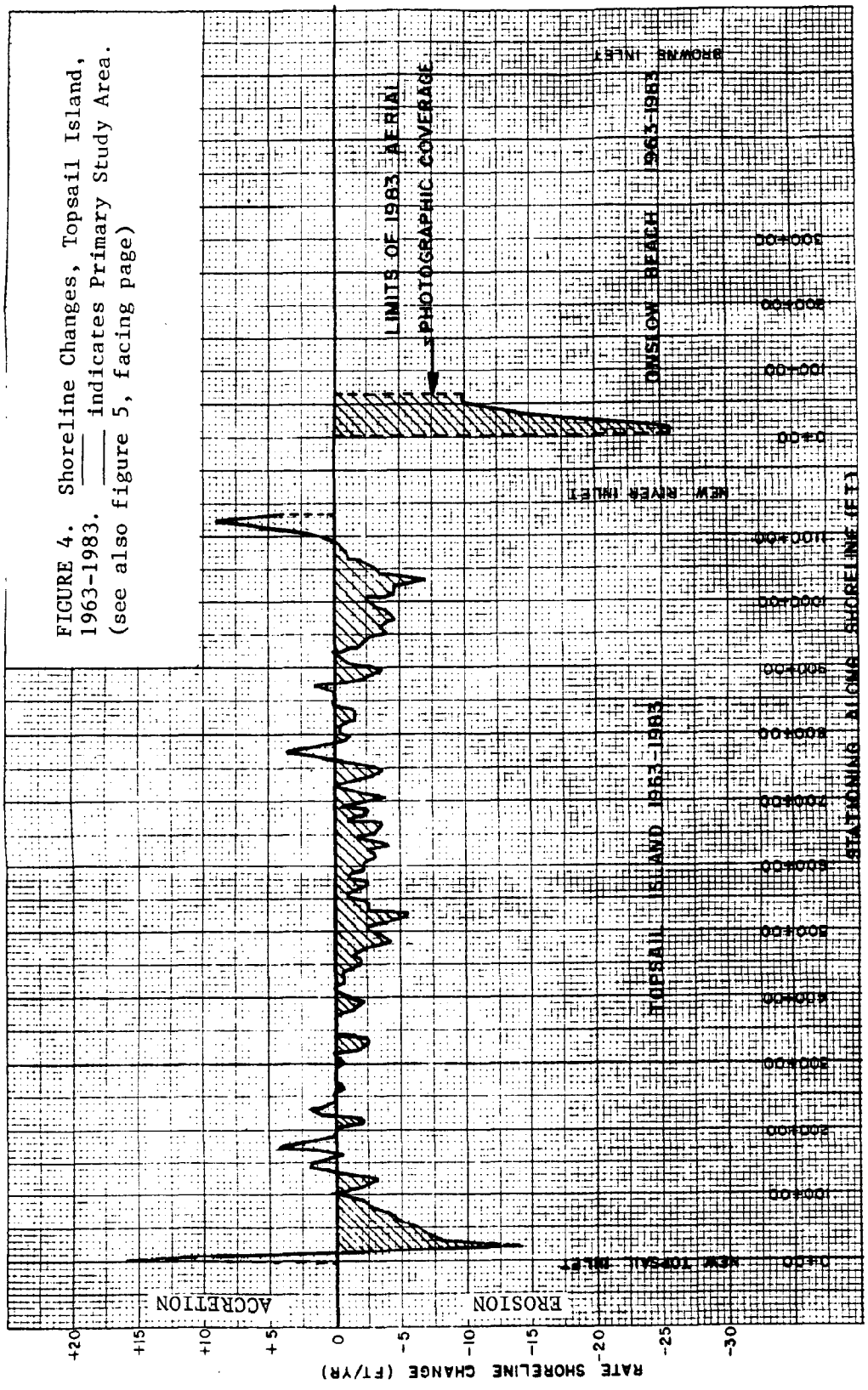


FIGURE 4. Shoreline Changes, Topsail Island, 1963-1983. ____ indicates Primary Study Area. (see also figure 5, facing page)

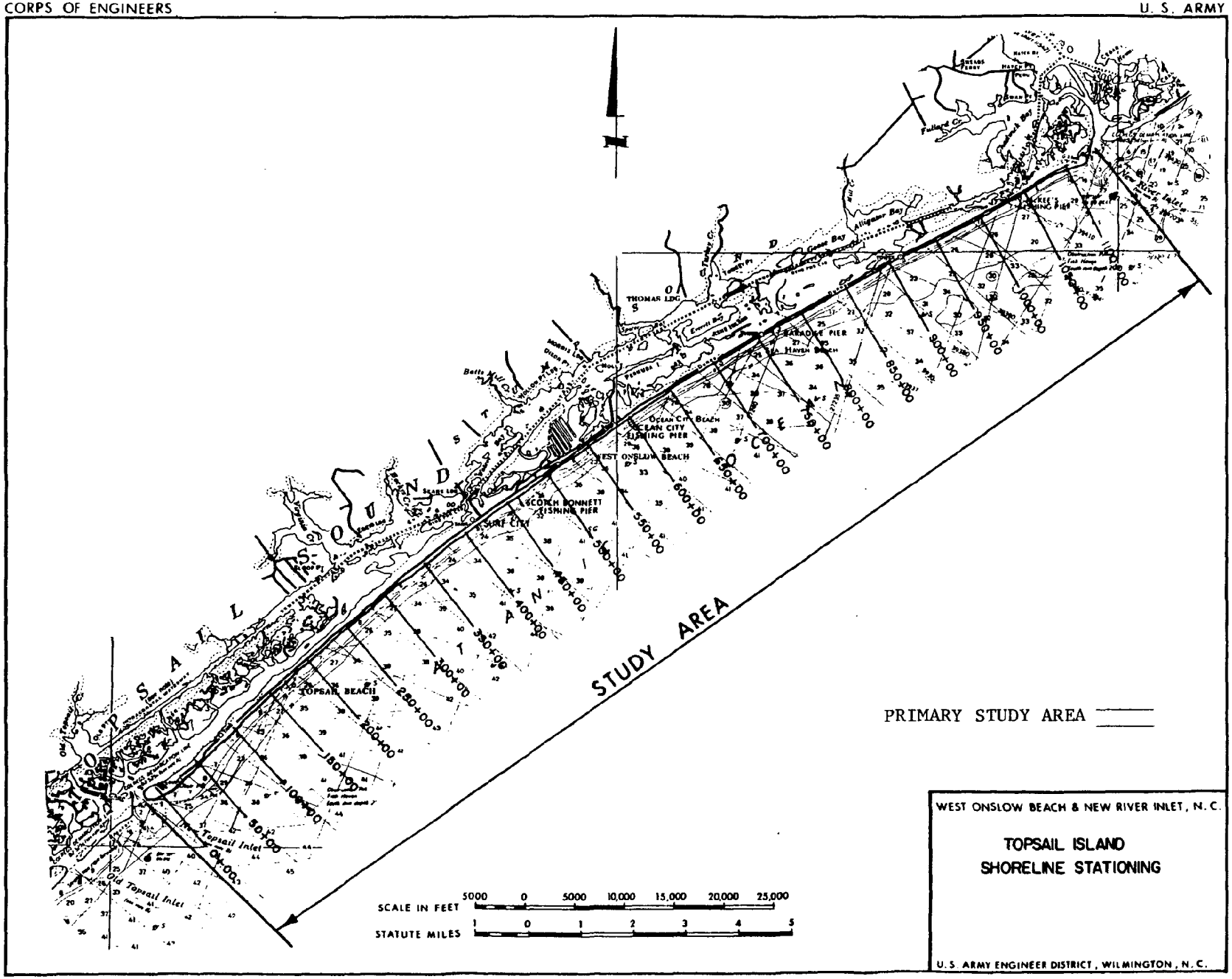

STUDY AREA
PRIMARY STUDY AREA
SCALE IN FEET 5000 0 5000 10,000 15,000 20,000 25,000
STATUTE MILES 1 0 1 2 3 4 5
WEST ONSLOW BEACH & NEW RIVER INLET, N.C.
TOPSAIL ISLAND
SHORELINE STATIONING
U.S. ARMY ENGINEER DISTRICT, WILMINGTON, N.C.
TOPSAIL BEACH
WEST ONSLOW BEACH
SURF CITY
Topsail Inlet
Old Topsail Inlet
NEW RIVER INLET
ATLANTIC OCEAN
INTRACOASTAL WATERWAY
NEW RIVER

FIGURE 5

Shoreline changes for southern Topsail Island during the period 1963 through 1983 are shown in table 1. During the same period, New Topsail Inlet migrated south at a rate of 110 feet per year, whereas over a longer, prior period, between 1856 and 1963, the average rate of movement was 63 feet per year (see figure 6, facing page.)

Erosion of the southern 2 miles of Topsail Beach has accelerated in recent years. Generally, the erosion of this area represents changes in the island configuration in response to the southward movement of New Topsail Inlet. This southward movement has occurred since the mid 1800's, but, as noted above, has increased in recent years as has erosion of Topsail Beach. An example of the relationship between southward inlet migration and shoreline erosion is shown in figure 6, facing page. As shown, the island takes on a bulbous configuration as it accretes near the inlet. As the inlet migrates farther south, the waves begin to erode this area and it becomes narrower. At Topsail Beach, this process is now resulting in the loss of approximately 1 acre of land per year along the southern 2 miles of the shoreline.

TABLE 1

Shoreline Changes - Southern End of Topsail Beach*
(1963-1983)

Station	Total Change 1963-1983 (ft.)	Rate of Change (ft./yr.)
0+00	+323	+16.0
6+28	+175	+ 8.6
11+29	-101	-5.0
18+80	-283	-14.0
27+23	-172	-8.5
35+19	-138	-6.8
42+23	-129	-6.4
53+84	-97	-4.8
61+33	-90	-4.4
68+51	-79	-3.9
80+58	-46	-2.3
89+62	-35	-1.7
101+26	+8	+0.4**
110+00	-41	-2.0
120+00	-61	-3.0
130+00	-10	-0.5
Average	-91	-4.5

*See plate 1 for detailed view of this area.

**Slight accretion at this station is probably related to the presence of a fishing pier nearby, and does not reflect a natural trend toward shoreline accretion.

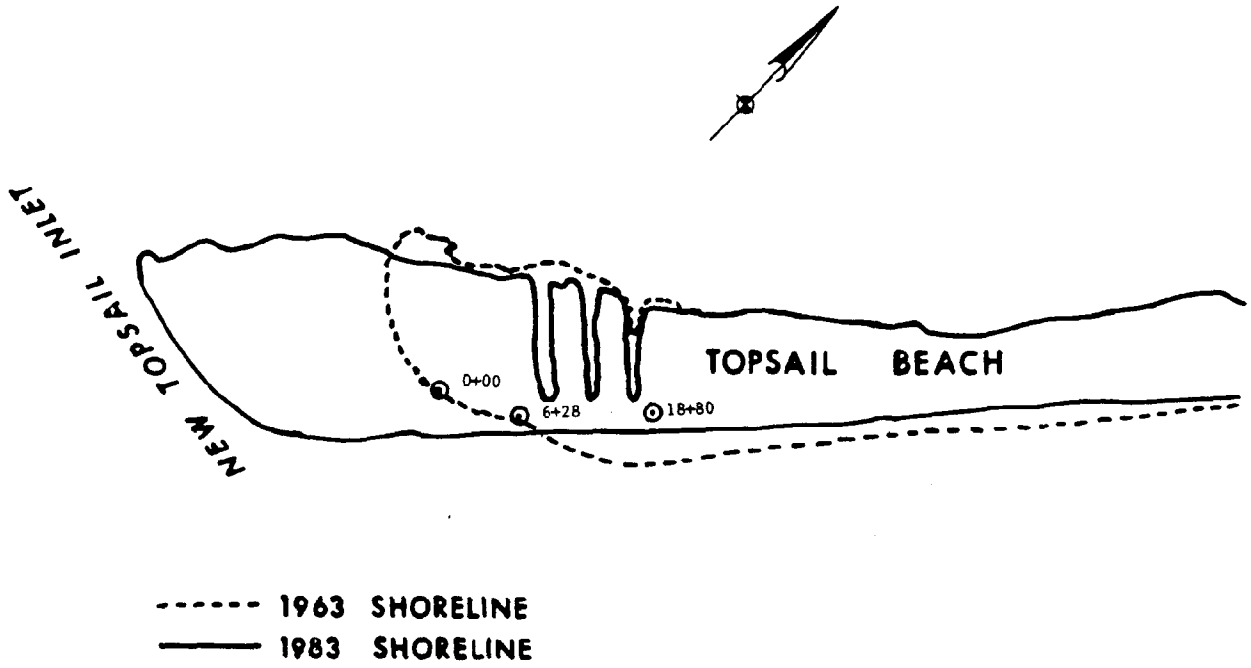


Figure 6. Shoreline Movement and Inlet Migration, South End of Topsail Beach.

The figure above shows the positions of New Topsail Inlet and the southern end of Topsail Island during 1963 and 1983. The shoreline stations shown correspond to the baseline stationing shown on plates 1 and 2 at the back of this report and in table 1, facing page. Reference to those exhibits is suggested. As shown, in 1963 New Topsail Inlet was located approximately 2,200 feet further north than it was in 1983. As a result of this earlier inlet position, the shoreline opposite baseline station 18+80 protruded seaward. This area is now heavily developed (see plate 1). When New Topsail Inlet moved further south, the protuberance disappeared, resulting in a high rate of erosion at station 6+28. South of station 18+80, the shoreline accreted during the 1963 to 1983 period in response to the southward movement of the inlet. However, between 1980 and 1983, shoreline changes measured at stations 0+00 and 6+28 have shown a trend toward erosion, indicating that the pattern of inlet migration and erosion is continuing in this area. Estimated future inlet and shoreline positions are discussed on the following page.

Estimated Future Shoreline Conditions, Topsail Island. The discussion below presents an estimate of the future shoreline condition at Topsail Beach. Again, emphasis is placed on the southern 2 miles of the shoreline, which is the Primary Study Area. This estimated future condition will form the basis for evaluating potential economic benefits of beach erosion control and developing plans to address these needs. For purposes of this discussion, it is assumed that no Federal project will be constructed at Topsail Island before 1997. The year 1997 is referred to as the "base year" in subsequent report sections. (It should be noted that a Federal project could be implemented before or after 1997; this base year is assumed for purposes of economic analysis; it does not reflect project scheduling, which is discussed on page 52 of this report under "Plan Implementation.")

Plate 2 shows estimated shoreline and inlet positions 5, 10, 15, 25, 35, and 50 years from the base year (1997). It should be noted that these projections were developed based on historic rates of inlet movement and shoreline adjustment, and do not take into account any erosion-control measure which might be undertaken during the periods of analysis. As shown on plate 2, erosion is expected to intrude on the existing oceanfront properties along the southern portion of Topsail Beach by the base year. By 1997, these buildings will probably have been destroyed by the ocean or relocated. By year 2002, erosion is expected to begin to wash out the road in front on the finger canals, at the narrowest point of Topsail Beach. This road, Ocean Boulevard, is the seawardmost road on Topsail Island. Ocean Boulevard provides the only access to the southern portion of Topsail Island. If this road is severed, this area of Topsail Beach would be isolated from the remainder of the island. Ocean Boulevard can be seen on plate 1 of this report, where the Corps of Engineers baseline follows this route.

As noted above, the future shoreline positions and inlet changes discussed above and shown on plate 2 are based on uniform rates of shoreline change and inlet movement. Considering the value of property on Topsail Island relative to the cost of erosion control measures, it is likely that local interests will undertake measures to protect against progressive erosion. At present, the town bulldozes the beach to create artificial dunes in the area where erosion is most acute. Also, the Corps of Engineers deposits materials on the beach from navigation maintenance dredging in Topsail Creek and Banks Channel. At the present level of activity, these measures are not sufficient to prevent erosion from destroying Ocean Boulevard and proceeding across the island, as shown on plate 2. Therefore, unless more effective beach erosion control measures are undertaken, erosion is expected to progress across Ocean Boulevard into the three finger canals on the landward side of this road. As shown on plate 2, this progressive erosion is expected to result in formation of a new inlet at the location of the finger canals. For purposes of economic evaluations presented in later report sections, it is assumed that local interests will be able, through increased placement of dredged material, to prevent erosion from destroying Ocean Boulevard. As discussed in subsequent report sections, protection of this road will require substantial expenditures by local interests.

Thus, the "most likely future" scenario at Topsail Island is based on the assumption that local interests, through increased placement of fill, will be able to prevent progressive erosion from washing out Ocean Boulevard. However, erosion control measures by local interests are not expected to provide significant protection against the short-term erosion and flooding associated with hurricanes and storm events. Also, a storm of moderate intensity could breach Topsail Beach near the finger canals. In the vicinity of the canals, the natural ground elevation varies from approximately 7 feet above mean sea level (m.s.l.) along the oceanfront to around 4 feet m.s.l. at the canals. At the narrowest point of the island, the ocean shoreline is within 200 feet of the canals. While placement of fill by local interests is expected to prevent permanent land loss, local actions would probably not be sufficient to prevent a breach of the island by storm action at the location of the canals. Based on analyses conducted during this study, a storm with a frequency of occurrence of 30 years or greater would probably breach the island at the finger canals, creating a new inlet and isolating development south of the canal location.

Possible Solutions for Beach Erosion Problems. As noted above, local interests are expected to increase their erosion control efforts in order to prevent the destruction of the seawardmost road along the island. However, the effectiveness of local efforts in halting progressive erosion is speculative, due to the limited resources of the community and the cost of the required dredging and fill placement. As will be discussed in subsequent report sections, the most effective solution for the beach erosion problem at Topsail Beach would be an artificial beach berm, constructed between Ocean Boulevard and the ocean. The beach berm would be constructed to the elevation of existing high ground along the oceanfront, about 7 feet above mean sea level, and would extend seaward a sufficient distance to provide a stable beachfront. If replenished as necessary, this project would offset the long-term effects of beach erosion, and provide protection against an inlet breakthrough in the narrowest portion of the island. A beach berm at Topsail Beach could be constructed alone, or in conjunction with artifical sand dunes. The dunes would provide protection against wave overwash during hurricane and storm events. Hurricane protection needs are discussed on the following page.

HURRICANE AND STORM DAMAGE REDUCTION NEEDS

"Hurricane and storm damages," as used in this report, refers to flooding by wave overwash during hurricanes and northeasters, as well as short-term erosion which occurs during these events. When the island is under hurricane attack, the full force of the storm waves is felt along the immediate ocean shoreline; as the waves break and spill over the ocean edge of the island, development in upland areas is subjected to the force of the waves. As noted in the discussion of "beach erosion" problems above, there is little natural dune protection along the southern end of Topsail Island. This segment of the island, which includes the Primary Study Area, could be overtopped by a 10-year storm. With the smaller storms, such as the 10-year storm, the principal damages would be associated with the battering and loosening of the pilings which support beachfront structures, and the loss of decks and other structures. With the larger hurricanes, such as Hurricane Hazel which occurred in 1954, entire structures can be swept away. Past hurricanes and hurricane damage potential are discussed below.

Past Hurricanes. The hurricane history for Topsail Island is somewhat limited since the island was undeveloped prior to World War II. In October of 1954, Topsail Island was struck by Hurricane Hazel, the most severe storm which has occurred since development of the island began. At Topsail Beach 210 buildings were lost, which constituted 65 percent of the structures existing at that time. Three damaging hurricanes followed in 1955: Connie, Diane, and Ione. However, these storms did much less damage than Hazel, partly because few undamaged properties remained at Topsail Island following that devastating storm. In recent years, Topsail Island has not been struck by a severe hurricane, although such an event could occur in any year. Most recently, property damage resulted from Hurricane Diana in 1984, and from northeasters in 1986 and 1987. However, this damage was insignificant compared to the damage that would occur from another hurricane of the "Hazel" magnitude.

Hurricane and Storm Damage Potential. As shown on plates 1 and 2, the southern portion of Topsail Island is heavily developed and the potential for hurricane-wave damage is obvious given the lack of natural dune protection in this area and the low elevation of the island. Unlike long-term erosion which can be predicted, to some extent, based on past trends and observed shore processes, damages from hurricane-wave attack can occur in any year, and can be predicted only as a mathematical probability. Based on these probabilities, average annual damages were computed for hurricane-wave damages and will be discussed in Section III of this report, "Potential Economic Benefits" (see page 23).

Possible Solutions for Hurricane and Storm Problems. As discussed previously, placement of a beachfill, or berm, along the coast of Topsail Island would prevent long-term erosion, providing it is regularly renourished. However, a beachfill project alone would not protect development from wave overwash during the larger storms. Also, short-term erosion of the beachfill during storms, although later replenished, would still threaten structures near the oceanfront. Protection against these forces would require protective structures to absorb wave energy and act as a barrier against overtopping of the island during storms. The best measure for providing this protection is the construction of artificial sand dunes along the oceanfront, along with placement of a beachfill. Projects of this type are referred to as "berm and dune" projects and will be discussed in detail in the "Plan Formulation Section" of this report (see page 30).

CONDITION IF NO FEDERAL ACTION IS TAKEN

Development at Topsail Beach is expected to continue, with or without a Federal project. However, if no Federal action is taken this development will continue to be threatened by hurricane and storm damage, including the possibility of a new inlet being opened through the island. Basic assumptions are as follows:

(1) Most development seaward of Ocean Boulevard is expected to have been destroyed or relocated by year 1997, the year in which it is assumed that a Federal project could be implemented at Topsail Beach. However, local interests are expected to take the necessary actions to protect this road, and prevent progressive erosion from advancing across Ocean Boulevard.

(2) Local measures are not considered likely to provide significant protection against hurricane and storm damage, including wave overwash and flooding.

(3) Likewise, local measures are not considered likely to provide significant protection against an inlet breakthrough in the area of the finger canals (see figure 3) in the southwest portion of Topsail Beach. Breach of the island and opening of a new inlet at this location is considered likely with the occurrence of a storm having a frequency of occurrence of 30 years or greater. However, it is further assumed that local interests would refill the breach, restoring the island to approximately its pre-storm condition. Also, it is expected that the breached area would quickly be redeveloped to pre-storm conditions.

SUMMARY OF PROBLEMS, NEEDS, AND OPPORTUNTITIES

The principal water-resources problems identified at Topsail Island are progressive beach erosion, due to long-term shore processes, and the threat of hurricane and storm overwash. The need for action to address these needs is particularly acute along the southernmost 2 miles of Topsail Beach, adjacent to New Topsail Inlet. The most effective measure to address these needs appears to be a berm and dune project along this portion of the Topsail Island oceanfront. However, as discussed in the preceding report section on the "National Objective," any plan of improvement to be implemented by the Federal Government must be economically feasible. It must also be environmentally acceptable. The following two report sections present analyses relevant to both these aspects of the National Objective. Section III, "Potential Economic Benefits," presents a quantitative analysis of the erosion and hurricane damage problems at Topsail Beach. Section IV, "Environmental Resources," presents a discussion of the study area's natural resources and identifies environmental resources which must be considered in developing an implementable plan.

SECTION III - POTENTIAL ECONOMIC BENEFITS

The purpose of this analysis is to estimate the potential economic benefits which could be realized with elimination of all preventable damages due to beach erosion and hurricane and storm action in the Primary Study Area. As discussed previously, the Primary Study Area includes the southern 2 miles of Topsail Beach, the only area at Topsail Island where potential benefits were of sufficient magnitude to merit detailed study of a Federal project. Prevention or reduction of these damages, along with benefits for enhanced recreational use of the area, constitutes the economic justification for the plans of improvement which will be discussed in subsequent report sections.

METHODOLOGY AND ASSUMPTIONS

The analysis of potential economic benefits which follows is based on the assumption that no effective action will be taken to prevent hurricane and storm damages at Topsail Island. However, efforts by local interests are assumed to be effective in preventing progressive erosion from advancing to and beyond Ocean Boulevard.

The interest rate for the analysis is 8-5/8 percent and a 50-year period of analysis is used. October 1988 price levels are applied. The "base year" used for economic analysis is 1997.

The base data for this analysis were compiled using a 1981 real estate appraisal, updated to reflect 1988 property values. These appraised values were updated by a factor of 1.4, reflecting an estimated increase of 40 percent in property values from 1981 through 1988. Real estate appraisals were conducted by the Savannah District, U.S. Army Corps of Engineers; updates have been coordinated with Savannah Real Estate. A content value of 30 percent of the structural value is assumed for the residential structures in the study area.

POTENTIAL BENEFITS FOR HURRICANE AND STORM DAMAGE REDUCTION

This analysis includes 685 structures (724 units) which are expected to occupy the study area by base year 1997. This level of development would completely fill the present supply of vacant lots in the study area. The total of 685 structures includes 108 structures expected to be built by 1997. The remaining 577 structures include 61 structures which are at locations expected to be seaward of the coastline by 1997 (see plate 1). For purposes of this analysis, it is assumed that these structures will have been randomly moved to new sites throughout the study area.

Average annual hurricane and storm damages for the Primary Study Area were computed using Wilmington District computer programs. These programs are used to compute damages based on the probability of occurrence for various storms, and the damages that would be done by these storms. These damages are then estimated at an average annual amount. Average annual hurricane and storm damages for the primary study area were estimated at $2,975,000. This average annual damage figure includes damages to structures due to inundation and undermining by erosion accompanying hurricanes and northeasters. It does not include land losses due to long-term, progressive erosion.

POTENTIAL BENEFITS FOR ROAD PROTECTION

At present, the town of Topsail Beach bulldozes the shoreface to create artificial dunes and the Corps of Engineers deposits material on the beach from navigation maintenance dredging in Topsail Creek and Banks Channel.

However, these measures alone will not be sufficient to prevent progressive erosion from undermining Ocean Boulevard. Based on analyses conducted during this study, effective protection of the road against progressive erosion will require placement of approximately 560,000 cubic yards of material on the beach every 4 years. The Corps of Engineers removes about 120,000 cubic yards of dredged material from Topsail Creek and Banks Channel every 4 years. This material is placed on Topsail Beach at no cost to local interests. This amount of fill material is expected to continue to be available, due to Corps of Engineers maintenance dredging operations in Topsail Creek and Banks Channel. However, as noted above, total nourishment requirements for protection of Ocean Boulevard are estimated at 560,000 cubic yards every 4 yards. Local interests would be responsible for the costs of dredging and placing the additional 440,000 cubic yards of material necessary to prevent the destruction of the oceanfront road. The cost of placing this material on the beach is estimated at $2.38 per cubic yard. The equivalent average annual costs for this 440,000 cubic yards of material to be dredged every 4 years is $321,000. This amount represents the potential economic benefit associated with protection of Ocean Boulevard. Benefits in this category will be referred to as "Road Protection" benefits in subsequent report sections.

POTENTIAL BENEFITS FOR PREVENTION OF CANAL ZONE BREAKTHROUGH

Potential benefits in this category are based on the value of land which would be lost with an inlet breakthrough in the area of the three finger canals shown on figure 3. Based on analyses conducted during this study, such a breakthrough would result from a 30-year or greater storm. About $4.3 million in land would be lost with an inlet breakthrough. The potential economic benefit associated with prevention of the canal zone breakthrough is the damages times the probably of a 30-year or greater storm, or an average annual amount of $143,400. It should be noted that this potential benefit is based on storm-frequency relationship. For purposes of economic analysis,it is assumed that the inlet breakthrough will occur due to a storm event, rather than progressive erosion. As discussed previously, actions by local interests are assumed to to be effective in preventing progressive erosion from washing out Ocean Boulevard. Also, when an inlet breach occurs, local interests are expected to take the necessary action to refill the breach, returning the canal zone to approximately its former configuration. Structures lost in the breached area are expected to be rebuilt in a short time. As noted previously, potential economic benefits associated with prevention of an inlet breakthrough are limited to land losses; loss of structures is accounted for in the "Hurricane and Storm Damage Reduction" category.

POTENTIAL BENEFITS FOR RECREATION

As discussed previously, local interests are expected to be able to prevent progressive erosion from destroying Ocean Boulevard by increased placement of dredged material. However, the recreational beach which remains by 1997, is expected to be very narrow or nonexistent at high tides. Potential recreation benefits for the portion of Topsail Beach in the Primary Study Area were computed by estimating the Unit Day Value of the recreational experience available with and without a Federal project. The term "unit day value" represents the economic value which is assigned to a day of recreational experience. A unit day value of $2.30 was assigned for the "without project" condition. The unit day value will be higher if a Federal project is implemented to restore and stabilize the beach strand. Assuming that any Federal project which is constructed will include a beach width of at least 50 feet and is regularly renourished, a unit day value of $3.08 is considered appropriate. This increase of $0.78 per unit day multiplied by estimated annual visitation represents the potential economic benefits for a restored and stabilized beach along the southern 2 miles of Topsail Island. Estimated visitation is discussed below.

Beach use at Topsail Beach is estimated at 6,805 persons per day over a 90-day beach season, based on data from the town's "Coastal Management Plan for 1995." This represents 612,450 beach users annually. Of this number, it is estimated that 248,410 visits to the beach will occur along the southern two miles of Topsail Beach (Primary Study Area) where beach use will be degraded by erosion. Therefore, potential recreation benefits for the Primary Study Area are estimated at an average annual amount of $193,800 (248,410 visitor days x $0.78 increase in unit day value).

SUMMARY OF POTENTIAL ECONOMIC BENEFITS

The total potential benefits for shore protection at Topsail Beach are summarized in table 2 below. As shown, potential economic benefits include four categories: (1) Hurricane and Storm Damage Reduction Benefits--Potential benefits in this category are based on damages due to short-term erosion and wave overwash during hurricanes and northeasters; all potential economic benefits in this category are for reduced damages to structures; (2) Road Protection Benefits--Implementation of a Federal project at Topsail Beach which effectively protects Ocean Boulevard from progressive erosion would eliminate the need for non-Federal erosion control measures to protect this road; thus, the potential economic benefit in this category is based on expected expenditures by non-Federal interests for fill placement to arrest erosion along this road; (3) Prevention of inlet breakthrough--Benefits in this category represent the elimination of the costs of refilling the breach in the island due to an inlet breakthrough in the area of the finger canals in the southwest portion of Topsail Beach (see figure 3); (4) Recreation--Benefits in this category are based on the increase in the value of the recreation experience for beachgoers which would be realized with implementation of a Federal project at Topsail Beach.

TABLE 2

Potential Economic Benefits, Topsail Beach

Benefit Category	Average Annual Benefit
Hurricane and Storm Damage Reduction	$2,975,000
Protection of Road	$ 321,000
Prevention of Inlet Breakthrough	$ 143,400
Recreation	193,800
TOTAL	$3,633,200

As shown above, total potential average annual benefits for the Primary Study Area at Topsail Beach are estimated at $3,633,200. In accord with the National Objective stated previously, the average annual cost of any Federal improvement recommended must be less than this amount. In addition, any plan of improvement to be recommended must be shown to be environmentally acceptable. Environmental resources of Topsail Island are discussed in the following report section.

SECTION IV - ENVIRONMENTAL CONSIDERATIONS IN PROJECT PLANNING

The purposes of this report section are (1) to identify significant environmental resources which might be affected by a Federal project along the southern 2 miles of Topsail Island; and (2) to identify criteria which should be followed in planning and designing a project to minimize impacts on these resources. Significant, or potentially significant, resources are discussed below.

SIGNIFICANT RESOURCES

Generally, the upland areas in the Primary Study Area have limited natural values, due to the intensity of development. However, the estuaries, inlets, beaches, and shallow ocean bottom surrounding Topsail Island have significant values, as discussed below.

BIOLOGICAL RESOURCES

Topsail Island is separated from the mainland by marshes and sounds. The estuary serves as a nursery ground for numerous marine species, while the barrier island serves as a buffer which protects the estuary from the ocean environment.

Although developed areas in the Primary Study Area have limited habitat value, the adjacent marshes and sounds support a rich mixture of wildlife. Terns, gulls, plovers, sandpipers, willets, rails, oyster-catchers, marsh hawks, kingfishers, mockingbirds, and painted buntings are seen in the area. Many other birds, reptiles, and small mammals frequent Topsail Island and associated wetlands. Topsail Sound and New River Inlet support significant quantities of sport and commercial marine species. Practically all of the sounds and creeks landward of Topsail Island are designated as primary nursery grounds for shrimp by the State of North Carolina. Oyster and clam harvesting takes place in the estuarine waters of Topsail Island and New River Inlet.

More detailed descriptions of the landforms and fish and wildlife resources of Topsail Island are presented in the attached environmental impact statement and appendix B. Appendix B contains the "West Onslow Beach and New River Inlet Study, Draft Fish and Wildlife Coordination Act Report," prepared by the U.S. Fish and Wildlife Service on Topsail Island.

ENDANGERED AND THREATENED SPECIES

Coordination with the U.S. Fish and Wildlife Service and the National Marine Fisheries Service has been conducted to identify endangered and threatened species which might be present in the vicinity of Topsail Island. One threatened species, the loggerhead sea turtle, is known to nest on Topsail Island. An endangered species, the piping plover, is a winter visitor in the vicinity of Topsail Island. However, this species has not been documented to nest on the island, and is unlikely to be affected by a Federal project at Topsail Island.

WATER QUALITY

The tidal saltwaters of New River Inlet from the Atlantic Ocean to the AIWW and New Topsail Inlet from the Atlantic Ocean to the AIWW are classified "SA" by the State of North Carolina. Best usage of Class SA waters includes shellfishing for market purposes, primary recreation, fishing, and secondary recreation. Waters of this area generally meet the designated classification, although there are areas of localized degradation, depending on proximity to human settlements, as is evidenced by the "closed to shellfishing" signs along the AIWW.

CULTURAL RESOURCES

No upland archeological sites have been recorded from the primary study area and none are likely because of the recent formation of this area of the beach. Should any sites be present, it is likely that they are of recent origin and have been severely damaged by modern human activity. A review of the National Register of Historic Places indicated that there are no historical sites listed or nominated for inclusion. Beachfront erosion, inlet migrations, and limited project dimensions in the most recently formed beach areas resulted in a decision to perform reconnaissance of the borrow area only. This decision was coordinated with the North Carolina Division of Archives and History, Underwater Archeology Unit, and is documented in an assessment dated 19 August 1987.

Twelve shipwrecks have been documented near New Topsail Inlet by the North Carolina Division of Archives and History. Of these 12 vessels, six are known to have sunk at locations unlikely to be impacted by a Federal project at Topsail Beach. The locations of the six other vessels are uncertain. Surveys of the borrow areas have been conducted with negative results.

ESTHETIC RESOURCES

The esthetic values of Topsail Island and vicinity are evidenced by the popularity of the area for tourism. The total environment of barrier islands, oceans, estuaries, and inlets attract many visitors to enjoy the esthetic experience created by the sounds, smells, winds, and sprays.

The town of Topsail Beach is an area with many well maintained beach cottages and year-round homes. The exception is found near the southern end of Topsail Island in the region of the existing finger canals at the Town of Topsail Beach. In this area, the esthetic qualities of the beach, and its overall value for recreation, are being diminished by beach erosion. As erosion advances in this area, without a Federal project, esthetic qualities can be expected to diminish as the beach is littered with the remnants of structures which have been lost to erosion.

ENVIRONMENTAL CRITERIA AND CONSTRAINTS

No environmental constraint was identified which would preclude implementation of a Federal project at Topsail Beach. However, any plan of improvement should be designed and implemented, to the extent practicable, to avoid interference with the nesting of the threatened loggerhead sea turtle.

Generally, any plan of improvement should be designed to avoid adverse impacts on water quality and biological resources. Also, the timing of project construction and maintenance should be adjusted as practicable to avoid periods of high biological productivity.

As noted above, the esthetic qualities of the beach strand at Topsail Beach will probably continue to be degraded as erosion encroaches on development. Therefore, there is an opportunity to enhance this aspect of the island's esthetic quality by restoration and maintenance of the beachfront.

SECTION V - PLAN FORMULATION

This report section describes the procedures by which alternative plans were developed and the optimum plan of improvement for Topsail Beach was ultimately selected. Plans discussed herein provide protection for the reach of Topsail Beach shown on plate 3. This reach, including approximately 2 miles of beachfront, corresponds to the Primary Study Area described previously.

PLAN FORMULATION RATIONALE

Based on engineering and economic analyses conducted during this study, the most appropriate measure to address hurricane protection and erosion control needs at Topsail Beach is a shore protection project. A shore protection project would consist of (1) a beach berm to control erosion; or (2) a beach berm and artificial dunes to control erosion and reduce wave overwash during storms. "Nonstructural" measures were also considered as required by Federal planning regulations. These measures usually include relocation, elevation, or waterproofing of buildings to reduce damageability. The only nonstructural measure which would substantially reduce damages at Topsail Beach is structure relocation. However, every developable lot on the island will probably be occupied by 1997, the assumed base year for project implementation. Thus, relocation was not considered a practicable alternative.

ALTERNATIVE PLANS

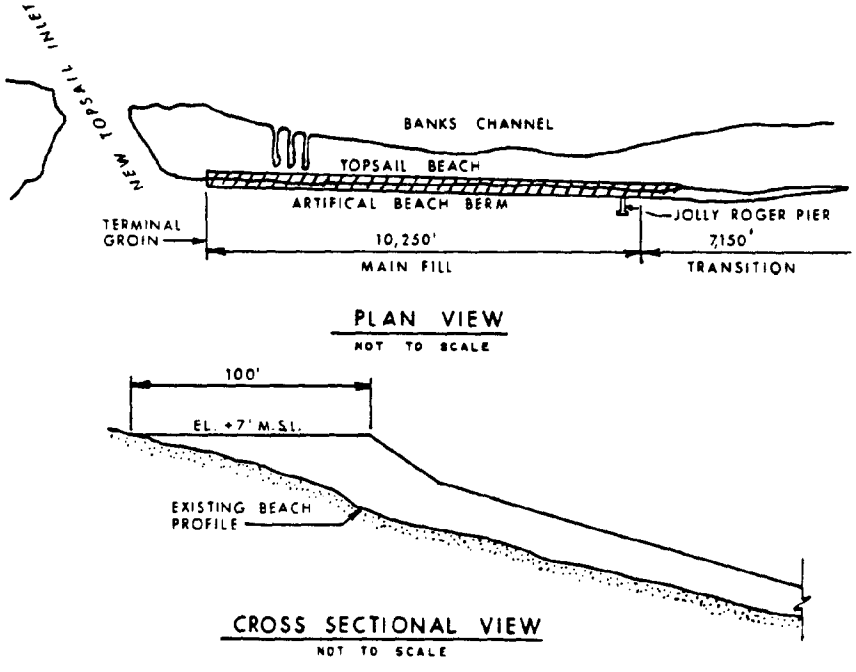
The alternative plans evaluated in detail were beachfill plans, referred to below as "Beach Erosion Control Plans," and berm and dune plans, referred to as "Combined Hurricane Protection and Beach Erosion Control Plans." Within each of these categories, various levels of protection were evaluated for comparison of benefits to costs. In all cases, the area protected extends along the same reach of Topsail Beach, as shown on plate 3. This project reach was evaluated for all alternative plans since: (1) This reach has consistent development and lacks natural dune protection; and (2) there are no environmental constraints associated with this reach, such as the Coastal Barrier Resources designation at West Onslow Beach, which would preclude construction of a Federal project.

BEACH EROSION CONTROL PLANS

The "beachfill" plan is illustrated on figure 7, following page. As shown, the area to be protected by the berm extends from just south of the three finger canals to a point about 800 feet north of the Jolly Roger Fishing Pier, or a total distance of 10,250 feet (see plate 3). The north end of the fill would terminate with a gradual transition, as shown on figure 7. At the south end, the distance between the fill terminus and New Topsail Inlet is not sufficient to allow the use of a gradual transition from the fill shoreline back to the existing shoreline. Therefore, a terminal groin would be used at the south end of the fill. The terminal groin is a feature of all plans considered. All shore protection plans considered would be constructed using the borrow area shown on plate 3. In each case, material would be pumped from this area to the beach and shaped by earth moving equipment.

Widths of 50, 100, and 200 feet were considered for the beach berm. In each case, the beach berm would be constructed at an elevation of 7 feet m.s.l., the elevation of the natural beach berm along the project reach. The 50-foot width is the minimum width necessary to prevent long-term erosion and inlet breakthrough during storm events. However, a beach berm alone would not protect structures against short-term shoreline retreat during storms. Although the berm would later be restored by natural processes and/or by pumping sand from a borrow source, structures in the eroded area would be damaged. Also, the beach berm alternative would not substantially reduce damage due to hurricane and storm overwash; measures to address this problem will be discussed in the following report section on "Berm and Dune" alternatives. Benefits and costs for the 50-, 100-, and 200-foot berm alternatives are shown in table 3, following page.

As shown in table 3, all three berm widths achieve the same benefits for road protection, prevention of a canal zone breakthrough, and recreation, since each alternative would effectively control progressive erosion and provide an adequate recreation beach. Therefore, all potential benefits related to control of long-term erosion, including costs of protecting the seawardmost road on Topsail Beach and recreation benefits, would be realized by the 50-foot berm alternative (see "Summary of Potential Economic Benefits," page 26). With the 200-foot berm alternative, the greatest benefits would be realized for hurricane-wave damage reduction. These additional benefits represent reduced damages to structures due to short-term erosion induced by storms. However, as shown in table 3, these additional benefits are less than the additional costs associated with the 200-foot berm width.



Schematic of Beach Berm

TABLE 3

Costs and Benefits for Beach Berm Plans
(Based on 8-5/8 percent interest rate, 50-year period of analysis)
(October 88 price levels)

PART I - COSTS

Item	50-ft.-wide berm at +7 feet m.s.l.	100-ft.-wide berm at +7 feet m.s.l.	200-ft.-wide berm at +7 feet m.s.l.
First Cost:			
Beachfill Construction	$2,306,000	$4,092,000	$ 7,645,000
Terminal Groin	859,000	923,000	1,007,000
Contingencies (25%)	791,000	1,254,000	2,163,000
Subtotal	$3,956,000	$6,269,000	$10,815,000
Engineering & Design	198,000	313,000	541,000
Supervision & Admin.	198,000	313,000	541,000
Real Estate	1,875,000	1,875,000	1,875,000
Total First Cost	$6,227,000	$8,770,000	$13,772,000
Interest During Const.	290,000	405,000	627,000
Total Investment Cost	$6,517,000	$9,175,000	$14,399,000
Average Annual Cost:			
Interest & Amortization	$571,000	$ 804,000	$ 1,262,000
Beach Nourishment	349,000	393,000	480,000
Groin Maintenance	10,000	10,000	10,000
Monitoring Surveys	15,000	15,000	15,000
Total Average Annual Cost	$945,000	$1,222,000	$ 1,767,000

PART II - AVERAGE ANNUAL BENEFITS

Hurricane and Storm Damage Reduction	$ 416,000	$ 800,700	$ 1,046,500
Prevent Road Loss	321,000	321,000	321,000
Prevent Canal Breakthrough	143,400	143,400	143,400
Recreation	193,800	193,800	193,800
Benefits During Construction	53,300	72,400	84,600
Total Average Annual Benefits	$1,127,500	$1,531,300	$ 1,789,300

PART III - BENEFIT-COST RATIOS

1.2	1.3	1.0

PART IV - NET AVERAGE ANNUAL BENEFITS

$182,500	$309,300	$22,300

BEACH EROSION AND HURRICANE WAVE PROTECTION PLANS

In order to increase the protective value of the beachfill, artificial dunes and storm berms can be incorporated into the upper portion of the fills. The added elevation and mass of the dunes would reduce the landward retreat of the beach during storms and would decrease the size of the wave capable of propagating across the island.

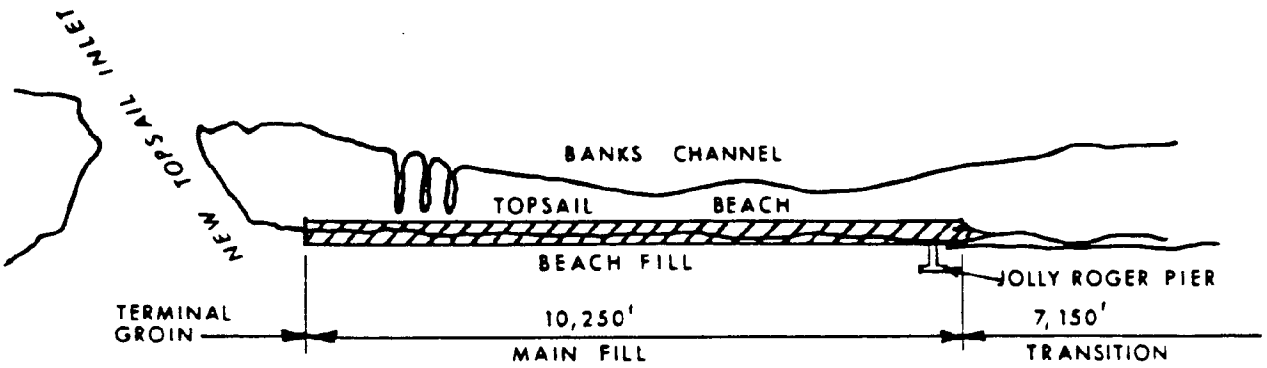
Four dune and storm berm fill cross sections were analyzed to determine their effectiveness in reducing storm induced erosion and wave heights across the southern 2 miles of Topsail Beach. Schematics of the four combined erosion control and storm wave protection fills are shown on figure 8, page 34. As shown in figure 8, the alternatives considered consist of (a) an 11-foot m.s.l. dune and an 8-foot m.s.l. storm berm; (b) a 13-foot m.s.l. dune and a 9-foot m.s.l. storm berm; (c) a 15-foot m.s.l. dune and an 11-foot m.s.l. berm; and (d) a 20-foot m.s.l. dune and a 16-foot m.s.l. storm berm. For brevity, the four sections will be referred to as the 11, 13, 15, and 20-foot m.s.l. dune sections. As indicated on the schematic, each of the dune sections is fronted by a beach berm at elevation +7 feet m.s.l.

EFFECTS OF BERM AND DUNE ALTERNATIVES ON BEACH EROSION

Each of the alternatives described above would effectively control long-term shore erosion, as would the "berm only" alternative discussed previously. In addition, the added elevation and mass of the berm and dune fills would provide a higher level of protection against short-term shoreline retreat during storms. For example, the 100-foot-wide berm discussed previously would prevent storm induced erosion damages for storms with a return period of 10 years. The 13-foot and 15-foot berm and dune alternatives would prevent storm induced erosion damages for storms with return periods of 70 and 230 years, respectively. The 20-foot dune section would prevent storm erosion damages for a storm with a return period greater than 500 years.

EFFECTS OF BEACHFILLS ON STORM WAVE HEIGHTS

In addition to reducing storm-induced erosion, the berm and dune alternatives would reduce damages to upland development due to hurricane-wave overwash. Each berm and dune plan would reduce the heights of the waves capable of propagating across the island during hurricane events. Increasing the height and mass of the protective structure increases its resistance to storm erosion and wave overtopping. Thus, the level of protection for upland development is increased with the higher, more massive dune structures. Table 4, page 35, shows benefits, costs, and benefit-cost ratios for the berm and dune alternatives considered. As shown in table 4, maximum net benefits (benefits minus costs) are achieved with the 13-foot m.s.l. dune alternative. Although this alternative would produce less average annual benefits than the larger dune alternatives, the additional benefits achieved by the 15-foot and 20-foot dune alternatives are less than the additional cost.



PLAN VIEW

NOT TO SCALE

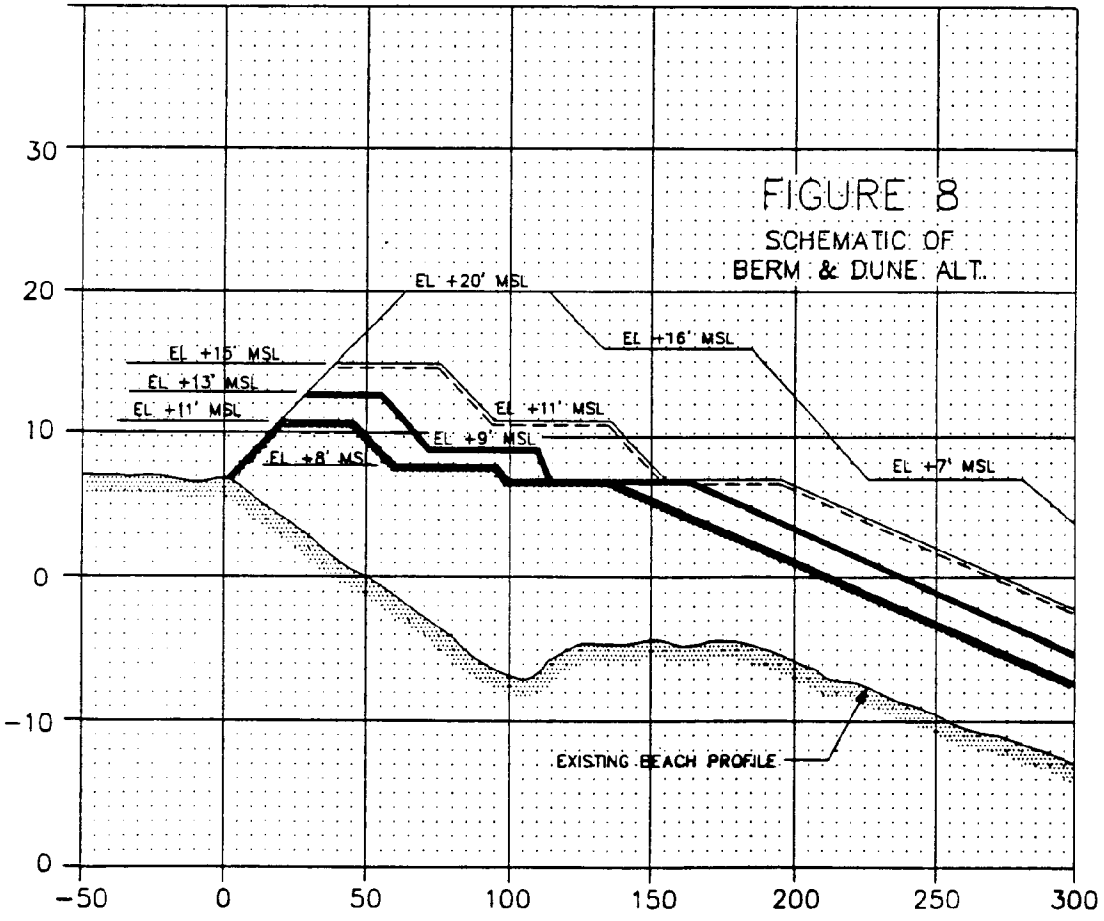


TABLE 4

Costs and Benefits for Combined Beach Erosion and Hurricane Protection Plans
(Based on 50-year period of analysis, 8-5/8% interest rate, October 1988 price levels)

PART I - COSTS

Item	11-ft. m.s.l. Dune Section	13-ft. m.s.l. Dune Section	15-ft. m.s.l. Dune Section	20-foot m.s.l. Dune Section
First Cost:				
Beachfill Construction	$ 4,795,000	$ 6,676,000	$ 8,196,000	$12,148,000
Dune Grassing	51,000	65,000	82,000	112,000
Terminal Groin	926,000	972,000	1,004,000	1,070,000
Contingencies (25%)	1,443,000	1,928,000	2,321,000	3,333,000
Subtotal	7,215,000	$ 9,641,000	$11,603,000	$16,663,000
Engineering & Design (5%)	361,000	482,000	580,000	833,000
Supervision & Admin. (5%)	361,000	482,000	580,000	833,000
Real Estate	1,875,000	1,875,000	1,875,000	1,875,000
Total First Cost	$9,812,000	$12,480,000	$14,638,000	$20,204,000
Interest During Const.	450,000	568,000	663,000	906,000
Total Investment Cost	$10,262,000	$13,048,000	$15,301,000	$21,110,000
Average Annual Cost:				
Interest & Amortization	$ 899,000	$ 1,144,000	$ 1,341,000	$ 1,850,000
Beach Nourishment	425,000	445,000	476,000	551,000
Dune Maintenance	2,000	2,000	2,000	3,000
Groin Maintenance	10,000	10,000	10,000	10,000
Monitoring Surveys	15,000	15,000	15,000	15,000
Total Avg. Annual Cost	$1,351,000	$ 1,616,000	$ 1,844,000	$ 2,429,000

PART II - AVERAGE ANNUAL BENEFITS

Hurricane-Storm Damage Reduction	$1,133,300	$1,629,700	$1,827,100	$2,351,000
Prevent Road Loss	321,000	321,000	321,000	321,000
Prevent Canal Breakthrough	143,400	143,400	143,400	143,400
Recreation	193,800	193,800	193,800	186,300
Benefits During Construction	88,900	113,500	123,300	144,300
Total Avg. Annual Benefits	$1,880,400	$2,401,400	$2,608,600	$3,158,500

PART III - BENEFIT-COST RATIOS

1.4	1.5	1.4	1.3

PART IV - NET AVERAGE ANNUAL BENEFITS

$529,400	$785,400	$764,600	$729,500

RATIONALE FOR PLAN SELECTION

All plans considered for Topsail Beach would control progressive erosion and eliminate permanent land losses. All plans would, to varying extents, reduce damages to structures caused by short-term, storm-induced erosion. The berm and dune plans would also reduce damages due to overwash during hurricanes. All plans are considered to be environmentally acceptable. As discussed previously, the National Objective for Federal water resources projects is to contribute to the National Economic Development. The plan which maximizes this contribution, measured as net economic benefits, is designated the "National Economic Development (NED) Plan." Unless there are other, overriding considerations which favor an alternative plan, the NED plan will be the plan selected for implementation. As shown in table 4, page 35, net average annual benefits are maximized with the 13-foot m.s.l. berm and dune alternative. Therefore, the 13-foot m.s.l. berm and dune plan is designated the NED Plan and the Selected Plan. This plan is discussed in detail in the following report section.

SECTION VI - SELECTED PLAN OF IMPROVEMENT

The purpose of this report section is to centralize information concerning the Selected Plan of Improvement. The Selected Plan is discussed in terms of (1) Plan Features, (2) Construction and Operation, (3) Plan Accomplishments, (4) Plan Impacts, (5) Public Views, and (6) Plan Implementation.

PLAN FEATURES

The Selected Plan of Improvement for Topsail Beach includes a 13-foot m.s.l. dune and a 9-foot m.s.l. storm berm with a total fill width of 160 feet. The dune and storm berm will be fronted by a beach berm at an elevation of 7 feet m.s.l. Project dimensions are shown on figure 9, below, and on plates 3 and 4. Following construction, the dune will be planted with beach grass.

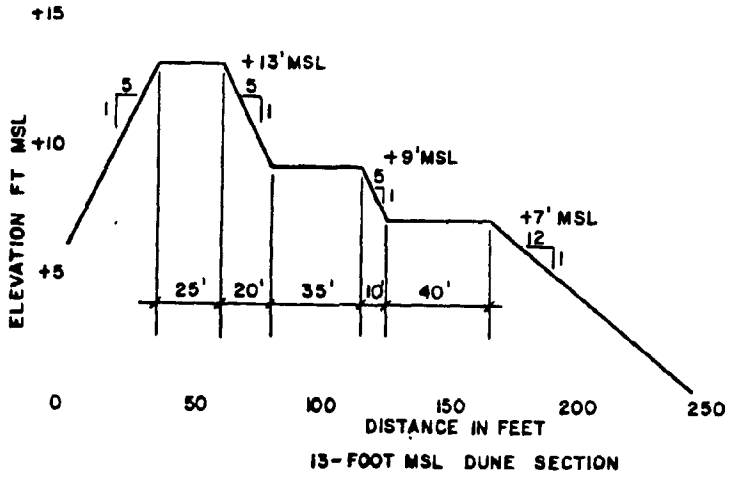


FIGURE 9

Cross-Section, Selected Plan of Improvement

The berm and dune project will extend along the reach shown on plate 3. As shown on the plate, the total length of the fill will be 17,400 feet. This length includes 10,250 feet for the main fill and 7,150 feet for the northern transition where the beach fill will taper into the existing shoreline.

At the south end of the fill a terminal groin will be constructed to control sediment losses from the main fill. A groin structure is necessary at this location since the proximity to New Topsail Inlet does not allow sufficient distance for a gradual transition. Without the groin at this location, sediment losses would make protection of this heavily developed area impracticable. Details of the groin structure are shown on plate 4. As shown, the groin will be constructed of concrete sheetpiles protected by a rubble toe along both sides of the structure. Total length of the groin is 1,010 feet, including a landward section of 260 feet.

PROJECT CONSTRUCTION AND OPERATION

Initial construction of the Topsail Beach project will require approximately 3,240,000 cubic yards of sand. Annual nourishment for the project is projected to be 126,000 cubic yards of material. Renourishment of the project will be done every four years. Therefore, approximately 504,000 cubic yards of sand will be required for each nourishment operation. Material for beachfill construction and nourishment will be obtained from the borrow area shown on plate 3. The material will be pumped to the beach by pipeline dredge and shaped by earth moving equipment.

The terminal groin at the south end of the project will be constructed utilizing prestressed concrete sheetpiles available from sources as close as Wilmington, North Carolina. The granitic stone for the toe protection will come from inland quarries. Marine limestone for bedding material is available from quarries near Maysville and New Bern, North Carolina (quantities and cost estimates are shown in table 5, page 41). Project construction is expected to take about 1.5 years (9 months for the groin and 9 months for the berm and dune); a construction time of 2 years is assumed for economic analysis.

BORROW AREAS AND FILL MATERIAL

As noted above, a potential source of beachfill material is located in Banks Channel as outlined on plate 3. Based on grain size analysis of samples taken in this area, the potential borrow area contains good quality beach sand The amount of silt and clay in the borrow area appeared to be minimal, constituting less than 5 percent of the total volume of material in the borrow area. The material in the Banks Channel potential borrow area is ideal for beach nourishment in that it is coarser than the native beach material and has a wider range of particle sizes. Due to the good quality of the sand in the borrow area and the absence of significant silt or clay deposits, the material in the Banks Channel borrow area was taken to be 100-percent compatible with the native beach material. Material from the borrow area outlined on plate 3 will be utilized for both construction and periodic beach nourishment.

REAL ESTATE REQUIREMENTS

Project construction will require acquisition of a narrow strip of beachfront land along the 10,250-foot reach over which the main fill will be constructed. A construction easement will be required along the 7,150-foot transition section. In addition, 16.5 acres of undeveloped land southwest of the terminal groin will be acquired in fee title. This property will be subject to shoreline adjustments downdrift of the terminal groin (see "Possible Impacts on Shore Processes," page 46).

OPERATION AND MAINTENANCE

The principal task, from a cost standpoint, for operation of the project will be periodic beach nourishment. In addition, dune and groin maintenance will be required. Costs for these items are shown in table 6, page 41.

PLAN ACCOMPLISHMENTS

The Selected Plan of Improvement will stabilize the project reach against further land losses due to progressive erosion and provide an adequate recreation beach for existing and projected future demand. The plan will also eliminate damages caused by storm wave overwash for storms up to a 30-year return interval and reduce wave overwash damages for larger events. Finally, structural damages associated with storm-induced beach erosion would be prevented for storms with return periods up to 70 years.

In summary, the Selected Plan achieves 100 percent of the potential economic benefits for recreation, road protection, and prevention of inlet breakthrough. The Selected Plan reduces average annual damages to structures due to hurricane-wave action and storm induced erosion. As shown in table 2, page 26, estimated average annual damages in the hurricane-wave category are estimated at $2,975,000 without a Federal project. With the Selected Plan in place, average annual damages are estimated at $1,345,300. Thus, the plan would reduce hurricane-wave damages by an average annual amount of $1,629,700, or about 55 percent. A summary of economic benefits for the Selected Plan is presented below under "Costs and Benefits."

Although the plan will substantially reduce damages due to hurricane-wave overwash, it should be noted that the Selected Plan of Improvement provides for storm protection only in terms of protecting development from the action of ocean storm surge and wave action. There are no provisions in the project to protect the area against storm-tide flooding occurring from increased water levels in the estuaries backing the barrier island.

COSTS AND BENEFITS, SELECTED PLAN

As discussed in the report section on the "Federal Objective," any plan to be recommended for implementation as a result of this study must make a positive contribution to National Economic Development. This contribution is measured by the amount by which project benefits exceed project costs. As discussed below, the Selected Plan of Improvement has a favorable benefit-cost ratio, indicating that it is consistent with this objective. Benefits and costs are discussed on the following page.

BENEFITS

Total average annual benefits for the Selected Plan are summarized in table 5, below. As shown in table 5, the majority of the project benefits are for hurricane and storm damage reduction.

TABLE 5

Average Annual Benefits for Selected Plan of Improvement,
13-foot m.s.l. Dune with 9-foot Storm Berm
(8-5/8 percent interest rate, October 1988 price levels,
50-year period of analysis)

Benefit Category	Average Annual Benefit
Hurricane and Storm Damage Reduction	$1,629,700
Protection of Road	321,000
Prevention of Canal Breakthrough	143,400
Recreation	193,800
Benefits During Construction	113,500
TOTAL AVERAGE ANNUAL BENEFITS	$2,401,400

As shown above, total average annual benefits for the Selected Plan are estimated at $2,401,400. If the plan is to be recommended for implementation, average annual costs must be less than this amount. Project costs are discussed below.

PROJECT COSTS

Determination of the economic costs of the Selected Plan consists of three basic steps. First, project first costs are computed. First costs include expenditures for project design and construction and related costs of supervision and administration. First costs also include the lands, easements, and rights of way needed for project construction and maintenance.

Second, interest during construction is added to the project first cost. For purposes of economic analysis, a 2-year construction period is assumed. The project first cost plus interest during construction represents the total investment required to place the project into operation.

Third, average annual costs are computed. These costs consist of interest and amortization of the initial investment, and the annual cost of project operation, maintenance, and nourishment. The average annual costs provide a basis for comparing project costs to project benefits. A summary of the computations involved in each of the three steps described above is presented on the following pages.

Project First Costs--The total first cost of construction for the Selected Plan is estimated at $12,480,000, based on October 1988 price levels. An itemized listing of first costs is presented in table 6, below.

TABLE 6

Estimated First Costs for Selected Plan of Improvement
13-foot m.s.l. Dune Section
(8-5/8 percent interest rate; October 1988 price levels)

Item	Quantity	Unit Cost	Cost
BEACHFILL CONSTRUCTION			
Mobilization & Demobilization	Job	Lump Sum	$ 520,000
Dredging	3,240,000	$1.90/cy	6,156,000
Subtotal, Beachfill			$ 6,676,000
DUNE GRASSING	19 Acres	$3,400/ac	$ 65,000
TERMINAL GROIN			
Concrete Sheetpile	6,888 LF	$80/LF	$ 551,000
Toe Protection			
a. 1,600-lb. Granitic Stone	4,600 Tons	$46/Ton	212,000
b. 6,400 lb. Granitic Stone	3,200 Tons	$46/Ton	147,000
c. Marine Limestone Bedding	2,600 Tons	$24/Ton	62,000
Subtotal, Groin			$ 972,000
CONTINGENCIES (25%)			$ 1,928,000
Subtotal			$ 9,641,000
ENGINEERING & DESIGN			$ 482,000
SUPERVISION & ADMINISTRATION			$ 482,000
REAL ESTATE			$ 1,875,000
TOTAL FIRST COST			$12,480,000

Interest During Construction--Interest during construction, based on a 2-year construction period, is estimated at $568,000. Thus, the total investment required to place the project into operation will be $13,048,000 ($12,480,000 first cost plus $568,000 interest during construction).

Average Annual Costs--Average annual costs consist of interest and amortization of the initial investment over an assumed project life of 50 years. Operation, maintenance, and beach nourishment costs are also included. As shown in table 7, below, average annual costs for the Selected Plan of Improvement are estimated at $1,616,000.

TABLE 7

Average Annual Costs for Selected Plan of Improvement
13-foot m.s.l. Dune Section
(8-5/8 percent interest rate, 50-year period of analysis)

Item	Average Annual Ccost
INTEREST & AMORTIZATION OF INITIAL INVESTMENT	$1,144,000
BEACH NOURISHMENT	445,000
DUNE MAINTENANCE	2,000
GROIN MAINTENANCE	10,000
MONITORING SURVEYS	15,000
Total Average Annual Cost	$1,616,000

Benefit-Cost Ratio--The Selected Plan produces average annual benefits estimated at $2,401,400 (from table 5), while average annual costs are estimated at $1,616,000 (from table 7). Thus, benefits divided by costs results in a benefit-cost ratio of 1.5. Since project benefits exceed costs, the Selected Plan is considered to be economically feasible. However, any plan of improvement to be recommended for implementation must also be evaluated in terms of its environmental acceptability. A discussion of the environmental impacts of the Selected Plan is presented on the following pages.

ENVIRONMENTAL IMPACTS

The Selected Plan of Improvement is considered to be environmentally acceptable, although some adverse environmental impacts are anticipated. Significant resources likely to be affected by the Selected Plan include biological resources, water quality, esthetic values, and, possibly, a threatened species. No effect on cultural resources is anticipated. Anticipated impacts on each resource are discussed below.

IMPACTS ON BIOLOGICAL RESOURCES

Biological resources will be affected by dredging of material for project construction and by placement of this material on the beach. These impacts will reoccur as the project is renourished at 4-year intervals. Biological resources will also be affected, although to a lesser degree, by groin construction. In order to minimize impacts on biological resources, construction and maintenance activities will be conducted during a period of low biological productivity from 15 November to 1 May, if practicable. Construction of the groin at the south end of the fill cannot be accomplished within this time frame; however, as will be discussed below, impacts on biological resources associated with this plan feature are very minor. Expected impacts on biological resources due to borrow area dredging, fill placement, and groin construction are discussed below.

Borrow Area Dredging. Within the borrow area, existing shallow water and intertidal habitat will be converted to deep water habitat, and resident fauna will be lost. Limited sample data from the overall borrow area indicate that a small number (both species and population) of bottom-dwelling worms inhabit the area. Since stable, productive bottom will be avoided, there should be very little impact associated with the borrow area. A stable bottom community is not expected to occur in the project area with or without the project because a suitable substrate for population by benthic organisms is lacking.

No significant impact on biological resources is expected due to piping of dredged material from the borrow area to the construction area. The pipeline route will follow existing waterways or roads from Banks Channel to the beach. Negative impacts associated with pipeline routes will be minor and temporary.

Fill Construction. The major impacts associated with this type of operation include:

A. Increased turbidity in the surf zone;

B. Effects on the benthic communities;

During disposal operations, there will be an increase in the turbidity of the surf zone in the immediate area of sand deposition. This increase may cause the temporary displacement of various species of sport fish, causing a negative impact to surf and pier fishing in the area of deposition.

Although a considerable body of information is available on the effects of dredging on benthic communities, much less is known about specific environmental consequences of beach nourishment. The disposal operation may also have a negative impact on the intertidal macrofauna as was documented in "A Study of the Ecological Impact of Beach Nourishment With Dredged Material of the Intertidal Zone," by Reilly and Bellis (1978). As stated by Reilly and Bellis, "Beach nourishment virtually destroys existing intertidal macrofauna; however, recovery is rapid once the pumping operation ceases. In most cases, recovery should occur within one or two seasons following the project completion." The impacts to intertidal macrofauna and subsequent reduction in surf feeding fish should be minimized by avoiding disposal during the summer months.

Groin Structure. The terminal groin should have no significant adverse impacts to either fish or wildlife resources since it will be located on a high energy sand beach. In all, approximately 0.1 acre of beach and ocean habitat will be converted to rocky shoreline with construction of the groin. Minor losses of coquina clam, mole crab, and ghost crab habitat will occur. These losses should be offset, however, by provision of a stable substrate upon which a diverse assemblage of fouling organisms (algae, barnacles, hydrozoans) can attach.

ENDANGERED AND THREATENED SPECIES

The threatened loggerhead sea turtle is known to use the project area for nesting and, therefore, could be affected by the proposed action. In order to avoid impacts on nesting sea turtles, nourishment sand should match natural sand as closely as possible. As discussed previously, the material available from the borrow area shown on plate 3 appears to closely match the existing beach material, and the sea turtle should not be affected by this aspect of project construction. In addition, construction and maintenance nourishment should take place during the 15 November to 1 May period to avoid times of high biological productivity, including sea turtle nesting. However, if circumstances require that project construction or nourishment occur during the nesting season, the sea turtle could be affected. Therefore, a monitoring and nest relocation program will be implemented if beach nourishment overlaps the nesting season. As discussed previously, the piping plover is known to be a winter resident in the vicinity of Topsail Island. However, this species has not been documented to nest on Topsail Island, and is not considered likely to be affected by project construction and maintenance.

IMPACTS ON WATER QUALITY

The proposed project will result in elevated turbidity and suspended solids compared to the existing non-storm conditions of the surf zone in the immediate area of sand deposition. Due to the low percentage of silt and clay in the proposed borrow area (less than 5%), this impact is not expected to be greater than the natural increase in turbidity and suspended material during storm events. The impacts associated with the discharge of dredged material into waters of the United States are discussed in the Section 404(b) evaluation (attachment 1 to the Environmental Impact Statement).

ESTHETIC RESOURCES

Esthetic impacts of project construction are expected to be both positive and negative. Construction and maintenance of a wider, stabilized beachfront should generally have a positive effect on the esthetic values of the beach as perceived by local residents and vacationers. Although the landward portion of the groin will be visible on the south end of the project fill, the overall beach strand should have a more "natural" appearance than would be present if no action is taken to control erosion in this area. Minor noise and visual intrusion will be associated with project construction and beach nourishment. However, these effects will be short-term.

CULTURAL RESOURCES

An assessment of cultural resources was conducted and coordinated with the North Carolina Division of Archives and History, Underwater Archaeology Unit. The assessment recommended magnetic survey of the borrow area only for purposes of identifying shipwrecks determined to be probable for the project borrow area. No reconnaissance was recommended for the beachfront fill area because of: recent formation of this area as a by-product of channel migration, erosion of the existing beachfront, and beachfront location and limited dimensions of the project features. No historic sites are known for the beach area. A remote sensing reconnaissance and aerial photo study of the borrow area were conducted during June 1988. No submerged resources were identified within the borrow area and no impacts are anticipated.

SUMMARY OF ENVIRONMENTAL IMPACTS

Adverse environmental impacts associated with the proposed action include (1) Destruction and displacement of intertidal and benthic fauna during construction and nourishment operations; (2) temporary increases in turbidity and suspended solids during construction and nourishment operations; and (3) potential adverse impacts on the loggerhead sea turtle if project construction and beach nourishment occur during the nesting season. A program of monitoring and nest relocation will be implemented to avoid adverse impacts on the loggerhead sea turtle if beach nourishment operations overlap the sea turtle nesting season.

MITIGATION REQUIREMENTS

The term "mitigation requirements," as used herein, refers to actions necessary to reduce or compensate for adverse environmental impacts of the project. Overall environmental impacts are expected to be minor, due to the scope, location, and timing of project activities. Impacts on fish and wildlife resources will be negligible. Therefore, no specific mitigation measures appear necessary. However, should project construction and beach nourishment occur during the nesting season of the threatened loggerhead sea turtle (1 May through 15 November), a beach monitoring and nest relocation program will be implemented to avoid impacts on this species.

POSSIBLE IMPACTS ON SHORE PROCESSES

As discussed previously, the use of a single terminal groin at the south end of the beachfill is an element of each project plan. This project feature is necesary due to the proximity of the fill terminus to New Topsail Inlet. The use of a groin at this location could cause a readjustment in the shoreline configuration on the inlet side of the groin. The undeveloped area southwest of the groin, consisting of 16.5 acres, will be acquired by the Federal Government.

The shape of the reconfigured shoreline is difficult to predict due to the groin being situated in an inlet environment in which the configuration of the shoreline is controlled by both tidal currents and incident wave conditions. With the placement of the beachfill north of the groin, however, sediment transport past the groin should continue at a rate equal to or slightly greater than the normal rate. Thus, the beach to the inlet side of the groin would continue to receive material at the present rate, which would prevent significant net land losses in this area.

PUBLIC VIEWS

To date, the emphasis in project coordination has been in obtaining the views of the potential non-Federal sponsor, the Town of Topsail Beach, and the U.S. Fish and Wildlife Service. The project plan, as presently formulated, is considered acceptable to local interests and to agencies and individuals having responsibilities and interests related to environmental quality. Required coordination related to the environmental permits and entitlements necessary for project construction is discussed in detail in the attached Environmental Impact Statement (EIS). Public coordination will continue with circulation of this draft Feasibility Report and EIS for review and comment. Local views and the views of the Fish and Wildlife Service are summarized below.

VIEWS OF POTENTIAL NON-FEDERAL SPONSOR

If the project is ultimately constructed, a non-Federal sponsor will be required to participate financially in project construction (see attached discussion of "Division of Plan Responsibilities." The potential non-Federal sponsor is the Town of Topsail Beach. The Selected Plan of Improvement is considered to be acceptable to, and supported by, the Town of Topsail Beach (see "Pertinent Correspondence," appendix A.)

VIEWS OF THE U.S. FISH AND WILDLIFE SERVICE

Views of the Fish and Wildlife Service are contained in the attached Draft Coordination Act Report (see appendix B). The project plan is considered to be acceptable to the Service, provided certain environmental criteria are observed in project construction and subsequent beach nourishment operations. Specific recommendations of the Fish and Wildlife Service are presented below, along with a discussion of how each recommendation has been incorporated into the project plan.

Recommendation--Borrow materials needed for the beach and dune restoration alternatives will be obtained from estuarine bottoms which do not support environmentally significant plant or animal communities as determined by the Service.

Discussion--The proposed borrow area, located in Banks Channel, is shown on plate 3. This area meets the criteria recommended by the Service.

Recommendation--Excavation of borrow materials and beach and dune restoration work will be limited to the period December 15 through February 28 of any year unless otherwise specified by the Service and the Corps of Engineers.

Discussion--The period recommended by the Service appears to be too restrictive. Based on estimated time required for project construction and beach nourishment, a period of 15 November through 1 May appears more practicable, and is the construction period used in the analyses herein. If construction and beach nourishment activities go beyond these dates, a beach monitoring and nest relocation program for the loggerhead sea turtle will be implemented to avoid impacts on this species.

Recommendation--To preclude private use of publicly funded beach and dune restoration sites, undeveloped oceanfront property located adjacent to restored beaches and dunes will be maintained, to the maximum extent practicable, as public lands for the life of the project.

Discussion--All lands necessary for project construction and permanent right of way will be maintained as public lands. However, as discussed previously, all developable lots at Topsail Beach are expected to be occupied by the time (1997) a Federal project is implemented.

Recommendation--Beach access and parking will be provided to the maximum extent practicable; access by pedestrians and off-road vehicles to public trust lands and waters in the vicinity of Topsail Inlet will be provided.

Discussion--An analysis of parking and access needs will be conducted during the subsequent stages in development of the project. These recommendations will be made part of the plan. It will be the responsibility of the locals to provide land for additional parking and access needs.

SUMMARY OF PLAN EFFECTS

Table 8, following page, provides a summary of project effects. Effects are evaluated in the following categories, or "accounts:" (1) National Economic Development (NED), which reflects the plan's economic justification; (2) Environmental Quality, which evaluates the plan's environmental acceptability; (3) Regional Economic Development; and (4) Other Social Effects, including health and safety. Effects in these four categories encompass significant effects on the human environment as required by the National Environmental Policy Act of 1969. They also encompass social well being as required by Section 122 of the Flood Control Act of 1970. For purposes of comparison, the effects of the Selected Plan are evaluated against the "without project" or "no action" condition. As shown in table 8, the Selected Plan is judged to have an adverse environmental impact, although this impact is not considered significant. Except for temporary noise and disruption of beach activities during construction and maintenance, all impacts on the community are considered positive.

TABLE 8

Summary of Plan Effects

	SELECTED PLAN OF IMPROVEMENT	"NO ACTION"
1. NATIONAL ECONOMIC DEVELOPMENT		
Beneficial Contributions		
Hurricane-Storm Damage Reduction	$1,629,700	None
Elimination of Non-Federal Costs for Protection of Ocean Boulevard	$ 321,000	None
Prevention of Inlet Breakthrough	$ 143,400	None
Recreation	$ 193,800	None
Benefits During Construction	$ 113,500	None
Total Average Annual Benefits	$2,401,400	None
Adverse Contributions		
Annual Project Costs: Interest & Amortization	$1,144,000	Continuation of hurricane and and storm damages, along with expenditures for road protection
Maint. & Beach Nourishment	$ 472,000	
Total Avg. Annual Cost	$1,616,000	
2. ENVIRONMENTAL QUALITY		
Beneficial Contributions	None	None
Adverse Contributions		
a. Water Quality and Aquatic Resources	*Increased turbidity during construction and maintenance	None
b. Vegetation and Wetlands	*No significant impact	None
c. Wildlife Habitat	*Destruction and displacement of intertidal and benthic fauna during construction and maintenance; effect will be temporary, but will recur over life of project	None
d. Esthetic Values	*No significant impact	Continued loss of esthetic values of oceanfront as erosion intrudes upon development
e. Air and Noise Pollution	*Increased noise and air pollution during construction and maintenance	None

TABLE 8

Summary of Plan Effects--continued

	SELECTED PLAN OF IMPROVEMENT	"NO ACTION"
2. ENVIRONMENTAL QUALITY--cont'd		
f. Threatened and Endangered Species	*Loggerhead sea turtle is known to use project area; if project construction or beach renourish- overlaps nesting season, nest monitoring and relocation program program will be implemented.	None
g. Cultural Resources	None	None
3. REGIONAL ECONOMIC DEVELOPMENT		
Beneficial Contribution		
Increased Income and employment	*Potential increase in tourism income due to beach stabilization	None
Adverse Contributions		
Increased Income and employment	None	*Potential loss of tourism income due to beach erosion
4. OTHER SOCIAL EFFECTS		
Beneficial Contributions		
Enhancement of community social well being, health and safety	*Reduction of hurricane and storm hazard along with shoreline stabilization is expected to have favorable impact on social well being and safety; net effect not quantified	None
Adverse Contributions		
Enhancement of community social well being, health and safety	*Minor and temporary inconvenience due to construction activities.	*Continued threat of erosion, along with hurricane and storm damages; hurricane of moderate intensity could breach island, isolating a portion of the community

*Effect specified in Section 122 of PL 91-611.

SECTION VII - PLAN IMPLEMENTATION

The purpose of this report section is to present information related to the procedures which will be followed in obtaining the necessary congressional and administrative approvals for the Selected Plan and its ultimate construction. This section presents (1) a summary of the required steps which must be accomplished prior to project construction; and (2) a discussion of the division of plan responsibilities.

REQUIRED STEPS

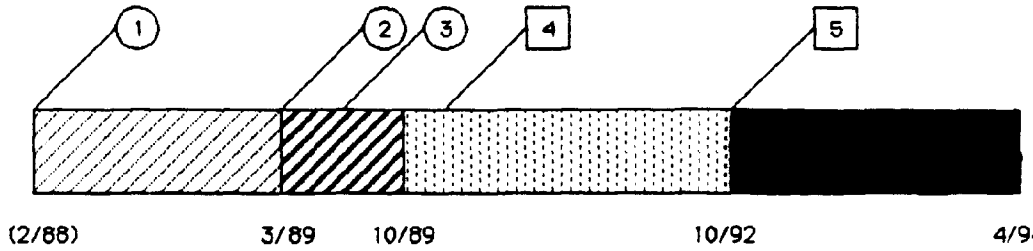
Figures 10 and 11 show the schedule for the Topsail Beach project through construction. The reviewer should note that this schedule assumes expeditious review and approval of the project through all steps, including congressional authorization and funding. Actual project implementation could take longer. The procedure leading to implementation of the Selected Plan is as follows: the District Engineer will transmit this report to the Division Engineer, South Atlantic, U.S. Army Corps of Engineers, for review. Upon completion of review, the Division Engineer will issue a public notice to interested parties advising them of the report recommendations and informing them that the report will be considered by the Board of Engineers for Rivers and Harbors, Washington, D.C. Interested parties will have an opportunity to present written views on the report for consideration by the Board.

Following action by the Board, its report and the proposed report of the Chief of Engineers will be submitted to the Governor of North Carolina and interested Federal agencies for comment. Following the State and interagency review, the final report of the Chief of Engineers will be forwarded by the Secretary of the Army to the Congress, subsequent to his seeking the comments of the Office of Management and Budget regarding the relationship of the project to the program of the President.

Congressional authorization of the project would then be required. This procedure would include appropriate review hearings by the Public Works Committees. If the project is authorized the Chief of Engineers would then have to include funds in his budget request for design and construction. If the Congress appropriates the necessary initial funds, formal assurances of local cooperation would then be requested from the non-Federal sponsor.

Advance engineering and design would then be initiated, project formulation reviewed, and the plan modified to meet the then-current conditions. Plans, specifications, and an engineering estimate of costs would then be prepared by the District Engineer, bids would be invited, and a contract awarded. Prior to contract award, the necessary local actions would be required. Following completion of the project, local interests would be responsible for operation and maintenance. Beach nourishment will be accomplished under contract to the Federal Government, and will be cost-shared by the Federal Government and the non-Federal sponsor. A discussion of the division of responsibilities is presented on page 55.

TOPSAIL BEACH SCHEDULE THROUGH CONSTRUCTION



○ Apportionment/Allotment Decision

□ New Start Decision (Budget Decision)

1. Draft Feasibility Report Completed
2. Feasibility Report Completed
3. ASA(CW) Report to Congress
4. Congressional Authorization
5. Construction Start

Feasibility Phase

Washington Review

Preconstruction Engr & Design (PED)

Construction Phase

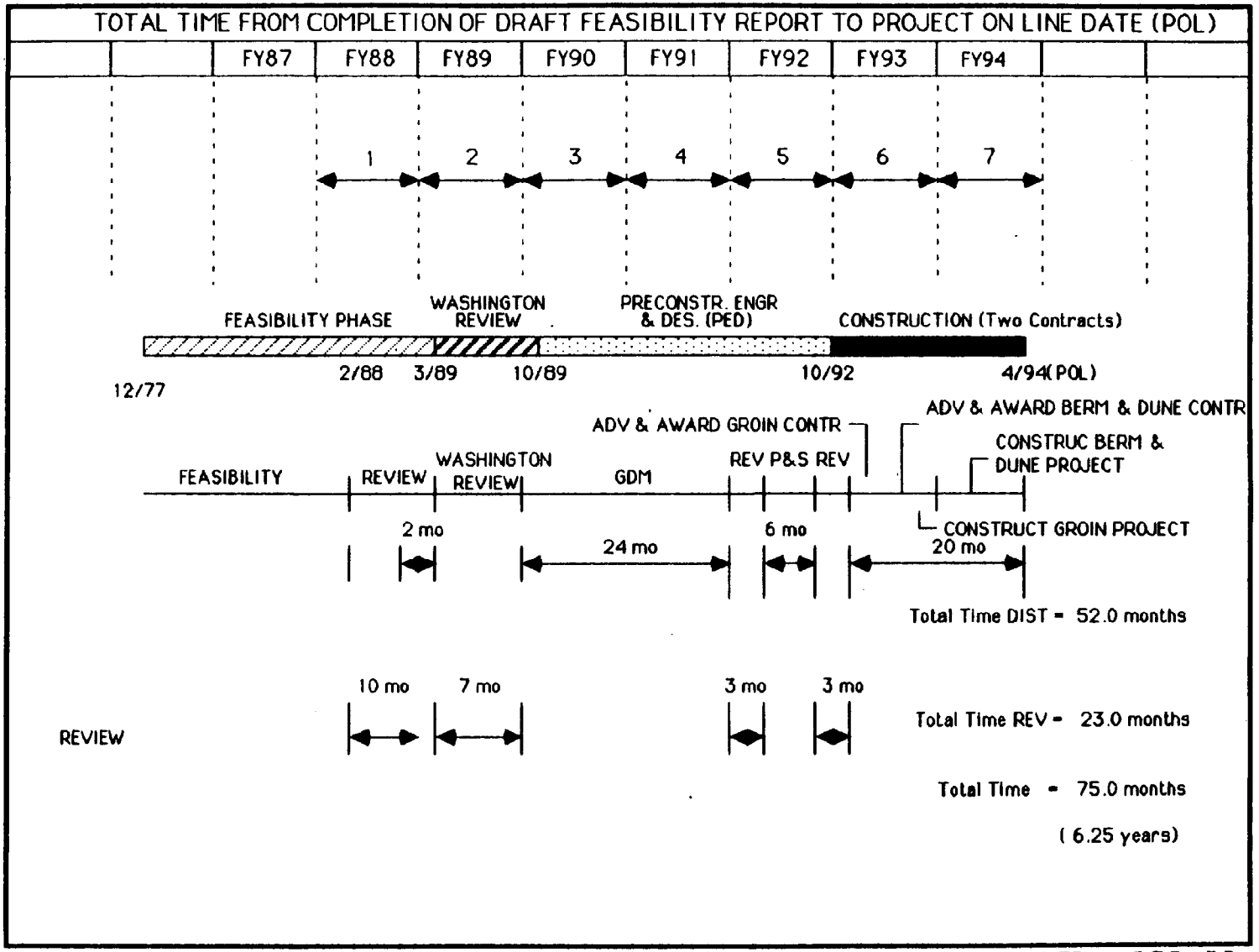
TENTATIVE MILESTONE SCHEDULE

Comments	Schedule	Item	Duration
	2/89	Wilmington District (SAW) submits final Feasibility Report to South Atlantic Division (SAD)	
	3/89	Report review, coordination, finalization, Div Engr's Public Notice, send final report to Board of Engrs for Rivers & Harbors (BERH). Express FY90 capability PED	1 month
	4/89 - 6/89	Washington level processes & submits report to Congress	3 months
	12/89	Congress authorizes project	
Receive FY90 PED	10/89 - 9/91	SAW initiates Preconstruction Engineering & Design (PED) & completes General Design Memorandum (GDM) & draft Local Cooperation Agreement (LCA) & submits to SAD	24 months
	10/91 - 12/91	SAW processes GDM and gets approval to start plans & specifications (P&S)	3 months
	1/92 - 6/92	SAW completes two draft P&S & submits to SAD	6 months
Congressional authorization required by 12/89	7/92 - 9/92	SAD review, SAW revisions, ready to advertise	3 months
	10/92 - 12/92	SAW advertises & awards terminal groin contract	3 months
	1/93 - 10/93	SAW construcst terminal groin	9 months
	6/93 - 8/93	SAW advertises & awards berm & dune contract	3 months
	8/93 - 4/94	SAW constructs berm and dune (Dredge Window Nov-May)	9 months

FIGURE 10

FIGURE 11

STUDY/PROJECT SCHEDULE **STUDY/PROJECT NAME: TOPSAIL BEACH**



CWIS NO. 79730 **NAME OF MANAGER: RON FASCHER** **DATE SCHD REVISED: DEC 88**

ADP NO. AA937

FILE: TOPSAIL

DIVISION OF PLAN RESPONSIBILITIES

Federal policy concerning cost sharing for water resources projects requires that project costs be allocated to the various purposes served by the project; these costs are then apportioned between the Federal Government and the non-Federal sponsor according to percentages specified in Federal guidelines. As shown in table 9, below, all project costs are allocated to the purpose of "hurricane and storm damage reduction." Under current Federal policy, costs allocated to this category are shared with the Federal Government paying 65 percent and the non-Federal sponsor paying 35 percent.

TABLE 9

Cost Allocation and Apportionment

PART I - INITIAL PROJECT CONSTRUCTION

Project Purpose	Project First Cost	Apportionment (%) Non-Federal	Federal	Apportionment ($) Non-Federal	Federal
Hurricane and Storm Damage Reduction	$12,480,000	35%	65%	$4,368,000	$8,112,000

PART II - BEACH RENOURISHMENT

Project Purpose	Cost Per Operation	Apportionment (%) Non-Federal	Federal	Apportionment ($) Non-Federal	Federal
Hurricane and Storm Damage Reduction	$2,100,000	35%	65%	$735,000	$1,365,000

As shown above, the Federal and non-Federal shares of initial project construction are estimated at $8,112,000 and $4,368,000, respectively. The non-Federal share includes $1,875,000 in lands, easements, and rights of ways. The remainder will be in the form of a cash contribution. Costs of beach renourishment are estimated at $1,365,000 Federal and $735,000 non-Federal for each renourishment operation. Renourishment is expected to be required at intervals of about 4 years. The reviewer should note that, for purposes of cost apportionment, beach renourishment is considered "construction" and thus is cost shared in the same percentages (65-percent Federal, 35-percent non-Federal) as are the project first costs. Project maintenance, including dune and groin repair, will be the responsibility of the non-Federal sponsor (see table 7, page 42).

SECTION VIII - CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

I have given consideration to all significant aspects in the overall public interest, including engineering feasibility, economic, social, and environmental effects. The Selected Plan described in the report provides the optimum solution for storm damage reduction for Topsail Beach and adjacent areas.

RECOMMENDATIONS

This study has addressed the needs for hurricane protection, beach erosion control, and navigation at Topsail Beach, Surf City, West Onslow Beach, Bogue Inlet, and New River Inlet. Recommendations relative to Bogue Inlet and New River Inlet are contained in the project reports pertaining to these inlets. No Federal improvements are recommended at Surf City and West Onslow Beach. Recommendations relative to Topsail Beach are presented below.

I recommend that the plan of improvement described herein as the "13-foot m.s.l. dune alternative," and selected herein for purposes of beach erosion control and hurricane protection at Topsail Beach, North Carolina, be authorized for implementation as a Federal project, with such modifications as in the discretion of the Chief of Engineers may be advisable; at a first cost to the United States presently estimated at $8,112,000, and annual costs to the United States presently estimated at $1,365,000. The recommended plan consists of a dune system to be constructed to a height of 13 feet m.s.l., fronted by a storm berm at elevation 9 feet m.s.l., with a main fill length of 10,250 feet. Recommendation of this plan is made, provided that, except as otherwise provided in these recommendations, the exact amount of non-Federal contributions shall be determined by the Chief of Engineers prior to project implementation in accordance with the following requirements to which non-Federal interests must agree prior to implementation.

a. Provide all lands, easements, right-of-way, and dredged material disposal areas and perform all relocations and alterations of buildings, utilities, highways, railroads, bridges (other than railroad bridges), sewers and related and special facilities determined by the Government to be necessary for construction of the project.

b. If the value of the contributions provided under paragraph (a) represents less than 35 percent of total project costs, provide, during the period of construction, a cash contribution in the amount necessary to make its total contribution equal to 35 percent of total project costs.

c. Hold and save the Government free from all damages arising from the construction, operation, and maintenance of the project, except for damages due to the fault or negligence of the Government or its contractors.

d. Comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (P.L. 91-646).

e. Publicize flood plain information in the area concerned and provide this information to zoning and other regulatory agencies for their guidance and leadership in preventing unwise future development in the flood plain and in adopting such regulations as may be necessary to prevent unwise future development and to insure compatability with protection levels provided by the project.

f. As to realize the benefits upon which Federal participation is based, provide and maintain clearly marked beach access, nearby parking areas, and other public use facilities, open and available to all on equal terms.

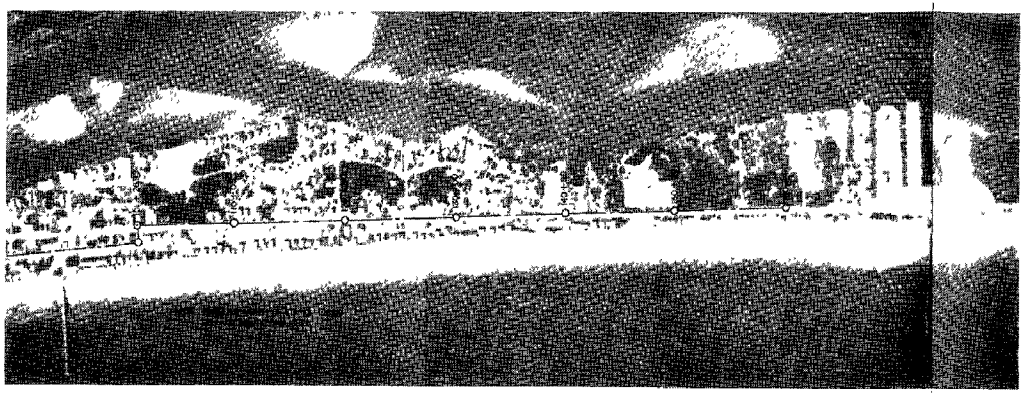
g. Assure and continue to assure conditions of public ownership and use upon which the amount of Federal participation is based during the economic life of the project in accordance with the existing law and based on shore ownership and use existing at the time of construction.

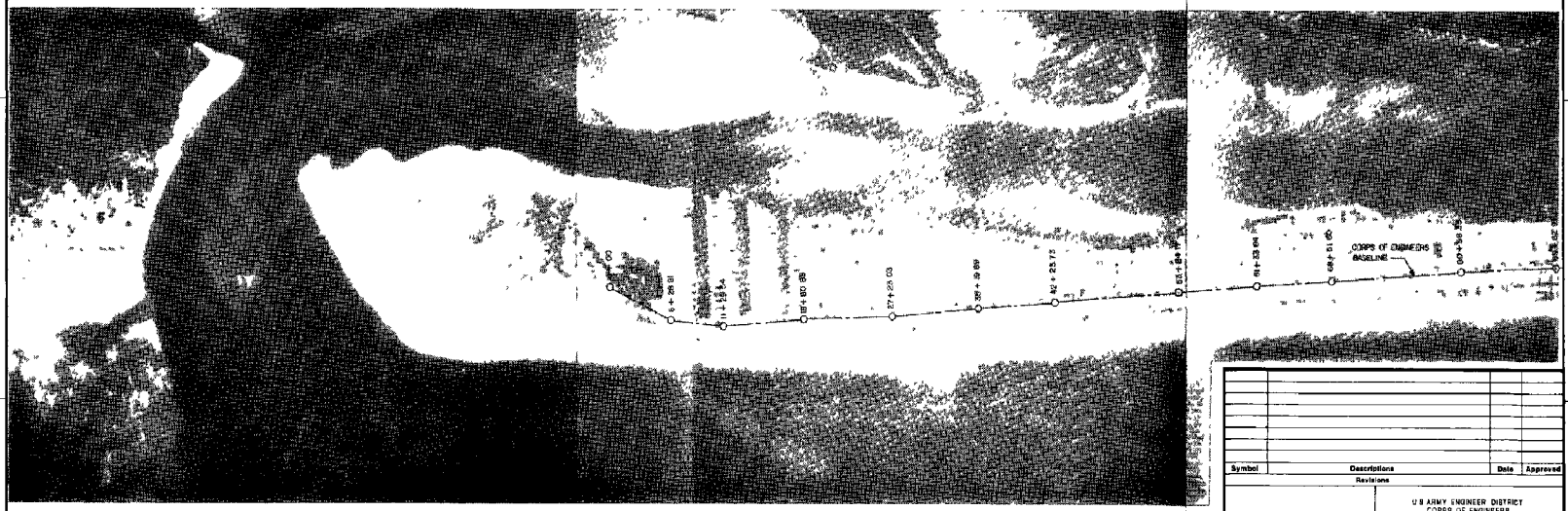
h. Be solely responsible for operating, maintaining, replacing, and rehabilitating the project or element.

The recommendations contained herein reflect the information available at this time and current departmental policies governing formulation of individual projects. They do not reflect program and budgeting priorities inherent in the formulation of a national Civil Works construction program nor the perspective of higher review levels within the Executive Branch. Consequently, the recommendations may be modified before they are transmitted to the Congress as proposals for authorization and implementation funding.

LAWRENCE W. SAUNDERS
Chief, Planning Division

PAUL W. WOODBURY
Colonel, Corps of Engineers
Commanding





Symbol	Descriptions	Date	Approved
	Revisions		

U S ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
WILMINGTON NORTH CAROLINA

Designed by

Drawn by

Checked by

Reviewed by
CHIEF, SECTION

Approved by:
CHIEF, DESIGN BRANCH

US Army Corps of Engineers

SOUTH END
TOPSAIL BEACH

Scale:

Date:

Drawing Code:

Plate Number: 1

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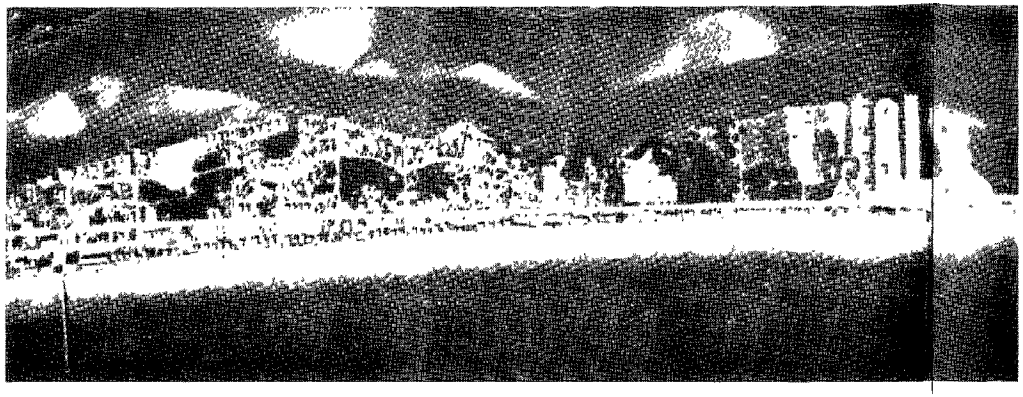
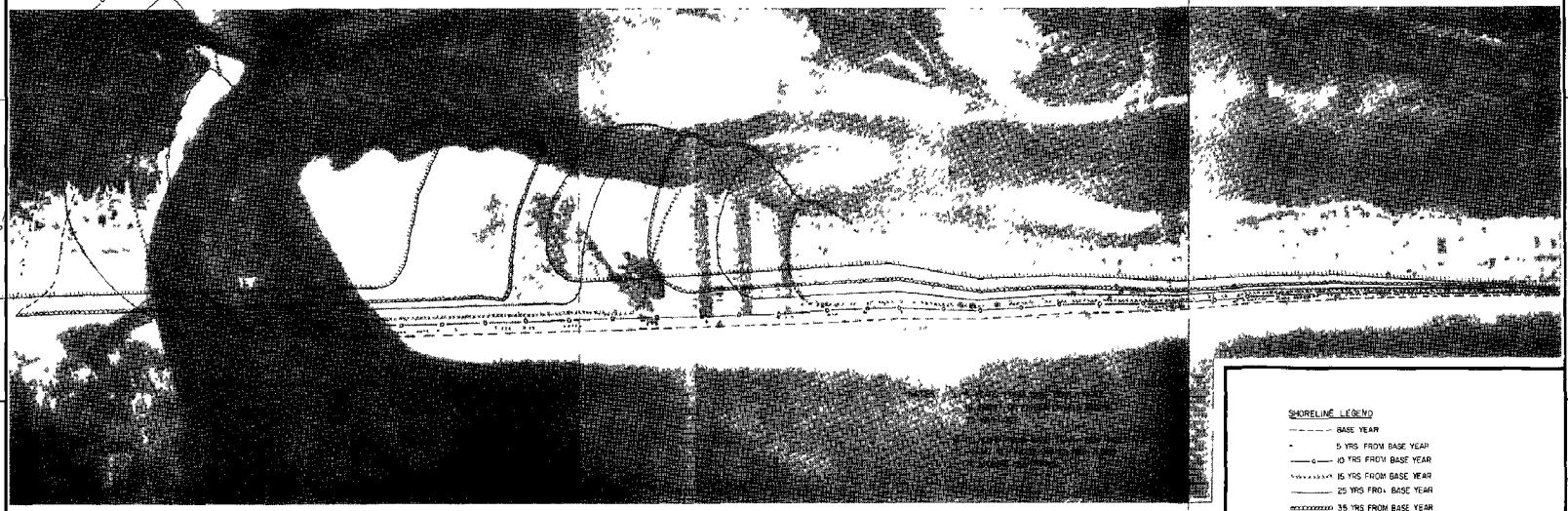
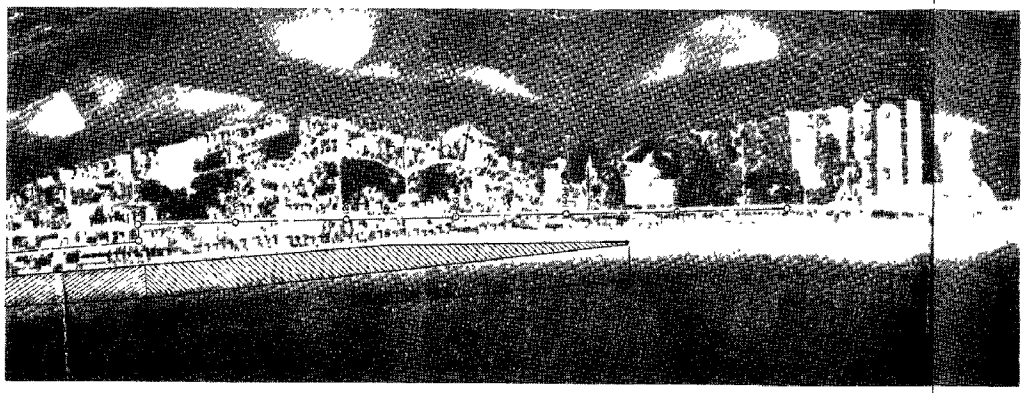


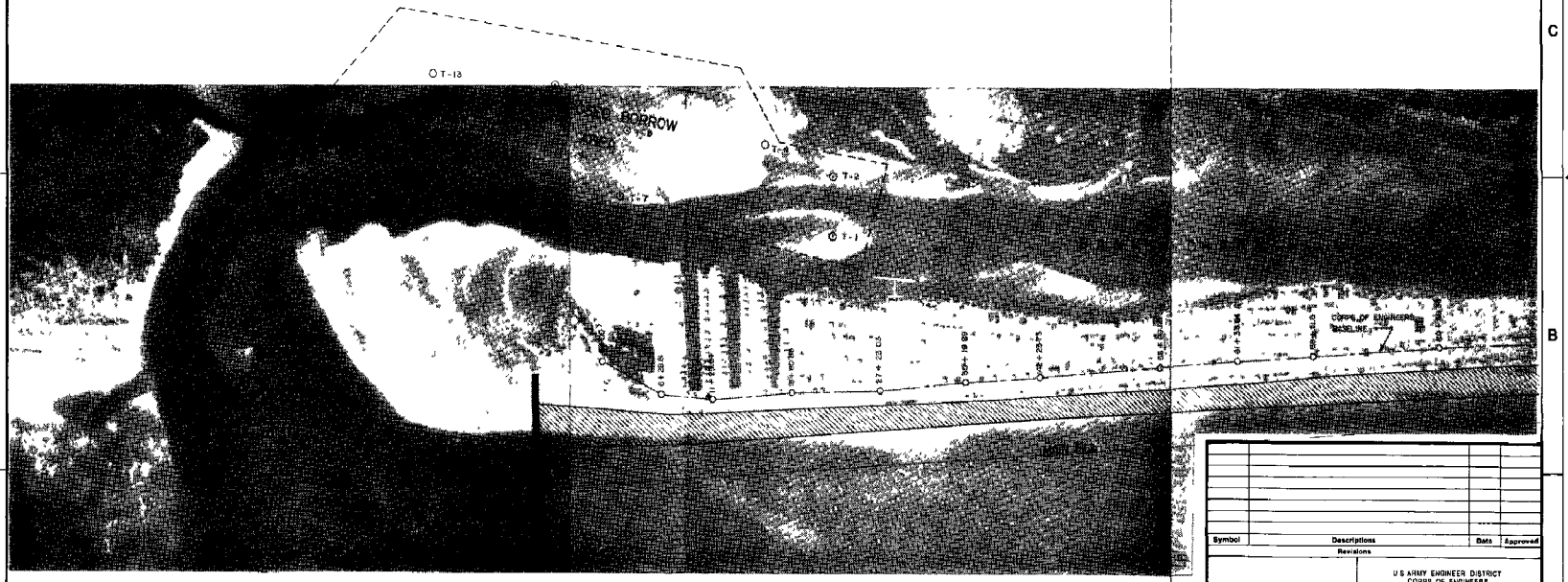


SHORELINE LEGEND

- BASE YEAR
- 5 YRS FROM BASE YEAR
- 10 YRS FROM BASE YEAR
- 15 YRS FROM BASE YEAR
- 25 YRS FROM BASE YEAR
- 35 YRS FROM BASE YEAR
- 50 YRS FROM BASE YEAR

Designed by	US Army Corps of Engineers	
Drawn by	FUTURE SHORELINE CONDITIONS	
Checked by	SOUTH END OF TOPSAIL BEACH	
Reviewed by: CHIEF, SECTION	Scale	Plate Number: 2
Approved by: CHIEF, DESIGN BRANCH	Date	Sheet of
	Drawing Code	





Symbol	Descriptions	Date	Approved
	Revisions		

U S ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
WILMINGTON NORTH CAROLINA

Designed by
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Approved by

GENERALIZED BEACHFILL
PLAN LAYOUT

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Date
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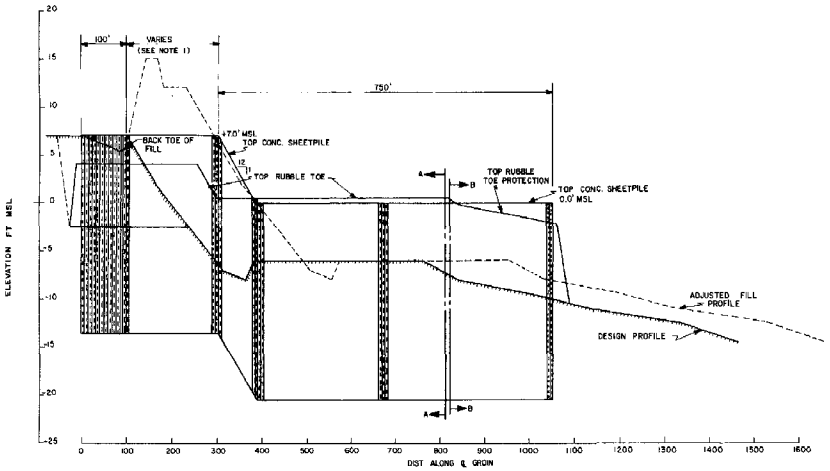
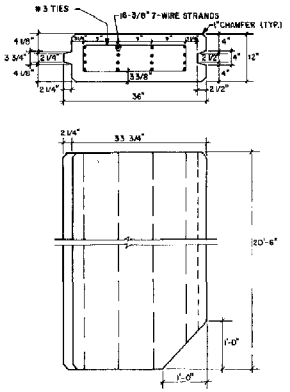


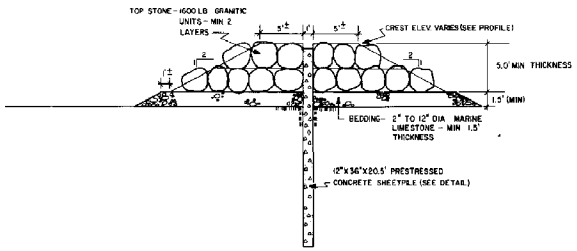
PROFILE - TERMINAL GROIN - TOPSAIL BEACH



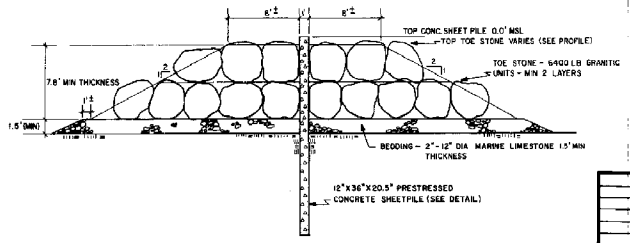
SHEET PILE DETAIL
(NO SCALE)

NOTE 1: LENGTH OF VARIABLE SECTION OF GROIN DEPENDS ON BEACHFILL DESIGN. FOR BEACHFILL DESIGNS CONSIDERED LENGTH WOULD BE:

7' × 100' BERM	100'
7' × 200' BERM	200'
13' DUNE	160'
15' DUNE	195'
20' DUNE	280'



SECTION A-A
TERMINAL GROIN TOE PROTECTION
(NO SCALE)



SECTION B-B
(NO SCALE)

Symbol	Revisions	Date	Approved

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
WILMINGTON, NORTH CAROLINA

Designed by:
Drawn by:
Checked by:
Reviewed by:
Chief SECTION
Approved by:
CHIEF, DESIGN BRANCH

US Army Corps of Engineers

TERMINAL GROIN DETAILS

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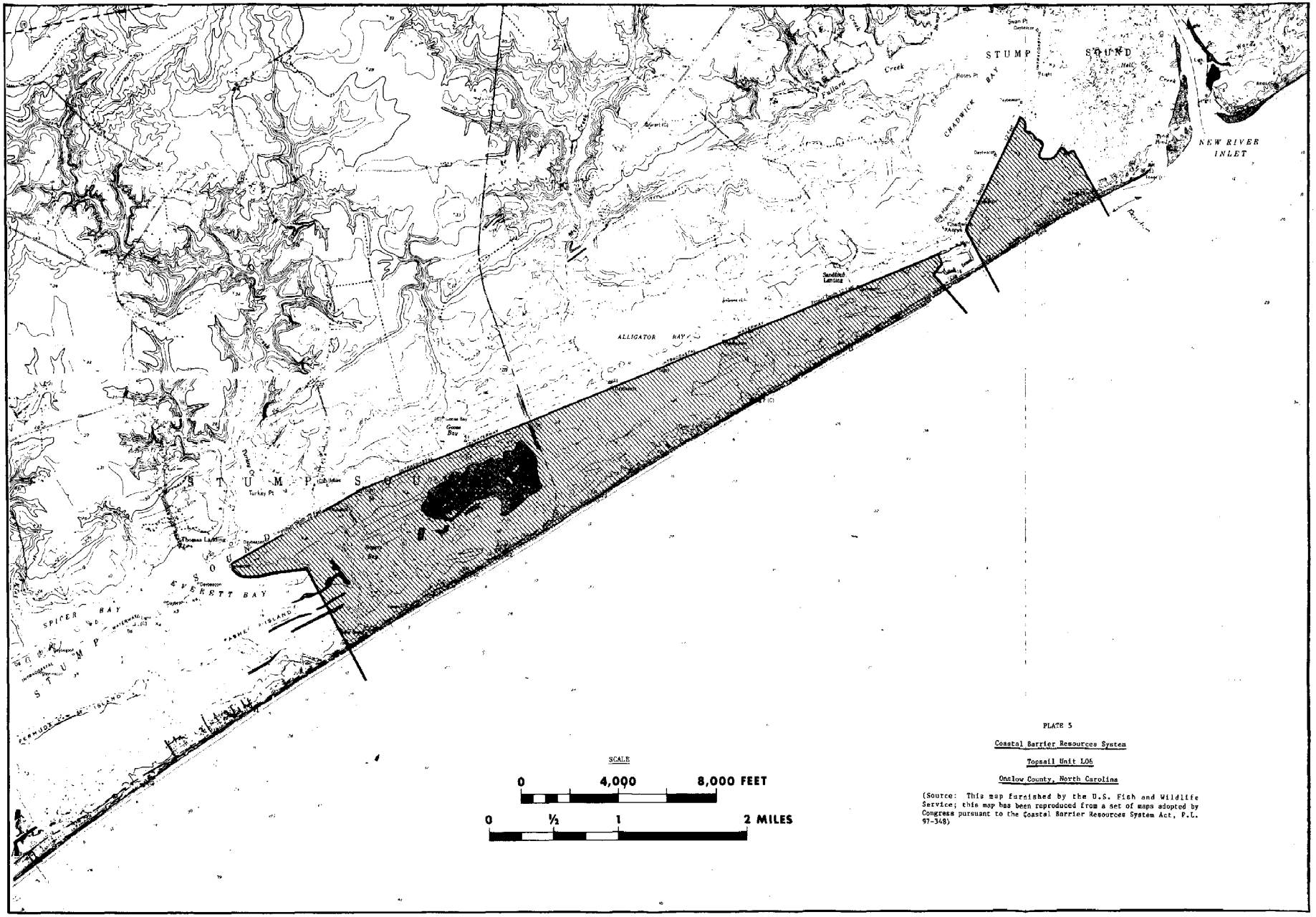

PLATE 5

Coastal Barrier Resources System

Topsail Unit L06

Onslow County, North Carolina

(Source: This map furnished by the U.S. Fish and Wildlife Service; this map has been reproduced from a set of maps adopted by Congress pursuant to the Coastal Barrier Resources System Act, P.L. 97-348)

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  19  740 01  Trent Woods CAMA land use plan.


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$   2  043     n-us-nc %
$   3  086     D 103.62:W52/draft %
$   4  090     'b  %
$   5  049     NO@M %
$   6  245 00  Feasibility report and environmental impact statement on
hurricane protection and beach erosion control, West Onslow Beach and New River
Inlet, North Carolina (Topsail Beach). %
$   7  260     Wilmington, N.C. : 'b U.S. Army Corps of Engineers, 'c 1988. %
$   8  300     1 v. (various pagings) : 'b ill. (some folded) ; 'c 28 cm. %
$   9  500     Above title: Draft. %
$  10  500     "December 1988"--cover. %

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District.
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DRAFT ENVIRONMENTAL IMPACT STATEMENT
West Onslow Beach and New River Inlet
(Topsail Beach)

Beach Erosion Control and Hurricane Wave Protection
Pender County, North Carolina

The responsible lead agency is the U.S. Army Engineer District, Wilmington

Abstract: Topsail Island is located in Onslow and Pender Counties. The Wilmington District has investigated public concerns of the Topsail Beach study area related to greater protection from hurricane waves and flooding so as to reduce their detrimental effects, and control of beach erosion to arrest recession of the shoreline. Of the four plans initially considered, one was selected for detailed study. This plan, consisting of a berm, dune and terminal groin, maximizes net benefits and will have minimum impact on the environment. The plan was selected based on its performance in addressing identified public concerns and its net positive contributions to the goal of National Economic Development.

SEND YOUR COMMENTS TO THE DISTRICT ENGINEER BY _____

If you would like further information on this statement, please contact:

Mr. John Baden
CESAW-PD-E
U.S. Army Engineer District
P.O. Box 1890
Wilmington, N.C. 28402-1890
Commercial Telephone (919) 251-4754

Note: Information, displays, maps, etc. discussed in the West Onslow Beach and New River Inlet Main Report are incorporated by reference in the EIS.

TABLE OF CONTENTS

List of Attachments

DRAFT ENVIRONMENTAL IMPACT STATEMENT
WEST ONSLOW BEACH AND NEW RIVER INLET
(TOPSAIL BEACH)

BEACH EROSION CONTROL AND HURRICANE WAVE PROTECTION
PENDER COUNTY, NORTH CAROLINA

1.00 SUMMARY

1.01 Major Conclusions and Findings. The selected plan, which is also the National Economic Development (NED) plan, consists of a berm, dune, and terminal groin. The National Economic Development Plan is the plan which maximizes the net annual benefits. The selected plan maximizes net benefits and has minimal impacts on the existing environment. The benefit-cost ratio is 1.4 to 1. The project involves a discharge of fill material into waters of the United States which is in compliance with Section 404(b) (1), Public Law 95-217 (see attachment 1).

1.02 Areas of Controversy. There are no known areas of controversy concerning the proposed plan.

1.03 Unresolved Issues. There are no unresolved issues.

1.04 Relationship of Plans to Environmental Requirements. Table 1 summarizes the relationship of the proposed plan to environmental requirements. Compliance with all applicable Federal, State, and local policies has been examined.

TABLE 1

Relationship of Proposed Plan to Environmental Requirements

Federal Policies	Proposed Plan
Preservation of Historical Archeological Data Act of 1974, 16 U.S.C. 469, et seq.	Full Compliance
Clean Air Act, as amended, 42 U.S.C. 7609	Full Compliance
Clean Water Act of 1977, as amended, 33 U.S.C 1251, et seq.	Full Compliance
Coastal Zone Management Act, as amended, 16 U.S.C. 1451, et seq.	Full Compliance
Endangered Species Act of 1973, as amended, 16 U.S.C. 1531, et seq.	Full Compliance
Estuary Protection Act, 16 U.S.C. 1221, et seq.	Full Compliance
Federal Water Project Recreation Act, as amended, 16 U.S.C. 460-1-12, et seq.	Full Compliance
Fish & Wildlife Coordination Act, as amended, 16 U.S.C. 661, et seq.	Full Compliance
Land & Water Conservation Fund Act, as amended, 16 U.S.C. 4601, et seq.	Full Compliance
Marine Protection, Research, and Sanctuaries Act of 1972, as amended, 33 U.S.C. 1401, et seq.	Full Compliance
National Historic Preservation Act, as amended, 16 U.S.C. 470a, et seq.	Full Compliance
National Environmental Policy Act, as amended, 42 U.S.C. 4321, et seq.	Full Compliance
River and Harbor Act, 33 U.S.C. 401, et seq.	Full Compliance
Watershed Protection and Flood Prevention Act, 16 U.S.C. 1001, et seq.	N/A
Wild and Scenic Rivers Act, as amended, 16 U.S.C. 1271, et seq.	Full Compliance
Executive Order 11990, Protection of Wetlands	Full Compliance
Executive Order 11988, Flood Plain Management	Full Compliance
Executive Order 11593, Protection and Enhancement of the Cultural Environment	Full Compliance
State Policies	
Coastal Area Management Act of 1974	Full Compliance
Local Policies	
The Town of Topsail Beach, N.C., Land Use Plan	Full Compliance
Pender County, N.C., Land Use Plan	Full Compliance
Onslow County, N.C., Land Use Plan	Full Compliance

2.00 NEED FOR AND OBJECTIVES OF ACTION

2.01 Study Authority. The general investigation of West Onslow Beach and New River Inlet, N.C., is being conducted pursuant to resolutions of the Committee on Public Works of the United States Senate, adopted 24 June 1970, and the Committee on Public Works of the United States House of Representatives, adopted 3 December 1970, for a survey to determine the advisability of stabilizing and deepening New River Inlet. Also, it is being conducted pursuant to a resolution of the Committee on Public Works of the United States House of Representatives for a survey of the shores of West Onslow Beach in the interest of beach erosion control, hurricane protection, and related purposes. Also, it is being conducted pursuant to a resolution of the Committee on Public Works and Transportation of the United States House of Representatives for a survey of Topsail Beach and Surf City and adjacent beaches and inlets in the interest of beach erosion control, hurricane protection, and related purposes.

2.02 Public Concerns. The desires of local interests include:

a. Greater protection from hurricane waves and flooding so as to reduce their detrimental effects, and

b. Control of beach erosion to arrest recession of the shoreline (Satilla Planning, 1987).

c. The U.S. Fish and Wildlife Service has expressed concern that any Federal plan of improvement be implemented in a manner which avoids or minimizes environmental impacts.

2.03 Planning Objectives. Based on the identified public concerns and the needs and opportunities determined in the course of the planning process, the following planning objectives were established:

a. Reduce the adverse effects of hurricane flooding and erosion.

b. Reduce the potential of new inlet breakthrough adjacent to the canals at the south end of Topsail Island.

3.00 ALTERNATIVES

3.01 Alternative Plans. Each element of the selected plan was considered individually and in combination. Alternatives considered included the following:

a. Beach Erosion Control Plans, consisting of beachfills constructed at an elevation of 7 feet above mean sea level. Alternatives considered in this category included beach berms with widths of 50, 100, and 200 feet.

b. Beach Erosion Control and Hurricane Protection Plans, consisting of beachfills with artificial dunes and storm berms incorporated into the upper portion of the fills. Alternatives considered in this category included dune sections with elevations of 11, 13, 15, and 20 feet above mean sea level.

Each of the alternatives described above includes a terminal groin at the south end of the fill.

After further analyses, the berm, dune, and terminal groin alternative with a dune elevation of 13 feet above mean sea level was selected as the National Economic Development (NED) Plan. All other plans were eliminated due to economic criteria.

3.02 Without Conditions (No Action). Under a no action alternative there would be no Federal participation in beach erosion control and hurricane wave protection at Topsail Beach. State or local governments could provide protection.

3.03 Plans Considered in Detail. The only plan considered in detail was a combined beach erosion and hurricane-wave protection plan. Four dune and storm berm fill cross sections were analyzed to determine their effectiveness in reducing storm induced erosion and wave heights across the southern 2 miles of Topsail Beach. Schematics of the four combined erosion control and storm wave protection fills are shown on figure 3 of the main report and consist of (a) an 11-foot m.s.l. dune and an 8-foot m.s.l. storm berm with a total fill width of 140 feet, with a terminal groin; (b) a 13-foot m.s.l. dune and a 9-foot m.s.l. storm berm with a total beach fill width of 160 feet, with a terminal groin (b) a 15-foot m.s.l. dune and an 11-foot m.s.l. storm berm with a total beach fill width of 195 feet with a terminal groin and (c) a 20-foot m.s.l. dune and a 16-foot m.s.l. storm berm with a total fill width of 280 feet with a terminal groin. As indicated on the schematic, each of the dune sections is fronted by a beach berm at elevation +7 m.s.l. The 13-foot m.s.l. dune and 9-foot m.s.l. storm berm of a total fill width of 160 feet with a terminal groin is the NED plan, the plan which maximizes the net annual benefits, as well as the selected plan. The dune will be planted with dune grasses.

The main fill of the selected plan will be placed along the southern end of Topsail Beach for 10,250 feet. There will be a northern transition zone of 7,150 feet to give a total fill length of 17,400 feet. A single terminal groin would be used at the south end of the fill to prevent excessive or unacceptable erosion losses in the area of the main beach fill (see plate 3 of main report).

The basic configuration of the groin was the same for all fills in that a horizontal section, at +7 ft m.s.l., would extend from a landward anchorage point 260 ft seaward to approximately the intersection with the +7 foot m.s.l. contour on the fill. From this point the groin would slope 1V:12 H down to an elevation of 0 feet m.s.l. for a distance of 84 feet and then horizontally at this elevation to approximately the -10 to -11-foot m.s.l. depth in the ocean for a distance of 666 ft. The terminal groin would be constructed with prestressed concrete sheetpiles and scour protection would be provided by a rubble toe. The total length of the groin is 1,010 feet. (See plate 4 in main report for profile.)

A potential source of beachfill material is located in Banks Channel as outlined in plate 3 of the main report. Initial beachfill construction will require approximately 3,240,000 cubic yards of sand. Maintenance or annual nourishment for the project is projected to be 126,000 cubic yards of material. Renourishment of the project will be done every four years for a total of approximately 504,000 cubic yards per maintenance event.

3.04 Comparative Impacts of Alternatives. The alternatives considered include the construction of a berm and dune with a terminal groin, and no action. A comparison of the predicted impacts of these alternatives on the area's resources is summarized in table 2.

TABLE 2

Comparative Impacts of Alternatives

Resource	Proposed Action	No Action
Socioeconomic Resources	1. Improved recreational attraction of expanded beach	1. Continued deterioration of the existing beach
	2. Greater protection of oceanfront land, structures, and personal property	2. Continued threat to oceanfront land, structures, and personal property
	3. Stimulation of the local economy through economic investment with resulting increase in employment opportunity	3. Discouragement of tourism and economic investment, and decline in employment opportunity
Recreational and Esthetic Resources	1. Attraction and accommodation of more recreational uses with increased capacity of beach	1. Further reduction of recreational capacity of beach
	2. Temporary inconvenience to beach users during construction	2. No adverse esthetic impact beyond existing conditions.
Biological Resources	1. Slight adverse impact to benethic organisms in the borrow area	1. No change from present conditions
	2. Unquantifiable mortality of benthic invertebrates of beach intertidal community by covering with fill material. Rapid recovery should occur.	
	3. Minor and temporary negative impact due to elevated turbidity during disposal for construction or maintenance.	
Cultural Resources	1. Possible discoveries and recoveries	1. Potential resource impacted by natural channel migration or severe storms
	2. Potential resource impacted by natural channel migration or severe storms	

TABLE 2

Comparative Impacts of Alternatives —continued

Resource	Proposed Action	No Action
Water Quality	1. Temporarily elevated turbidities over existing conditions during construction and maintenance 2. Small additional amount of material placed in suspension during construction and maintenance. This would be temporary.	1. No change over existing conditions
Threatened and Endangered Species	1. The threatened loggerhead sea turtle may be affected if project construction and maintenance occurs during the nesting season. A monitoring and nest relocation program would be implemented if beach nourishment overlaps the nesting season.	1. Status quo maintained

4.00 AFFECTED ENVIRONMENT

4.01 Geographic Setting. Topsail Island is 21.7 miles long and is bordered on the southwest by New Topsail Inlet and on the northeast by New River Inlet. The general orientation of the island is N 43 E which exposes it to waves propagating from the east-northeast clockwise around to the southwest. The island has a concave seaward shape between the bordering inlets which is typical of most North Carolina barrier islands.

Topsail Island is located about 25 miles northeast of Wilmington and 20 miles south of Jacksonville, N.C. It includes the communities of Topsail Beach, Surf City, and West Onslow Beach. The island varies in width from 900 to 6,000 ft. The primary dune system is narrow and varies in elevation from +10 feet NGVD (National Geodetic Datum -1929 m.s.l.) to +25 feet NGVD.

4.02 Socioeconomic Resources. On Topsail Island there are high quality seashore areas available for recreation activities, i.e., sunbathing, surf fishing, walking, jogging, bird watching, shell collecting, etc. The northern half of the island (West Onslow Beach) is sparsely developed, and the southern half of the island (Surf City and Topsail Beach) is highly developed with summer resort housing. Tourist and beach populations support the local economy which thrives on a seasonal basis. Success of the local economy is highly dependent upon the recreational beaches and continued biological productivity of nearby waters, as well as other recreational and esthetic resources of the area which draw people to Topsail Beach.

4.03 Esthetic Resources. The high esthetic values of Topsail Island and vicinity are evidenced by the popularity of the area for tourism. The total environment of barrier islands, oceans, estuaries, and inlets attracts many visitors to enjoy the total esthetic experience created by the sights, sounds, smells, winds and ocean sprays.

The various elements of the total landscape found on Topsail Island are: beach, developed areas, estuary, mainland, inlet, dunes, and marsh. Topsail Island can be broken into three main visual elements: first, commercial building sites and highways; next homes; and finally, natural areas - be they "Areas of Environmental Concern" or undeveloped portions of Topsail Island. In the West Onslow Beach portion of Topsail Island, except for one development at the northern end, one finds integrity of the landscape witnessed by natural undisturbed vegetation and architecture that fits the existing landforms. In Surf City, the conditions are more cluttered. There are many house trailers in this area which seem to be almost stacked on top of each other. The City of Topsail Beach is an area with many well maintained beach cottages and year-round homes. The exception is found near the southern end of Topsail Island in the region of the existing finger canals of the City of Topsail Beach. The ocean is eroding away the existing beach, beachfront homes, and a motel. There is the potential, due to storm action, for a breach in the island in the vicinity of the three canals on the south end.

4.04 Biological Resources. Topsail Island is separated from the mainland by marshes and sounds. It consists of a high energy beach system, dune ridges behind the beach, flats which support grasslands, shrub thickets, and/or maritime forests, and the estuarine environment containing high and low marsh, tidal flats and open water with submerged bottoms. The estuary serves as a nursery ground for numerous marine species. The barrier island serves as a buffer which protects the estuary from the ocean environment.

The adjacent marshes and sounds support a rich mixture of wildlife. Terns, gulls, sandpipers, willets, rails, oyster-catchers, marsh hawks, kingfishers, mockingbirds, and painted buntings are seen in the area. Many other birds, reptiles, and small mammals frequent Topsail Island and associated wetlands.

Colonies of nesting birds are sometimes found in the study area on dredged material disposal islands which offer isolation and suitable nesting substrate. These colonies are places where large numbers of sea birds (primarily terns and gulls) nest in close association with one another to rear their offspring. Colony areas are especially sensitive to the disruptive influences of man. A simple disturbance such as a roaming dog or a picnicking family can cause abandonment of the entire colony site by the birds.

The use of the study area by mammals (except man), reptiles, and amphibians is poorly understood, and little data for the project area is known to exist; therefore, species residence is somewhat speculative. In general, tidal marshes are important wildlife habitats. The dense plant growth in these areas provides excellent cover for many animal species. The vegetated dredged material disposal islands in the marshes should serve as upland refuges although they offer little food in the form of nuts or berries. The dunes are a harsher environment but do harbor animal species, as evidenced by the small mammal tracks which can be found in the sand early in the morning before the winds begin to blow. The maritime shrub thicket and forest provides an important resting and feeding area for migrating birds during the winter. Animals which are known to inhabit the dune-marsh complex in other areas include the raccoon, rice rat, terrapin, and otter.

Wildlife on the island has faced a reduction in available habitat during the recent past. Developed wildlife habitat is probably irreversibly committed to human habitat.

Topsail Sound and New River Inlet support significant quantities of sport and commercial marine species, including blue crabs, scallops, flounder, trout, mullet, croaker and spot. Practically all of the sounds and creeks landward of Topsail Island are designated as primary nursery grounds for shrimp by the State of North Carolina. Oyster and clam harvesting takes place in the estuarine waters of Topsail Island and New River Inlet.

The proposed borrow area is mainly an intertidal area with some shallow water habitat. Sample data from the overall borrow area indicate that a small number (both species and population) of polychaete and oligochaete bottom-dwelling worms inhabit the area. There were no grass beds present in the area.

More detailed descriptions of the fish and wildlife habitats of the study area can be found in appendix B of the main report. Appendix B of the main report contains the "West Onslow Beach and New River Inlet Study, Draft Fish and Wildlife Coordination Act Report" dated August 1986 prepared by the U.S. Fish and Wildlife Service.

4.05 Water Quality. The tidal saltwaters of New River Inlet from the Atlantic Ocean to the AIWW, New Topsail Inlet from the Atlantic Ocean to the AIWW, and the AIWW and several small bays and sounds are classified "SA" by the State of North Carolina. Best usage of class SA waters includes shellfishing for market purposes, primary recreation, fishing, and secondary recreation. Waters of this area generally meet the designated classification, although there are areas of localized degradation, depending on proximity to human settlements, as is evidenced by the "closed to shellfishing" signs along the AIWW.

Several point source discharges occur in streams draining into the AIWW and New River. Other pollution sources include leakage from faulty operation of septic tanks and leaching fields and sewage discharge from commercial and pleasure boats, and urban and rural runoff.

The water bearing groundwater units on Topsail Island are the surficial aquifer and the cretaceous aquifer. The cretaceous aquifer is used as the water source for the various communities located on Topsail Island. The Town of Topsail Beach has deep wells on the island. Surf City's wells are located on the mainland across the AIWW near Highway 210. West Onslow Beach is supplied by the Onslow County water system which has its wells inland. There is a threat of contamination to the surficial aquifer with the continued use of septic tanks (Shiver,1987).

Forty representative samples from the borrow area were analyzed for grain size. The borrow area was found to contain good quality beach sand. The amount of silt and clay in the borrow area constitutes less than 5 percent of the total volume of material in the borrow area.

4.06 Cultural Resources. From archeological investigation of coastal North Carolina and other coastal areas of the southeast, it is known that upland oceanfront archeological sites are uncommon and are usually poorly preserved with little historical association or context remaining. No archeological sites have been recorded from the study area and, should any be present, it is likely that they have been severely damaged by modern human activity. A review of the National Register of Historical Places indicated that there are no historic properties listed in or eligible for inclusion.

The New Topsail Beach project area (herein referring to the vicinity of the inlet and sound) was documented in 1984 by the North Carolina Division of Archives and History, Research Branch. In An Historical Overview of New Topsail Inlet, Wilson Angley has documented European settlement of Topsail Inlet beginning in the first quarter of the eighteenth century. The sound and inlet served as an early artery for trade, with New Topsail Sound providing anchorage for the many landings and settlements which grew up on its northern

shore. The inlet was designated as an official inspection station for New Hanover County, Brunswick, Wilmington and New Exeter in 1755. Trade remained active although limited from this time throughout the Civil War. Plantations and other private holdings exported commodities, naval stores and timber products and, during the Civil War, the sound became a salt production center of sufficient importance to warrant two Union attacks on local plants. The area's early commercial success has been limited by shallow depths through the inlet gorge and the shifting nature of the inlet and sound shoals. This condition, of course, persists to the present day. Angley has documented a 4-mile northward migration of the inlet for the period 1755 - 1865, at which time the migration abated. Vessels lost prior to 1865 at the inlet, therefore, are likely to be south of the project area. Shipwrecks in and near the inlet and sound have occurred primarily as a result of the difficulties of navigation. Shipwrecks documented near the inlet and sound by the North Carolina Division of Archives and History, Underwater Archaeology Unit include:

EL SALVADOR (Spanish) ashore at inlet, 8-18-1750.
TWO BROTHERS schooner at inlet, 12-10-1797.
SUPERIOR schooner ashore near inlet, 11-24-1841.
ADELAIDE schooner Topsail Sound, 10-22-1862.
UNKNOWN schooner aground at inlet, 1-21-1863.
INDUSTRY schooner 5 miles north of inlet, 2-2-1863.
ALEXANDER COOPER schooner Topsail Sound at Sloop Point, 8-22-1863.
PHANTOM blockade runner, south side of inlet, 9-23-1863, location known.
W.J. POTTER schooner inside inlet on north side, 1878, vessel saved
W.H. MARSHALL brig sunk off inlet, 4-25-1878.
SUMNER schooner aground, 1919. Equipment and cargo salvaged.
UNKNOWN wreck north side of inlet, location known.

Of these 12 vessels, the locations of two, PHANTOM and an unknown wreck, are known and are safely beyond the area of impact; two others, EL SALVADOR and TWO BROTHERS, can be assumed to be out of the area of impact, since they are documented as having sunk at New Topsail Inlet, which, at the time of sinking, would have been further south than its current alignment; one vessel, the W.J. POTTER was saved, and one other, the W.H. MARSHALL is recorded as having sunk offshore. This leaves six vessels whose locations are questionable on the basis of current documentation, and it is possible that other undocumented losses have occurred in the area as well.

4.07 Endangered Species. Coordination with the U.S. Fish and Wildlife Service and the National Marine Fisheries Service has provided the following list of endangered and threatened species to be considered.

LISTED SPECIES	Scientific Name	Status
finback whale	Balaenoptera physalus	E
humpback whale	Megaptera novaeangliae	E
right whale	Eubaleana glacialis	E
sei whale	Balaenoptera borealis	E
sperm whale	Physeter catodon	E
Florida manatee	Trichechus manatus	E
green sea turtle	Chelonia mydas	Th
hawksbill sea turtle	Eretmochelys imbricata	E
Kemp's (Atlantic) ridley sea turtle	Lepidochelys kempi	E
leatherback sea turtle	Dermochelys coriacea	E
loggerhead sea turtle	Caretta caretta	Th
shortnose sturgeon	Acipenser brevirostrum	E
piping plover	Charadrius melodus	Th

The whales have been documented from North Carolina in the waters off the coast outside of the project impact zone (Cooper et al., 1977). There are no records for the Florida manatee from the project area.

The only sea turtle known to frequent Topsail Beach and vicinity is the loggerhead sea turtle. The loggerhead sea turtle has been documented as having nested on Topsail Beach (Henson, 1987). Development on beaches has been documented to discourage nesting by the loggerhead sea turtle (Marine Turtle Recovery Team, 1984). However, nesting on Topsail Beach persists in spite of development. Beaches in the region with little or no development receive substantially more nesting (Henson, 1987).

The green and hawksbill sea turtles are not known to frequent nearshore waters of the Topsail Beach area. These species and the leatherback and Kemp's (Atlantic) ridley sea turtles are known from offshore waters outside of the impact area.

The shortnose sturgeon is not likely to be found in the Topsail Beach area because there is no coastal river associated with this project. The piping plover has not been documented to nest on Topsail Beach. This species is a winter resident of the area (Potter et al., 1980). The adjacent beaches are undisturbed and may offer suitable habitat for the species.

4.08 Coastal Zone. The Coastal Zone Management Act of 1972, as amended, requires that the State develop a management plan to assure a coordinated approach to coastal development. This is accomplished through two mechanisms: the formulation of local land-use plans articulating the objectives of local citizens and translating them into desired future land-use patterns, and the designation of areas of environmental concern (AEC) for the protection of areas of statewide concern within the coastal area. The local land-use plans for the study area are: 1) Onslow County, N.C., Land Use Plan, 1981; 2) Pender County, N.C., Land Use Plan, 1981; and 3) The Town of Topsail Beach, N.C., Land Use Plan, 1987.

Based on shoreline changes that have occurred between 1963 and 1983, the average erosion rate along the southern two miles of Topsail Beach was 4.5 feet/year. In 1963, New Topsail Inlet was located approximately 2,200 feet further north than it is today.

5.00 ENVIRONMENTAL EFFECTS

5.01 Introduction. Positive and negative effects on all resources impacted by the proposed project were summarized in table 2 which appears in Section 3. Net effects on area resources over the life of the project are expected to be beneficial.

5.02 Socioeconomic Resources. The proposed berm, dune and terminal groin project would have beneficial impacts on socioeconomic conditions. A considerably larger expanse of beach available during both high and low tidal conditions would be far more attractive to tourists who, if present in larger numbers, would stimulate the local economy. The greater protection afforded to beachfront property would encourage greater investment in and better maintenance of these properties. The benefit-cost ratio for this project is 1.4 to 1.

5.03 Recreational and Esthetic Resources. Greatly improved recreational opportunities would be available to beach users through expansion of the beach area. The esthetic quality of Topsail Island will be impacted by the noise and visual intrusion of the dredge and associated pipes and equipment during construction and maintenance of the project. This impact is not considered significant. The presence of a dredge will be periodic and temporary. Additionally, a dredge and associated pipes and equipment are periodically seen in New Topsail Inlet, Banks Channel, and Topsail Beach during maintenance of the existing navigation channels with disposal on Topsail Beach.

5.04 Biological Resources. Construction and maintenance of the project should take place during the period of low biological productivity (15 November to 1 May). The major impacts associated with this type of operation include:

A. Increased turbidity in the surf zone

B. Effects on the benthic communities.

During disposal operations, there will be an increase in the turbidity of the surf zone in the immediate area of sand deposition. This increase may cause the temporary displacement of various species of sport fish, causing a negative impact to surf and pier fishing in the area of deposition.

Although a considerable body of information is available on the effects of dredging on benthic communities, much less is known about specific environmental consequences of beach nourishment (Nelson 1985). The disposal operation may also have a negative impact on the intertidal macrofauna as was documented in A Study of the Ecological Impact of Beach Nourishment With Dredged Material of the Intertidal Zone by Reilly and Bellis, 1978. As stated by Reilly and Bellis (1978), "Beach nourishment virtually destroys existing intertidal macrofauna; however, recovery is rapid once the pumping operation ceases. In most cases, recovery should occur within one or two seasons following the project completion." The impacts to intertidal macrofauna and subsequent reduction in surf feeding fish should be minimized by avoiding disposal during the summer months.

Within the borrow site, existing shallow water and intertidal habitat will be converted to deep water habitat, and resident fauna will be lost. Limited sample data from the overall borrow area indicate that a small number (both species and population) of polychaete and oligochaete bottom-dwelling worms inhabit the area. Since stable, productive bottom is being avoided, there should be very little impact associated with the borrow area. A stable bottom community is not expected to occur in the project area with or without the project because a suitable substrate for population by benthic organisms is lacking. A buffer zone will be left between the borrow area and the existing marsh along the shoreline to reduce the potential for erosion of the marsh.

The proposed groin should have no significant adverse impacts to either fish or wildlife since it will be located on a high energy sand beach. In all, approximately 0.1 acre of beach and ocean habitat will be converted to rocky shoreline with construction of the groin. Minor losses of coquina clam, mole crab and ghost crab habitat will occur. These losses should be offset, however, by provision of a stable substrate upon which a diverse assemblage of fouling organisms (algae, barnacles, hydrozoans) can attach (U.S. Fish & Wildlife Service, 1986).

The other biological resources of the area (See Section 4.04) should not be impacted by the project. The pipeline route will follow existing waterways or roads from Banks Channel to the beach. If necessary, the pipeline will be burlapped and welded with straps to provide maximum protection against leakage. Negative impacts associated with pipeline routes would be minor and temporary.

5.05 Water Quality. The proposed project will result in elevated turbidity and suspended solids compared to the existing non-storm conditions of the surf zone in the immediate area of sand deposition. Due to the low percentage of silt and clay in the proposed borrow area (<5%), this impact is not expected to be greater than the natural increase in turbidity and suspended material during storm events.

Under Section 404(r) of the Clean Water Act of 1977, as amended, the requirement to obtain the State Water Quality Certificate is waived if information on the effects of the discharge of dredged or fill material into waters of the United States, including the application of the Section 404(b)(1) Guidelines, is included in the EIS on the proposed project, and the EIS is submitted to Congress before the actual discharge takes place and before Congress authorizes the project or appropriates funds for construction.

The impacts associated with the discharge of dredged material into waters of the United states are discussed in the Section 404(b)(1) (PL 95-217) evaluation (attachment 1).

5.06 Cultural Resources. Based on the existing documentation (See Section 4.06), reconnaissance-level remote sensing investigations have been undertaken for shipwreck resources within the proposed borrow area, the only project feature likely to impact shipwrecks. The reconnaissance indicates that no resources are present within the borrow area. Beachfront erosion, inlet migrations, and limited project dimensions in the most recently formed beach areas indicate that reconnaissance will not be necessary for the area of the beach fill or terminal groin.

5.07 Endangered Species. Except for the loggerhead sea turtle, the species on the list in Section 4.07 are not known to frequent Topsail Beach and vicinity. In order to minimize the impact of beach nourishment on nesting sea turtles, nourishment sand should match natural natural sand as closely as possible (Naqvi and Pullen, 1982). The potential borrow area was found to contain good quality beach sand. The amount of silt and clay in the borrow area appeared to be minimal, constituting less than 5% of the total volume of material in the borrow area. This is very similar to the beach sand already present.

Nourishment for construction and maintenance should take place between 15 November and 1 May to avoid impacts to loggerhead sea turtles. This species may be affected if project construction and maintenance occurs during the nesting season. A monitoring and nest relocation program will be implemented if beach nourishment overlaps the nesting season.

5.08 Coastal Zone. Review and determination of consistency with the N.C. Coastal Management Program is required because the proposed action directly affects the coastal zone (Coastal Zone Management Act of 1972, as amended). A consistency determination is included as attachment 2. The proposed action is consistent with the approved coastal program of the State of North Carolina.

The beach next to the groin will be artificially filled with sand during construction of the project. Therefore, sand transport will still take place around and over the groin. The groin may cause some reshaping on the inlet side of the groin because of modifications in tidal currents and wave conditions. The impacts are expected to be minor without significant loss of land area.

5.09 Relationship Between Short-Term Impacts and Long-Term Benefits and Irreversible and Irretrievable Commitments of Resources. Short-term impacts associated with construction activities are discussed in Sections 5.01 through 5.08. The same short-term impacts would occur during each renourishment for maintenance of the project. This project will have very little impact upon long-term productivity. There are no significant long-term impacts associated with this project. If the project was abandoned, the project area would return to preproject conditions in a very short period of time. The borrow area will trap sands after use and bottom topography would return to preproject conditions if its use was terminated. Without additional sand on the beach, erosion would continue.

There would be irreversible and irretrievable commitments of materials, fuel, and manpower resources from other activities to construct and maintain the project. The prestressed concrete sheetpiles could not be recovered if the project was abandoned.

This project will have negligible adverse impact on fish and wildlife.

LIST OF PREPARERS

6.00 The following people were primarily responsible for preparing this Environmental Impact Statement:

Name	Expertise	Experience	Professional Discipline
Christina E. Correale (Supervisor of EIS Preparation)	Environmental Impact Assessment, Water Quality	2 yrs., Chief, Environmental Resources Branch Wilmington Dist., 7 yrs. Chemist, Ch.,Water Quality Sec., Wilm. Dist. 5 yrs. Chemist, Envir. Resources Br. Wilm. Dist.	Environmental Sciences
John Baden (EIS Coordinator)	Plant Ecology	2 1/2 yrs., Environmental Biologist, Federal Power Commission 1 yr, Biologist, Savannah Dist. 2-1/2 yrs., Environmental Specialist, Ft. Eustis, Virginia, 9 yrs., Biologist, Wilmington Dist.	Biology
Ronald G. Fascher (Study Manager)	Coastal Engineering, Water Resources Planning	8 yrs., Plan Formulation and 11 yrs., Coastal Engineering, Wilmington District; 1 yr., Omaha District; 4 yrs., Officer, Engineering Department, Heavy Cruiser, U.S. Navy	Civil Engineering
Richard H. Kimmel (Cultural Resource Studies Coordinator)	Archaeology	11 years, Environmental Resources Branch Wilmington District; 2 yrs., graduate research, UNC-Chapel Hill; 1.5 yrs., Institute of Archaeology and Anthropology, USC; 1 yr., misc. archaeological studies.	Archaeology
Trudy Wilder (401, 404 & Consistency Coordination)	Water Quality	15 years, Environmental Resources Branch, Wilmington District	Water Quality

7.00 PUBLIC INVOLVEMENT

7.01 Public Involvement. Local interests have actively pursued greater protection from hurricane waves and flooding so as to reduce their detrimental effects, and control of beach erosion to arrest recession of the shoreline (Land Use Plan Update, the Town of Topsail Beach, N.C., 1981). Numerous field trips have been made to Topsail Beach by personnel of Wilmington District, Corps of Engineers and U.S. Fish and Wildlife Service to document erosion and flooding along the southern end of Topsail Island since 1977.

The Wilmington District has coordinated this study with various Federal, state, and local agencies having concerns about hurricane protection, beach erosion control, and the environmental impacts of any potential improvements (see main report). The policy of the U.S. Army Corps of Engineers is to develop water resources plans with a continued interchange of ideas, information, and results with affected citizens of the study area, the state involved and other Federal agencies. To date, the Wilmington District has accomplished this through many informal contacts, by attending local meetings with U.S. Representatives, and by making presentations at the Wilmington District Coastal Conferences (October 1978, April 1979, and November 1980).

A Notice of Intent to prepare a draft environmental impact statement appeared on Thursday, August 4, 1988, in the Federal Register (Vol. 53, No. 150) inviting comments from all agencies, organizations, and interested parties.

7.02 Required Coordination. The coordination required for the proposed project is outlined by the applicable environmental requirements listed in table 1. The Fish and Wildlife Coordination Act, as amended, 16 U.S.C. 661, et seq, requirement that the Corps of Engineers coordinate and obtain comments from the U.S. Fish and Wildlife Service has been satisfied by the draft Fish and Wildlife Coordination Act Report presented in appendix B of the main report. Informal consultation under Section 7(c) of the Endangered Species Act of 1973, as amended, is ongoing with the U.S. Department of the Interior, Fish and Wildlife Service, and the U.S. Department of Commerce, National Marine Fisheries Service. A cultural resources assessment and reconnaissance have been coordinated with the North Carolina Division of Archives and History, Underwater Archaeology Unit, and will be formally coordinated with the North Carolina State Historic Preservation Officer and the Advisory Council on Historic Preservation during EIS review, pursuant to the National Historic Preservation Act of 1966, as amended, codified at 36 CFR 800. Federal consistency under the Coastal Zone Management Act of 1972, as amended, (attachment 2) will be satisfied, if the State of North Carolina concurs with the consistency determination. The project involves a discharge of fill material into the waters of the United States which is in compliance with Section 404(b)(1), Public Law 95-217 (attachment 1). A Section 404(a) (PL 95-217) public notice will be sent out concurrent with this environmental impact statement.

7.03 Statement Recipients. This statement is being circulated for review and comment to concerned agencies and the public. Statement recipients are listed in table 3.

TABLE 3

Recipients of this Environmental Impact Statement

Environmental Protection Agency
U.S. Department of Agriculture, Forest Service
N.C. Clearinghouse and Information Center
Department of Housing and Urban Development, Greensboro Area Office
U.S. Department of Commerce
Advisory Council on Historic Preservation
Department of Health and Human Services
U.S. Department of the Interior
Federal Emergency Management Administration
Federal Maritime Commission
Fifth Coast Guard District
Conservation Council of North Carolina
Izaac Walton League
Department of Transportation, Federal Highway Administration
National Audubon Society
N.C. Wildlife Federation
Department of Energy
U.S. Department of Agriculture, Soil Conservation Service
Sierra Club
Oceanic Society
Environmental Defense Fund, Inc.
University of North Carolina, Wilson Library
Library at Department of Natural Resources and Community Development
University of North Carolina at Wilmington, Randall Library
N.C. State Library, Documents Branch
Onslow County Board of Commissioners
County Manager, Onslow County
Daily News, Jacksonville, NC
Pender County Board of Commissioners
County Manager, Pender County
Mayor, Topsail Beach
Mayor, Surf City

7.04 Public Views and Responses. The Corps of Engineers and public concerns that had a major influence on the study were those listed in Sections 2.02 and 2.03. The original public concerns in Section 2.02 were translated along with Corps of Engineers concerns into the planning objectives found in Section 2.03.

8.00 References:

Cooper, J. E., S. S. Robinson and J. B. Funderburg,editors. 1977. Endangered and Threatened Plants and Animals of North Carolina. North Carolina State Museum of Natural History, Raleigh, North Carolina. 444 pages.

Henson, Tom. 1987. North Carolina Wildlife Resource Commission, Nongame Biologist. Personal Communication. September 1987.

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INDEX

ATTACHMENT 1

SECTION 404(b)(1) (P.L. 95-217) EVALUATION

WEST ONSLOW BEACH AND NEW RIVER INLET (TOPSAIL BEACH)
PENDER COUNTY, NORTH CAROLINA
BEACH EROSION CONTROL AND HURRICANE WAVE PROTECTION

November, 1988

I. PROJECT DESCRIPTION

A. Location. Southern end of Topsail Island, Pender County, North Carolina.

B. General Description. The project will consist of construction and maintenance of a 13-foot mean-sea-level (m.s.l.) dune, and a 9-foot m.s.l. storm berm fronted by a natural beach berm at elevation +7 feet m.s.l. The fill width is 160 feet wide over a distance of 10,250 feet leading into a transition zone of 7,150 feet to the north for a total fill length of 17,400 feet. A single terminal groin will be constructed and maintained at the southern end of the beach fill to prevent excessive or unacceptable erosion losses in the area of the main beach fill.

The terminal groin will involve construction of a horizontal section, at +7 feet m.s.l. extending from a landward anchorage point 260 feet seaward to approximately the intersection with the +7 m.s.l. contour of the beach fill. From this point, the groin will slope 1 vertically to 12 horizontally down to an elevation of 0 feet m.s.l. for a distance of 84 feet and then horizontally at this elevation to approximately -10 to -11-foot m.s.l. in the ocean for a distance of 666 feet. The terminal groin will be constructed with prestressed concrete sheetpiles and scour protection will be provided by a rubble toe. The total length of the groin is 1,010 feet.

Approximately 3,240,000 cubic yards of coarse to medium sand will be removed during initial dredging of Banks Channel, located behind the southern end of Topsail Island, and discharged along the ocean shoreline of Topsail Beach to construct the berm and dune. Maintenance or annual nourishment of the project is projected to be 126,000 cubic yards of material. Renourishment of the project will be done every four years for a total of approximately 504,000 cubic yards of material per maintenance event. See plate No. 3 of the main report.

The pipeline route will be carefully selected to minimize impacts. If necessary, the pipeline will be burlapped and welded with straps to provide maximum protection against leakage. If dune vegetation is lost, affected areas will be restored and replanted to reestablish preproject conditions.

C. Authority and Purpose. The purpose of the proposed work is to reduce the adverse effects of hurricane flooding and erosion and reduce the potential of new inlet breakthrough adjacent to the canals at the south end of Topsail Beach. The proposed work is being conducted pursuant to resolutions of the Committee on Public Works of the United States House of Representatives, as discussed in the environmental impact statement.

D. General Description of Fill Material.

1. General Characteristics of Material. The material to be discharged on the beach is predominantly medium to coarse grain sand. The terminal groin will be constructed of concrete sheetpiles, granitic stone and marine limestone.

2. Quantity of Material (cu. yds.). Initial beachfill will require discharge of about 3,240,000 cubic yards of material. Annual maintenance is projected to be about 126,000 cubic yards and renourishment, every four years, is projected to be about 504,000 cubic yards. Approximately 7,134 linear feet of concrete sheetpile, 4,800 tons of 1,600 lb granitic stone, 3,200 tons of 6,400 lb granitic stone, and 2,700 lbs of marine limestone will be used to construct the terminal groin.

3. Source. Material to be discharged on the beach will be obtained from existing shallow water and intertidal habitat of the most southern portion of Banks Channel, located behind Topsail Island. No marsh vegetation is involved. Concrete, stone, and marine limestone, needed for construction of the terminal groin will be obtained from local sources.

E. Description of the Proposed Discharge Site.

1. Location. Refer to I. B. General Description and plate No. 3 of the main report.

2. Size. Discharge of material on the beach will begin at the proposed groin at the southern end of the island, and will proceed in a northerly direction for a distance of 10,250 feet leading into a transition zone of 7,150 feet for a total disposal area of 17,400 feet. See plate 3 of the main report.

3. Type of Site. Unconfined beach, surf zone, and nearshore ocean.

4. Type of Habitat. Ocean beach consisting of medium to coarse sand, ocean surf zone, and nearshore ocean.

5. Timing and Duration of Discharge. Discharge of fill material will occur between 15 November and 1 May to avoid the nesting season of the loggerhead sea turtle and shorebirds. The piping plover has not been documented to nest on Topsail Beach. If it becomes necessary to discharge on the beach during the nesting season, a monitoring program will be implemented to assure no impacts to the loggerhead sea turtle nests result.

F. Description of Discharge Method. A hydraulic pipeline dredge will be used to discharge fill material on the beach and in the surf zone. Bulldozers and other earthmoving equipment will be used to construct the berm and dune and to grade the material. If necessary, a berm will be constructed to control the flow of effluent. Construction and maintenance of the terminal groin will be accomplished by bulldozers, cranes, and other earthmoving equipment.

II. FACTUAL DETERMINATIONS

A. Physical Substrate Determinations.

1. Substrate Elevation and Slope. The substrate elevation and slope will be altered by the construction of the 13-foot m.s.l. dune, the 9-foot m.s.l. storm berm, reshaping of the beach and construction of the terminal groin.

2. Sediment Type. The fill material is predominantly medium to coarse sand which is compatible with the existing substrate and granitic stone and concrete.

3. Fill Material Movement. Some lateral movement of material will likely occur as a result of the combined effects of currents, water circulation, wind, and wave action. The beach area next to the groin will fill with sand due to construction of the beach fill. Very little movement of material should occur in the area of the groin.

4. Physical Effects on Benthos. The discharge of fill material will smother benthic forms in the immediate vicinity of beach fill. Repopulation should begin soon after the disposal operation ends. The construction of the terminal groin will result in smothering of benthic organisms; however, organisms adapted to smooth substrate should populate the area. Turbidity related impacts are expected to be minor due to the coarseness of the material.

5. Other Effects. None.

6. Actions Taken to Minimize Impacts. A berm may be constructed along the mean high water line to help reduce turbidity. Nesting seasons for shorebirds and sea turtles will be avoided.

B. Water Circulation, Fluctuation, and Salinity Determinations.

1. Water.

a. Salinity. No significant effect.

b. Water chemistry. No significant effect.

c. Clarity. Clarity will be reduced locally and temporarily due to a slight increase in turbidity.

d. Color. No effect.

e. Odor. No effect.

f. Taste. Not applicable.

g. Dissolved gas levels. Not applicable.

h. Nutrients. No significant effect.

i. Eutrophication. No significant effect.

j. Other as appropriate. Not applicable.

2. Current Patterns and Circulation.

a. Current patterns and flow. The current patterns and flow in the vicinity of the terminal groin will be altered. The change in current patterns and flow will be localized in the vicinity of the terminal groin at the southern end of the beach fill.

b. Velocity. No significant effect.

c. Stratification. No effect.

d. Hydrologic regime. See II.B.2.a. above. No adverse changes to the hydrologic regime should occur.

3. Normal Water Level Fluctuations. No effect.

4. Salinity Gradients. No effect.

5. Actions Taken to Minimize Impacts. See II.A.6. above.

C. Suspended Particulate/Turbidity Determinations.

1. Expected Change in Suspended Particulate and Turbidity Levels in the Vicinity. A local, temporary, and minor increase in turbidity and particulates will occur due to the proposed discharge and groin construction. No violation of applicable water quality standards will occur.

2. Effects (Degree and Duration) on Chemical and Physical Properties of the Water Column.

a. Light penetration. A slight reduction in light penetration will occur due to the turbidity increase associated with the proposed action. Turbidity will quickly return to ambient levels upon completion of the work.

b. Dissolved oxygen. A slight decrease in dissolved oxygen concentrations may be associated with the proposed action resulting in a minor, local, and temporary effect. Dissolved oxygen should return to ambient levels soon after completion of the work.

c. Toxic metals and organics. No effect.

d. Pathogens. No effect.

e. Esthetics. No significant effect.

f. Others as appropriate. None.

3. Effects on Biota.

a. Primary production, photosynthesis. A slight reduction may occur due to minor turbidity.

b. Suspension/filter feeders. No significant effect.

c. Sight feeders. Turbidity is not expected to be high enough to significantly affect sight feeding organisms.

4. Actions Taken to Minimize Impacts. See II.A.6. above.

D. Contaminant Determinations. The discharge will not introduce, relocate, or increase contaminants.

E. Aquatic Ecosystem and Organism Determinations.

1. Effects on Plankton. Turbidity associated with deposition of material may have a slight effect on plankton; however, the effect is not considered significant.

2. Effects on Benthos. See II.A.4. above.

3. Effects on Nekton. No significant effect.

4. Effects on Aquatic Food Web. Deposition is expected to have a minimum adverse effect on the aquatic food web through smothering of benthos. Repopulation will occur rapidly upon completion of the work. No long term impacts are expected.

5. Effects on Special Aquatic Sites.

a. Sanctuaries and refuges. Not applicable.

b. Wetlands. No effect.

c. Mudflats. No effect.

d. Vegetated shallows. No effect.

e. Coral reefs. Not applicable.

f. Riffle and pool complexes. Not applicable.

6. Threatened and Endangered Species. Discharge of material during construction and maintenance will occur between November 15 and May 1 of any given year and will avoid adverse impacts to the loggerhead sea turtle. If discharge becomes necessary during the nesting season, a monitoring program will be established to assure no adverse impacts to the loggerhead sea turtle occurs.

The piping plover has not been documented to nest on Topsail Beach; therefore no effect on the piping plover is expected to occur.

7. Other Wildlife. No effect.

8. Actions Taken to Minimize Impacts. See II.A.6. above.

F. Proposed Disposal Site Determinations.

1. Mixing Zone Determination. The mixing zone is expected to be minimal due to the coarseness of the material.

2. Determination of Compliance with Applicable Water Quality Standards. In compliance with Section 404(r) (PL 95-217), a section 401 (PL 95-217) Water Quality Certificate is waived.

3. Potential Effects on Human Use Characteristics.

a. Municipal and private water supply. No effect.

b. Recreational and commercial fisheries. The proposed discharge of dredged material and groin construction may temporarily displace the surf-feeding fish populations. However, surf-feeding should return to normal upon completion of the project.

c. Water-related recreation. Due to the timing of the project, the effect on water related recreation is expected to be minimal.

d. Esthetics. Minor increased turbidity will reduce the esthetic appeal of the beach and nearshore zone with respect to beach-oriented recreation for the duration of the discharge operation.

e. Parks, national and historic monuments, national seashores, wilderness areas, research sites, and similar preserves. Not applicable.

G. Determination of Cumulative Effects on the Aquatic Ecosystem. No significant effect.

H. Determination of Secondary Effects on the Aquatic Ecosystem. No secondary effects on the aquatic ecosystem are anticipated.

III. FINDINGS OF COMPLIANCE WITH THE RESTRICTIONS ON DISCHARGE

A. No significant adaptations of the guidelines were made relative to this evaluation.

B. There are no practicable alternative discharge sites which would have less adverse impact on the aquatic ecosystem, and still achieve the project objectives of beach erosion control and hurricane wave protection.

C. Under Section 404(r) (PL 95-217), the requirement to obtain the State Water Quality Certificate is waived. The proposed discharge is in compliance with the Toxic Effluent Standards of Section 307 of the Clean Water Act.

D. The proposed discharge will not harm any endangered species or their critical habitat or violate the protective measures for marine sanctuaries.

E. The proposed placement of fill will not result in significant adverse effects on human health and welfare, including municipal and private water supplies, recreation and commercial fisheries, plankton, fish, shellfish, wildlife, and special aquatic sites. The life stages of aquatic life and other wildlife will not be adversely affected. Significant adverse effects on aquatic ecosystem diversity, productivity and stability; and recreational, esthetic, and economic values will not occur.

F. Appropriate steps will be taken to minimize potential adverse impacts of the fill material on the aquatic ecosystem.

G. On the basis of this analysis, the proposed discharge sites for fill material are specified as complying with the requirements of the Section 404(b)(1) (P.L. 95-217) guidelines.

ATTACHMENT 2

CONSISTENCY DETERMINATION
WEST ONSLOW BEACH AND NEW RIVER INLET (TOPSAIL BEACH)
BEACH EROSION CONTROL AND HURRICANE WAVE PROTECTION
PENDER COUNTY, NORTH CAROLINA

DATE: November 1988

PROJECT DESCRIPTION. The project will consist of construction and maintenance of a 13-foot mean-sea-level (m.s.l.) dune and a 9-foot m.s.l. storm berm fronted by a natural beach berm at elevation +7 feet m.s.l. The fill width is 160 feet over a distance of 10,250 feet leading into a transition zone of 7,150 feet to the north for a total fill length of 17,400 feet. A single terminal groin will be constructed and maintained at the southern end of the beach fill to prevent excessive or unacceptable erosion losses in the area of the main beach fill.

The terminal groin will involve construction of a horizontal section, at +7 feet m.s.l. extending from a landward anchorage point 260 feet seaward to approximately the intersection with the +7 feet m.s.l. contour of the beach fill. From this point, the groin will slope 1 vertically to 12 horizontally down to an elevation of 0 feet m.s.l. for a distance of 84 feet and then horizontally at this elevation to approximately -10 to -11-foot m.s.l. in the ocean for a distance of 666 feet. The terminal groin will be constructed with prestressed concrete sheetpiles and scour protection will be provided by a rubble toe. The total length of the groin is 1,010 feet.

Approximately 3,240,000 cubic yards of coarse to medium sand will be removed during initial dredging of Banks Channel, located behind the southern end of Topsail Island, and discharged along the ocean shoreline of Topsail Beach to construct the berm and dune. Maintenance or annual nourishment of the project is projected to be 126,000 cubic yards of material. Renourishment of the project will be done every four years for a total of approximately 504,000 cubic yards of material per maintenance event. See plate 3 of the main report.

The pipeline route will be carefully selected to minimize impacts. If necessary, the pipeline will be burlapped and welded with straps to provide maximum protection against leakage. If dune vegetation is lost, affected areas will be restored and replanted to reestablish preproject conditions.

The proposed project at Topsail Beach is consistent with the Coastal Management Program of the State of North Carolina. The following information supports the consistency determination:

A. Areas of Environmental Concern (AEC's): The proposed activity will take place in the estuarine system and the ocean hazard system and will affect the following AEC's:

Estuarine Waters. The proposed activity is defined as a second priority use of this AEC and is consistent with the management objectives.

Public Trust Areas: The project is an acceptable use within public trust areas. The project will not be detrimental to the biological and physical functions of the estuary.

Estuarine Shorelines: The project will not have any significant impact on this AEC. A buffer zone will be left between the borrow area and the existing marsh along the shoreline to reduce the potential for erosion of the marsh. The use of the selected borrow site will not weaken or eliminate natural barriers to erosion and is consistent with the management objective.

Coastal Wetlands: No impact to coastal wetlands is expected to occur. The pipeline route will not cross coastal wetlands.

Ocean Erodible Area: The discharge of material on the beach including the crossing of dunes by the pipeline will not cause any significant adverse effect to ocean erodible areas. The beach area next to the groin will fill with sand due to construction of the beach fill. Therefore, sand transport will still take place around and over the groin. The groin may cause some reshaping on the inlet side of the groin because of modifications in tidal currents and wave conditions. The impacts are expected to be minor without significant loss of land area.

High Hazard Flood Areas. Discharge of material on the beach would provide temporary protection for high hazard flood areas.

Inlet Hazard Areas. The discharge of material on Topsail Beach and the construction of the terminal groin will help to control beach erosion. The possibility of a breakthrough in the vicinity of the finger canals and long feeder channel north of the inlet may be avoided by nourishment and maintenance of the unvegetated beach area and the ocean shoreline.

With respect to the general and specific use standards for the estuarine system AEC's (15 NCAC 7H .0208):

1. The project is water dependent. (a)(1)

2. The need for the proposed activity is well documented in the Environmental Impact Statement (EIS), West Onslow Beach and New River Inlet (Topsail Beach), Pender County, North Carolina, dated November 1988. (a)(2)(A)

3. The alternatives considered in detail were the proposed action and no action. (a)(2)(B)

4. The proposed activity will not violate water and air quality standards. A Section 401 (P.L. 95-217) Water Quality Certificate for beach fill and terminal groin construction has been requested from the N.C. Division of Environmental Management. (a) (2)(C)

5. The proposed activity will not cause any major or irreversible damages to documented archeological or historic resources. (a)(2)(D)

6. The activity will cause a temporary and minor increase in siltation immediately adjacent to the area being dredged and near the area of deposition. (a)(2)(E)

7. The proposed acitivity will not create stagnant water bodies. (a)(2)(F)

8. Life cycles of estuarine resources are not expected to be significantly affected by the proposed acitivity. (a)(2)(G)

9. The proposed activity will promote navigation and the use of public trust and estuarine waters. (a)(2)(H)

10. The dredging and discharge are consistent with standards for the ocean hazard system as defined in 15 NCAC 7H .0300. (a)(2)(I)

11. The activity will not alter or affect productive shellfish beds, submerged vegetation, or regularly or irregularly flooded marsh areas. (b)(1)

12. Dredged material will be discharged on the ocean beach of Topsail Beach. (b)(2)(A-G)

13. The area being dredged is presently open to shellfishing. The beach discharge site is presently not classified for shellfishing. No adverse impacts to shellfishing are anticipated. (b)(2)(H)

Concerning general use standards for the ocean hazard system (.0306):

1. 15 NCAC 7H .0306 (a)(1-5): Not applicable (a)(1-5)

2. The existing dunes will be reworked to create artificial dunes and storm berms. The added elevation and mass of the fill will reduce the amount of landward retreat of the beach during storms and would decrease the size of the wave capable of propagating across the island. (b)

3. The terminal groin is integral to a project with an overriding Federal interest in flood control and consequent public benefits. It will not increase existing hazards or damage natural buffers and will not promote growth and development in the ocean hazard area. The groin has been designed to withstand flooding and erosion. (c)(1-4)

4. The proposed action will not cause major or irreversible damage to valuable documented historic, architectural, or archeological resources. (d)

5. 15 NCAC 7H .0306: (e) Not applicable. (e)

6. 15 NCAC 7H .0306. (f) Not applicable. (f)

7. The proposed action is consistent with general management objectives for ocean hazard areas set forth in 15 NCAC 7H .0303. (g)

8. This action will not create undue interference with access to or use of public resources. (h)

9. The proposed action incorporates all reasonable means and methods to minimize adverse impacts. (i) (1-3)

10. 15 NCAC 7H .0306 (j): Not applicable. (j)

11. 15 NCAC 7H .0306 (k): Not applicable. (k)

Concerning specific use standards for the ocean hazard system (15 NCAC 7H .0308):

1. Beach nourishment is a preferred erosion control measure. The construction of the terminal groin will protect the southern end of the beach fill from excessive erosion and is therefore an acceptable alternative. (a)(1)(A)

2. The construction of the terminal groin will not adversely impact on the value and enjoyment of adjoining properties or public access to and use of the ocean beach. (B)

3. 15 NCAC 7H .0308(a)(1)(C): Noted. (C)

4. The proposed action will not interfere with public access to and use of ocean beaches. (D)

5. Only minor erosion is expected to occur on the inlet side of the terminal groin. (E)

6. The project has been designed to include sound engineering and will be certified by a licensed engineer prior to construction. (F)

7. The beach is used for nesting purposes by loggerhead sea turtles and shorebirds. The project will be constructed and maintained between November 15 and May 1 to minimize impacts to wildlife. (G)

8. The project will be timed to have minimum significant adverse effect on biological activity. (H)

9. All littoral property owners within 100 feet of the boundaries of the project site will be notified of the proposed activity. (I)

10. The project is consistent with the general policy statement in 15 NCAC 7M .0200. (J)

11. Prior to project construction, all exposed debris will be removed from the area. (K)

12. The terminal groin will be properly marked. (L)

13. 15 NCAC 7H .0308(a)(2) & (a)(3): Not applicable. (2,3)

14. The material to be used for beach nourishment is compatible with existing grain size. Material will be removed from an area where minimal environmental impacts will occur. (4)

15. Existing material and material from the borrow area will be used to construct the proposed berm and dune. Bulldozers and earth moving equipment will be used during construction. A slope of adequate grade will be maintained so as not to endanger the public or public's use of the beach. Adjoining property owners will be notified of the proposed activity. The purpose of the berm and dune are beach erosion control and hurricane wave protection. The dune will be vegetated to aid in erosion control and stabilization of material. (5)(a)

16. The activity will not exceed the lateral bounds of the Federal project without obtaining permission from the adjoining land owners. (b)

17. Concurrence with this consistency determination will be obtained from the N.C. Division of Coastal Management prior to beginning work. (c)

18. The activity will not significantly increase erosion on neighboring properties and will not have a significant adverse effect on important natural or cultural resources. (d)

19. 15 NCAC 7H .0308(a)(5)(e): Not applicable. (e)

20. The construction and maintenance of the berm and dune will be aligned to the greatest extent possible with existing adjacent dune ridges and shall be of the same general configuration as adjacent natural dunes. (b)(1)

21. Proposed nourishment of the project will require broadening and extending the dune in an oceanward direction. (b)(2)

22. Damage to existing vegetation will be minimized. The dune will be planted with dune grasses. (b)(3)

23. The material used is compatible with existing substrate and will be obtained outside the ocean hazard area. (b)(4)

24. No dunes will be created in the inlet hazard area. (b)(5)

25. 15 NCAC 7H .0308(b)(6): Not applicable. (b)(6)

26. 15 NCAC 7H .0308(b)(7): Not applicable. (b)(7)

27. 15 NCAC 7H .0308(c)(1) through (3): Not applicable. (c)

28. 15 NCAC 7H .0308(d)(1) through (10): Not applicable. (d)

Concerning use standards for the inlet hazard areas (15 NCAC 7H .0310):

1. 15 NCAC 7H .0310(a)(1)(2)&(3): Not applicable. (1)(2)(3)

2. Established common-law and statutory public rights of access to the public trust lands and waters in the inlet hazard area will not be eliminated or restricted. (a)(4)

3. The construction of the terminal groin within the inlet hazard area will aid in stabilization of the publicly supported project. (a)(5)

4. 15 NCAC 7H .0310(a)(6): Not applicable. (6)

5. 15 NCAC 7H .0310(b): Not applicable. (b)

B. Land Use Plans. The project is located entirely in Pender County, North Carolina. The Land Use Plan for Pender County, dated 1981, classifies the beach discharge area as "conservation" which provides for effective long-term management of significant limited or irreplaceable areas, and the area to be used as a borrow site as "water."

C. State Guidelines:

1. For AEC's see paragraph A.

2. For land use plans see paragraph B.

3. General policy (15 NCAC 7M):

(a) Shoreline Erosion Policies (15 NCAC 7M .0200). The project involves discharge of dredged material on the ocean beach. Discharge of suitable material on the beach is consistent with State policy endorsing beach nourishment as the preferred method of controlling erosion.

(b) Shorefront Access Policies (15 NCAC 7M .0300). Discharge of material on the beach will enhance public access to and use of the beach.

D. Other State Policies: Other State policies found in the North Carolina Coastal Management Program document that were specifically reviewed were:

1. Coastal Area Management Act of 1974.

See paragraphs A and B above.

2. State Dredge and Fill Law

See paragraph A (Areas of Environmental Concern) above.

3. North Carolina Sedimentation Pollution Control Act.

Work will be accomplished in accordance with the Memorandum of Agreement Between the North Carolina Sedimentation Pollution Control Commission and the Wilmington District, U.S. Army Corps of Engineers, dated December 23, 1985.

4. Water Quality Regulations: A Section 401 (P.L. 95-217) Water Quality Certificate has been requested from the N.C. Division of Environmental Management.

E. Conclusion: Based on the above information, I have determined that the proposed dredging of Banks Channel with discharge of material on Topsail Beach; construction and maintenance of a dune and storm berm fronted by a natural beach berm; and construction and maintenance of a terminal groin are consistent with the Coastal Management Program of the State of North Carolina.

Attachment

Lawrence W. Saunders
Chief, Planning Division

DATE: _____

Paul W. Woodbury
Colonel, Corps of Engineers
District Engineer

DATE: _____

APPENDIX A

PERTINENT CORRESPONDENCE

APPENDIX A

PERTINENT CORRESPONDENCE

TOWN OF TOPSAIL BEACH NORTH CAROLINA

Post Office Box 3089
Topsail Beach, North Carolina 28445
Telephone (919) 328-5841

December 21, 1987

Col. Paul W. Woodberry
District Engineer
U. S. Army Corps of Engineers
P. O. Box 1890
Wilmington, N. C. 28402

Dear Col. Woodberry:

At the suggestion of Mr. Ron Fascher of your staff, I am corresponding with you to inform the Corps of Engineers of the committment on the part of the Town of Topsail Beach to do everything possible to fulfill any necessary local obligation of funds required in connection with the development of your proposal to renourish and reconstruct approximately three miles of beach strand in our community.

We first became aware of the feasibility study connected with this proposed project in the latter part of 1986 and the early part of 1987. At that time, we were experiencing some of the worst beach erosion in the history of the Town. We had inquired as to any assistance which could be provided by the Corps of Engineers and we were then informed of your long range plans.

I cannot express to you the urgency of the need for a shoreline protection project at Topsail Beach such as the one you are currently considering. Our understanding of the current proposal is as follows. Two proposals are currently under consideration. They range in costs from approximately $9.1 million to $14.5 million. We further understand that federal government funding of projects such as this is approximately 60% to 65% of the total project costs. The remaining 35% to 40% is generally raised at the local and state levels of government.

As I started earlier, the Town of Topsail Beach stands ready to assume the burden for providing the non-federal share of funds for this proposed project. We realize that acquiring the non-federal portion of these funds will not be easy, especially for a municipality as small as ourselves. We hope to convince the State of North Carolina to participate in the cost of the project as well. Regardless, the Town of Topsail Beach finds itself in the unenviable position of having to commit itself to acquiring the non-federal portion of the necessary funds, or face the loss of the lifeblood of this community. We can only hope that our beach strand, and, in turn, our economy, can survive until the proposed project construction period.

We had hoped to provide you with a resolution from the Topsail Beach Board of Commissioners which gave you a more formal pledge of our support for your proposal. Unfortunately, we have found ourselves between monthly Board meetings and in the midst of the holiday season. It is difficult at this time of year to get the members of the Board of Commissioners together in a special called meeting to

consider formal action. If you feel it is necessary to have such a resolution passed, please contact our Town Manager, Mr. Tony Caudle, at the Topsail Beach Town Hall and he will make the necessary arrangements. I must forwarn you, however, that many of our Board members take extended vacations at this time of year, and many times it is difficult to hold even our regularly scheduled meetings, much less a special called meeting.

Please do not interpret the lack of a formal resolution as a lack of committment to our portion of the proposed project. The current Board of Commissioners is firmly committed to the protection of our shoreline. This community stands firmly behind your proposals and will provide any assistance, financial or otherwise, which is within it power to control.

If you should have any further questions or concerns about this issue, please feel free to contact me, or any of the staff members, at the Topsail Beach Town Hall.

Thanking you for your assistance in this matter I am:

Very truly yours,

Milton R. "Kip" Oppegaard
Mayor, Town of Topsail Beach

CC: Mr. Ron Fascher, Chief
Plan Formulation Branch

PAUL TRIBLE
VIRGINIA

United States Senate

WASHINGTON, D.C. 20510

January 28, 1987

Colonel Paul Woodbury
District Engineer
U.S. Army Engineer District, Wilmington
Post Office Box 1890
Wilmington, North Carolina 28402-1890

Dear Colonel Woodbury:

Attached is a copy of information I recently received from William and Doris McDaniel regarding Topsail Beach in North Carolina.

I would appreciate your reviewing the concerns expressed herein and advising me of any action which has been taken or is contemplated which would be helpful.

Please return your findings and views, in duplicate form, along with the attached enclosure at your earliest convenience.

Sincerely,

Paul Trible

PT:sb
Enclosure

87 JAN 27 AM 10:18

12624 Winfree Street
Chester, VA 23831
January 18, 1987

The Honorable Paul S. Trible, Jr.
United States Senate
Washington, DC 20510

Dear Senator Trible:

The residents and property owners of Topsail Beach, NC are in need of your assistance. As you know, on December 2, 1986 and on January 1, 1987 Topsail Beach was devastated by abnormally high tides and exceptionally strong northeast winds. This resulted in severe beach erosion. The greatest degree of damage was to the public beach strand, which lost between 30 and 60 feet. The result has been that there is little or no public beach strand left.

We are residents of Virginia who own a house on Topsail Island, North Carolina. Many Virginia families use our house in North Carolina and have until this time enjoyed the beautiful beach there.

We are attempting to persuade the U. S. Army Corps of Engineers to provide Topsail Beach with a badly needed beach renourishment project. A project such as this requires that the Corps institute a pipeline dredging project, taking the sand out of the Topsail Inlet and pumping it through a large tube to be placed on the beach strand. The Town has approached the Corps about this type of project several times before only to be told that it would be too costly to justify the benefits of this project.

We understand that a similar situation exists on the Virginia coastline. It would be greatly appreciated if you could make a contact to the Army Corps of Engineers possibly persuading them to make an exception to their regulations to allow for the budgetary confines of smaller beach communities.

We have also written Senators Helms and Sanford of North Carolina about the problem and would appreciate any help you could give them.

Sincerely,

Doris & William O. McDaniel

Doris and William O. McDaniel
Property Owners
1303 Carolina Blvd.
Topsail Beach, NC

JOHN W. WARNER
VIRGINIA

235 FEDERAL BUILDING
180 WEST MAIN STREET
ABINGDON 24210
703/628-8158

805 FEDERAL BUILDING
200 GRANBY MALL
NORFOLK 23510
804/441-3079

U.S. PARCEL POST BUILDING
1100 EAST MAIN STREET
RICHMOND 23219
804/771-2579

United States Senate

WASHINGTON, DC 20510

ARMED SERVICES COMMITTEE
CHAIRMAN, STRATEGIC AND THEATER NUCLEAR FORCES SUBCOMMITTEE

ENERGY AND NATURAL RESOURCES COMMITTEE
CHAIRMAN, ENERGY AND MINERAL RESOURCES SUBCOMMITTEE

RULES AND ADMINISTRATION COMMITTEE

JOINT COMMITTEE ON THE LIBRARY OF CONGRESS

February 3, 1987

Colonel W. A. Hanson
District Engineer
Army Corps of Engineers
Wilmington District
P. O. Box 1890
Wilmington, North Carolina 28402

Dear Colonel Hanson:

Your consideration of the attached correspondence from a constituent will be appreciated. Please return your findings and views, in duplicate form, to the following address:

Office of Senator John W. Warner
805 Federal Building
200 Granby Mall
Norfolk, Virginia 23510

Thank you for your time and courtesy.

Sincerely,

John W. Warner

John W. Warner

JWW/bjt

12624 Winfree Street
Chester, VA 23831
January 18, 1987

The Honorable John W. Warner
United States Senate
Washington, DC 20510

Dear Senator Warner:

The residents and property owners of Topsail Beach, NC are in need of your assistance. As you know, on December 2, 1986 and on January 1, 1987 Topsail Beach was devastated by abnormally high tides and exceptionally strong northeast winds. This resulted in severe beach erosion. The greatest degree of damage was to the public beach strand, which lost between 30 and 60 feet. The result has been that there is little or no public beach strand left.

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We have also written Senators Helms and Sanford of North Carolina about the problem and would appreciate any help you could give them.

Sincerely,

Doris and William O McDaniel

Doris and William O. McDaniel
Property Owners
1303 Carolina Blvd.
Topsail Beach, NC

TIM VALENTINE
SECOND DISTRICT
NORTH CAROLINA

MEMBER:
COMMITTEE ON
PUBLIC WORKS AND
TRANSPORTATION
SUBCOMMITTEES:
SURFACE TRANSPORTATION
AVIATION

COMMITTEE ON SCIENCE
AND TECHNOLOGY
SUBCOMMITTEES:
NATURAL RESOURCES, AGRICULTURE
RESEARCH AND ENVIRONMENT
ENERGY RESEARCH AND PRODUCTION
SCIENCE, RESEARCH AND TECHNOLOGY

Congress of the United States
House of Representatives
Washington, DC 20515

WASHINGTON OFFICE:
ED NAGY
ADMINISTRATIVE ASSISTANT

1107 LONGWORTH HOUSE OFFICE BUILDING
WASHINGTON, DC 20515
TELEPHONE (202) 225-4531

DISTRICT OFFICES
A.B. SWINDELL IV
DISTRICT ADMINISTRATIVE ASSISTANT

121 EAST PARRISH STREET
DURHAM, NC 27701
TELEPHONE (919) 541-5201

219 SOUTH FRANKLIN STREET
ROCKY MOUNT, NC 27801
TELEPHONE (919) 446-1147

January 30, 1987

Colonel Paul Woodbury
District Engineer
United States Army Corps of Engineers
P. O. Box 1890
Wilmington, North Carolina 28402

Dear Colonel Woodbury:

I have been contacted by residents and property owners of Topsail Beach, North Carolina, who are greatly concerned about the severe public beach erosion and private property damage caused by recent storms.

As you know, the entire 6.5 mile length of Topsail Beach is now left with little or no public beach strand during high tides. In fact, two miles of that shoreline has no public beach area at all.

I am advised that Topsail Beach approached the U. S. Army Corps of Engineers in the past regarding a possible beach renourishment project but that the Corps felt it could not justify the cost to the Office of Management and Budget and, therefore, suggested that the Town pay a contracted price for the service. Because Topsail Beach cannot finance a project of that magnitude, the economy of the Town and surrounding areas will suffer unless a way is found to finance a beach renourishment project.

I would appreciate any assistance the Corps might be able to provide the citizens and homeowners of Topsail Beach and Pender County in alleviating the recent devastation.

Sincerely,

Tim Valentine

TV/jb

MARTIN LANCASTER
3D DISTRICT, NORTH CAROLINA

Congress of the United States
House of Representatives
Washington, DC 20515

February 17, 1987

Colonel Paul Woodbury
U. S. Army Corps of Engineers
P. O. Box 1890
Wilmington, North Carolina 28402-1890

Dear Colonel Woodbury:

Thank you for visiting with me in my office. I am very anxious to receive from you your letter spelling out the alternatives and their costs which I might consider for Topsail Island. I am also anxious to have something definitive from you with regard to dredging the back channel and using that small amount of fill as stopgap replenishment of the beach at the southern end of the island. Please let me hear from you as soon as possible. I will be meeting with the people on Topsail Island very soon and need to be able to give them some answers or at least some hope.

Thank you for your prompt attention to this matter.

Sincerely,

H. Martin Lancaster
Member of Congress

HML:dd

P.S. After dictating this letter, I received your letter of February 11. I am disappointed that your letter says so little. It was my understanding that you were going to provide for me the cost figures for a "rush job" on the project. While it is unlikely that I will have the clout to speed up the process, I want to at least give it a try. Being on the Public Works Committee may enable me to get early authorization of the project and earlier funding. It was also my understanding that you were going to provide me an estimate of the local government's share, so that I could be preparing those people to meet that obligation. I had also thought that you were going to tell me more about the channel dredging and the use of that spoil for stopgap beach replenishment. If you are reluctant to put all of those figures in writing, a personal briefing at which I can take notes will suffice. However, I do have a meeting scheduled with the people on Topsail Island and would like to be able to tell them something. Please expedite getting that information to me, either in writing or orally.

Congress of the United States

House of Representatives

Washington, D.C.

February 13 19 87

Army Corps. Of Engineers
Post Office Box 1890
Wilmington, N.C. 28402

Sir:

The attached communication is sent for your consideration. Please investigate the statements contained therein and forward me the necessary information for reply, returning the enclosed correspondence with your answer. Please respond to my Clearwater Office--Attention: Maureen Ahearn

Yours truly,

Michael Bilirakis

Re: Walton, Richard

M.C.

Michael Bilirakis, M.C.
1100 Cleveland Street Suite 1600
Clearwater, FL 33515-6993
Ninth District
Comm (813) 441-3721 FTS 821-7420

FEB 06 1987

January 21, 1987

The Honorable Michael Bilirais
1130 Longworth House Office Building
Washington, D. C. 20515

Dear Congressman Bilirais:

I am enclosing a copy of a letter we have written to both United States Senators from the State of North Carolina. It is self-explanatory.

If there is any assistance you could give us in this matter, believe me, it would be greatly appreciated. As a resident in Florida with us, you surely know what havoc high tides and strong winds play on our beaches!

Fortunately, here in Florida, most of the major beaches both on the West Coast and East Coast enjoy a much broader tax base because of the high population and multitude of businesses in the surrounding areas.

Topsail Beach is a very small community and desparately needs help!

Thank you for anything you can do.

Sincerely,

Richard C. Walton, Sr.
Georgette B. Walton
5008 Headland Hills
Tampa, Florida 33625

THIS LETTER WAS SENT TO BOTH SENATOR JESSE HELMS AND SENATOR TERRY SANFORD AND TO REP. H. MARTIN LANCASTER.

January 21, 1987

As a property owner in Topsail Beach, N. C., I am writing to request your assistance.

As you know, on December 2, 1986 Topsail Beach was devastated by abnormally high tides and exceptionally strong northeast winds. This resulted in severe beach erosion. I understand private property damage was more than 5 million. However, greater damage still occured to the public beach strand, which lost anywhere between 30 and 60 feet in one 24-hour period.

We can only imagine what additional damage was caused by the storm of December 31-January 1.

Obviously, there is little to no beach left during high tides and, in a two mile stretch, there is NO public beach area at all.

We must take action to replenish and renourish our beaches, and do so immediately! We believe the entire economy of the Pender County area will be affected. Estimates given to me indicate that approximately 45% of Pender County ad valorem tax base is located in Topsail Township. If beachfronthomes are lost, the tax base will be significantly reduced.

The primary attraction to this area is, of course, its beautiful beaches - the question is, Will the seasonal trade still come without them? The lost of associated business and tax revenue would have a devastating impact.

The Town has tried to work with the U. S. Army Corps of Engineers to replenish the beaches, but apparently the Corps felt a project of this magnitude could not be justified to the Office of Management and Budget. The Town of Topsail Beach does not have the means to pay the estimated $300,000.00 to $500,000.000 to pay for this service.

Perhaps with your assistance these agencies could be persuaded to make an exception to their regulations, or to change their regulations to allow for the budgetary confines of smaller beach communities.

We purchased our property in Topsail Beach with the plans of spending our retirement years there. I am sure many people who come to this lovely area have the same idea.

Please help us make our dreams come true. Please help the present residents keep their homes. Please help the businesspeople keep their businesses. And please help the State of North Carolina keep one of the most beautiful spots on the Atlantic Ocean.

Thank you for your help and cooperation!

Sincerely

Mr. and Mrs. Richard C. Walton, Sr.
5008 Headland Hills
Tampa, Florida 33625

and
115 McLeod Ave.
Topsail Beach, N. C. 28445

DEPARTMENT OF THE ARMY
OFFICE OF THE ASSISTANT SECRETARY
WASHINGTON, DC 20310-0103

1. Exec Asst
2. Dep Cdr
3. Commander
4. Chf File

ACTION CPO: Planning
CF: Engineering
26 FEB 1987 Con-Ops
PAO
DDE IDE

S:

Honorable Jesse Helms
United States Senate
Washington, D. C. 20515-3302

Dear Senator Helms:

This is in response to your letter of January 16, 1987, concerning beach erosion at Topsail Beach, North Carolina.

Since Topsail Beach is not an authorized Federal beach nourishment project, the Army Corps of Engineers does not have authority to program funds or participate in a beach nourishment project at this site. However, Section 933 of the Water Resources Development Act (Public Law 99-662) provides authority to dispose of dredged material on beaches, at the request of the State, if local interests agree to provide 50 percent of the added cost. I am now in the process of developing policy guidance implementing that section of the Act, and I have asked the Corps to review their activities around Topsail Island to determine if such a cooperative effort is possible.

I will inform you of the findings of the Corps investigation.

Sincerely,

for (signed) JOHN S. DOYLE, JR.

Robert K. Dawson
Assistant Secretary of the Army
(Civil Works)

cf: SASG
Wilmington District
South Atlantic Division
DAEN-CWZ-X/DAEN-CWO-M
DAEN-CW-SA (FILE)
SACW (Read, signer)
Document #141, 61,5
REVISED RK/tr/19Feb87; retyped ele/24Feb87
CN: 7020302

A-13

WILMINGTON DIST

JESSE HELMS
NORTH CAROLINA

United States Senate

WASHINGTON, DC 20510

January 16, 1987

The Honorable Robert K. Dawson
Assistant Secretary of the Army
Civil Works
The Pentagon
Washington, D.C. 20310-0103

Dear Bob:

I enclose copies of two letters from friends of mine, and I hope you folks will take a look at them. Also, at the appropriate time, I would like to talk with you about the situation at Topsail Island, North Carolina.

One of the letters is from a distinguished member of North Carolina's Supreme Court, Justice Louis B. Meyer; the other is from Alex Brock, executive secretary and director of the North Carolina Board of Elections.

Let me emphasize at the outset that I have some apprehension about contacting you, inasmuch as my wife owns a cottage on the island. However, her cottage is not on the ocean side of the island; it faces the inland waterway, and no damage has occurred to her property. So I am not asking for personal assistance.

Having said that, and assuming that it can be agreed that there is no conflict of interest involved in my contacting you, both Mr. Justice Meyer and Mr. Brock have accurately described the distress among a large number of good citizens who own property fronting the Atlantic Ocean.

What I am asking is this: I will be most grateful if your folks will carefully review this situation and then meet with me and/or Mr. Wayne Boyles of my staff. Needless to say, I hope some appropriate and proper way can be found to lend a hand to the people at Topsail who have been hit so hard.

Many thanks, and kindest personal regards.

Sincerely,

Jesse

JESSE HELMS:pd

Supreme Court
State of North Carolina
Raleigh

CHAMBERS OF
JUSTICE LOUIS B. MEYER

BOX 1841
ZIP CODE 27602

January 7, 1987

PERSONAL

The Honorable Jesse Helms
United States Senator
4213 Dirksen Building
Washington, DC 20501

Dear Senator Helms:

In the ordinary course of life's ups and downs, I am generally able to take care of my own problems and not burden official Washington with them. As a matter of fact, I believe this is the first letter I have ever written to seek the assistance of a federal agency in a matter in which I have been personally involved. I am, unfortunately, as it has turned out, the owner of an "ocean front" cottage at Topsail Beach, North Carolina. You will note that I did not use the term "beach front" cottage, as that would be an inaccurate description since there is, in fact, no beach left upon which to front. At this writing, the water from breaking waves at high tide runs well up under my house. During the period of syzygy which was from approximately November 30, 1986, through January 5, 1987, in addition to the extreme high tides, we suffered two periods of heavy winds which wreaked havoc along the south end of Topsail Beach. During that period, I lost forty feet of dune, two sets of steps, a walkway, the entire fully furnished first floor of my beach cottage (which I have had to tear out completely), a great deal of property valuation, and a lot of hair, tears, and sweat. Besides the loss in value to the building and the loss of the entire contents of the first floor, I have, to this point, paid out of pocket approximately $4,500 to shore up the second floor and tear out the entire downstairs. Though I have not yet heard from my federal flood insurance program claim, it is my understanding that the agency is denying coverage for all losses below the floor of the second story, or as they say, below "the first elevated floor."

I tell you all of this not simply because it happened to me, but because it happened to many, many property owners on the southern end of Topsail Island in the incorporated Town of Topsail Beach. The extent of the damage is absolutely unbelievable. As badly as the property owners have themselves suffered from the recent storms and flooding, the greatest degree of damage is to the public beach strand. There is, in fact, little or no public beach strand left during high tide for the entire six and one-half mile length of Topsail Beach. My house

happens to be located in the most heavily damaged area, consisting of about two and one-half miles in length where there is no remaining public beach area at all. I am enclosing a picture of my own beach house, which graphically illustrates the present situation.

Some man-made dunes were pushed up after the November 30, 1986, storm, but they were completely destroyed in the January 2, 1987, storm. Unless the beaches of the Town of Topsail Beach are restored and renourished, it will not be only the property owners who will be losers, but all the people of Pender County. If steps are not taken to accomplish a beach renourishment project immediately, the entire economy of Pender County will be drastically affected. Loss of homes on the beach front will significantly reduce the tax base of both Topsail Beach and Pender County. Estimates vary, but approximately 45 percent of the Pender County ad valorem tax base is located in Topsail Township. The overall economic effect of the loss of beach strand in Topsail Beach cannot be accurately predicted, but when one considers that an average daily seasonal population of 8,000 to 10,000 persons is drawn to this community, the loss of associated business and tax revenue would have a more devastating impact. The primary attraction that this area has to offer, as you well know, is its beautiful beaches, and when that attraction is gone, so will be the associated economic benefits.

The Town of Topsail Beach has, in the past and in an attempt to avert these tragic losses, approached the United States Corps of Engineers about a possible beach renourishment project. The Corps has informed the Town that it could not justify to the Office of Management and Budget a project of the magnitude that would be necessary. The Corps has informed the Town in the past that the Town could pay a contracted price for this service, which would range anywhere from $300,000 to $500,000. The little Town of Topsail Beach simply does not have the wherewithal to pay or the ability to raise that amount of money for contract dredging. The community is composed primarily of residential structures, and this type of property does not produce the amount of tax revenue that would support such an expenditure. Topsail Beach, like the other smaller beach communities, simply cannot raise the necessary funds to save the public beaches and apparently cannot qualify for a Corps project under existing regulations.

On behalf of all the residents of Topsail Beach, I request that you inform the Army Corps of Engineers and the Office of Management and Budget of our plight and the need for a project to replace and renourish the public beach areas of the Town. Topsail Island, at the point of the most severe damage, is very narrow (approximately two blocks wide), and it seems quite feasible to pump sand for that short distance from the sound onto the beach or to pump it from Topsail Inlet. Both the narrow

sound and the inlet are clogged and choked with huge sandbars, and a beach renourishment project would serve the additional purpose of opening the sound and inlet. A similar, and very successful, project was completed in recent years in the Atlantic Beach area. Hopefully, through your help, the Corps will be persuaded to come to the assistance of the Town of Topsail Beach.

I express to you, in advance, my sincere appreciation for your kind consideration in contacting the Corps of Engineers and the Office of Management and Budget.

Very truly yours,

Louis B. Meyer

LBM/ppb

Enclosure

STATE BOARD OF ELECTIONS

SUITE 801 RALEIGH BUILDING
5 WEST HARGETT STREET
RALEIGH, NORTH CAROLINA 27601

ALEX K. BROCK
EXECUTIVE SECRETARY–
DIRECTOR

TELEPHONE
(919) 733-7173

January 8, 1987

Senator Jesse Helms
United States Senate
4213 Dirksen Building
Washington, D. C. 20501

In re: Topsail Beach

Dear Jesse:

As you probably have heard Doris and I purchased a house at Topsail Beach with the intent to retire there and make it our permanent home for about 9 months out of the year.

We selected Topsail Beach because it appeared to be the only remaining 'unspoiled' area on our coast. The town is small and we do not have a significant commercial tax base. Nevertheless, if the government is serious about protecting coastal areas then we desperately need help for our little island.

As you must know the several recent storms have devastated the southern end of Topsail Beach and even though the town has made a valiant effort to restore the sand dunes that are routinely ravaged, it simply is not enough. We need an infusion on sand that can only be accomplished by dredging the sound and pumping it to the bare area of our beach. There is ample sand in the sound and there is usually a dredging unit tied up at a dock built for such purpose at the southern tip of the island.

In the past, efforts made to solicit assistance from the U. S. Army Corps of Engineers has been dismissed as unjustifiable. A beach renourishment project is sorely needed and the Corps of Engineers has the equipment available. It is my opinion that positions can be changed when desperate conditions exist. We are in desperate straits and need the assistance that your office can provide. There simply must be some facet of government able to change policy when such a natural resource is threatened.

We will sincerely appreciate your office looking into the possibility of securing a degree of modification of what appears to be unreasonable intransigent regulations.

A-19

With sincere thanks for your consistent concern and attention, I am

Very truly yours,

Alex K. Brock
P. O. Box 2682
Raleigh, N. C. 27602

A-20

APPENDIX B

Draft Coordination Act Report, U.S. Fish and Wildlife Service

DRAFT

WEST ONSLOW BEACH AND NEW RIVER INLET STUDY
DRAFT FISH AND WILDLIFE COORDINATION ACT REPORT

Prepared by
David H. Rackley

Under the Supervision of
L. K. (Mike) Gantt
Field Supervisor

Released by
U.S. Fish and Wildlife Service
Raleigh Field Office
Raleigh, North Carolina
August, 1986

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICIES

United States Department of the Interior
FISH AND WILDLIFE SERVICE

Division of Ecological Services
P.O. Box 25039
Raleigh, North Carolina 27611-5039

September 12, 1986

Colonel Paul W. Woodbury
District Engineer
U.S. Army Corps of Engineers
P.O. Box 1890
Wilmington, North Carolina 28402-1890

Dear Colonel Woodbury:

Attached is the Service's Draft Fish and Wildlife Coordination Act Report for the West Onslow Beach and New River Inlet Study, Onslow and Pender Counties, North Carolina. This report identifies fish and wildlife resources located in the project area and the potential effect of the various study alternatives on these resources. This report is provided in accordance with Section 2(b) of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.) and our FY 86 Transfer Funding Agreement and Scope of Work.

A copy of this report is being provided to the appropriate State and Federal review agencies, and their comments will be incorporated as soon as available. Any comments which you or your staff wish to provide should be received by September 30, 1986 so they may receive adequate and timely attention in preparation of the Final FWCA report. Technical questions should be directed to the attention of David Rackley of my staff.

Thank you for the opportunity to provide this report.

Sincerely yours,

L.K. (Mike) Gantt
Field Supervisor

b-111

DRAFT

EXECUTIVE SUMMARY

Topsail Island and its adjacent wetlands and waters provide a large, diverse and high-quality habitat base for fish and wildlife which are of ecological, economic and social importance at local, regional and national levels. High value habitats include maritime forests, maritime shrub thickets, tidal marshes and estuarine bottoms. Consumptive and non-consumptive uses include commercial and recreational fishing, birdwatching, nature study and management of threatened and endangered species. The greatest threat to the continued existence of fish and wildlife and their habitats on Topsail Island is the continued development of condominiums, second homes and businesses--all of which result in the direct loss or major alteration of fish and wildlife habitat, increase pollution and cause piecemeal reductions in water quality and resource abundance.

The West Onslow Beach and New River Inlet Study is being performed under authority of U.S. Senate Committee on Public Works Resolutions which authorize the study of inlet stabilization at New River Inlet and beach erosion control and hurricane protection of West Onslow Beach. The four alternatives being considered are: stabilization of New River Inlet with dual jetties; improved navigation at New River Inlet through expansion of the existing navigation channel; and the creation of a navigation channel through Kings Creek; beach nourishment at Topsail Beach including construction of a terminal groin; and beach nourishment/groint construction and dune restoration at Topsail Beach.

Each of the four alternatives has been evaluated by the Service. With exception of the jetty alternative and creation of a navigation channel at Kings Creek, we believe that with appropriate mitigation no significant adverse environmental consequences will occur. Mitigation recommendations are contained in the report; they require no major modifications or expenditures of the various alternatives which the Service believes are environmentally acceptable. The jettey alternative and the Kings Creek excavation work are environmentally unacceptable due to potential habitat losses involving submerged aquatic vegetation and beach and dune habitats.

ACKNOWLEDGEMENT

On August 30, 1978 John O. Fussell, III prepared under contract to the Service, a detailed description of the flora and fauna of Bogue Banks, North Carolina. Since then, we have frequently called upon John for assistance in determining the occurrence of resident and migratory wildlife on North Carolina's barrier islands. Such was the case in preparing this report. Without John's earlier work on Bogue Banks and his assistance in extrapolating data from that report for use on Topsail Island, our description of existing fish and wildlife would be sketchy, at best. We are grateful to John for his valued input.

INTRODUCTION

Topsail (Ashe) Island is located in Onslow and Pender Counties in southeastern North Carolina along the Atlantic Coast. The study area includes all of Topsail Island and extends approximately 22 miles from New River Inlet to the east to New Topsail Inlet to the west. The island varies from about 6,000 feet (average width) including wetlands, to 900 feet (average width) if uplands only are considered. Island elevations range from near sea level to about 25 feet above sea level. The island is aligned in a northeast to southwest direction and is bounded on the west by New Topsail Inlet, on the east by New River Inlet, on the south by the Atlantic Ocean, and on the north by the Atlantic Intracoastal Waterway (AIWW), wetlands, and several small bays and sounds (Figure 1). Historically, the island has been characterized by low density development consisting of vacation homes and cottages, but new and very dense development is occuring at a steady and rapid rate. Major ecosystems include wetlands, shrub thickets, dunes and beaches; these support an ecologically diverse and economically important resource of local, regional and national significance.

New River Inlet is approximately 1,200 feet wide and provides for the exchange of waters between the ocean and local estuaries. An existing Corps of Engineers' navigation project provides for a channel 6-feet-deep and 90-feet-wide from the AIWW through New River Inlet to deep water in the Atlantic Ocean. The inlet is utilized for navigation passage by commercial and recreational vessels and by assault craft associated with training at nearby Camp LeJeune Marine Base.

New Topsail Inlet is also utilized by commercial fishing and recreational vessels. It serves as an important link between the Atlantic ocean and protected estuarine waters which lie behind the barrier islands. New Topsail Inlet, which is approximately 1,000 feet in width, is maintained by the Corps of Engineers at a depth of 8-feet and a width of 150-feet (authorized dimensions). The AIWW, which extends the length of the island and is intersected by both New River Inlet and New Topsail Inlet, is approximately 90-feet wide and 12-feet deep (authorized dimensions).

The West Onslow Beach and New River Inlet Study is being performed under authority of the U.S. Senate Committee on Public Works Resolution adopted June 24, 1970 pursuant to stabilizing and deepening New River Inlet and the Committee's June 23, 1971 Resolution which authorizes a survey of beach erosion control, hurricane protection and related purposes at West Onslow Beach. The Service has participated in the planning process and submitted Planning Aid Reports on July 1, 1981, April 7, 1983 and May 11, 1984. A Reconnaissance Report which recommended initiation of this detailed phase of the study was issued in February 1982 by the Wilmington District Corps of Engineers.

This report is submitted under authority of Section 2(b) of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.) and should be incorporated into the Corps of Engineers planning process.

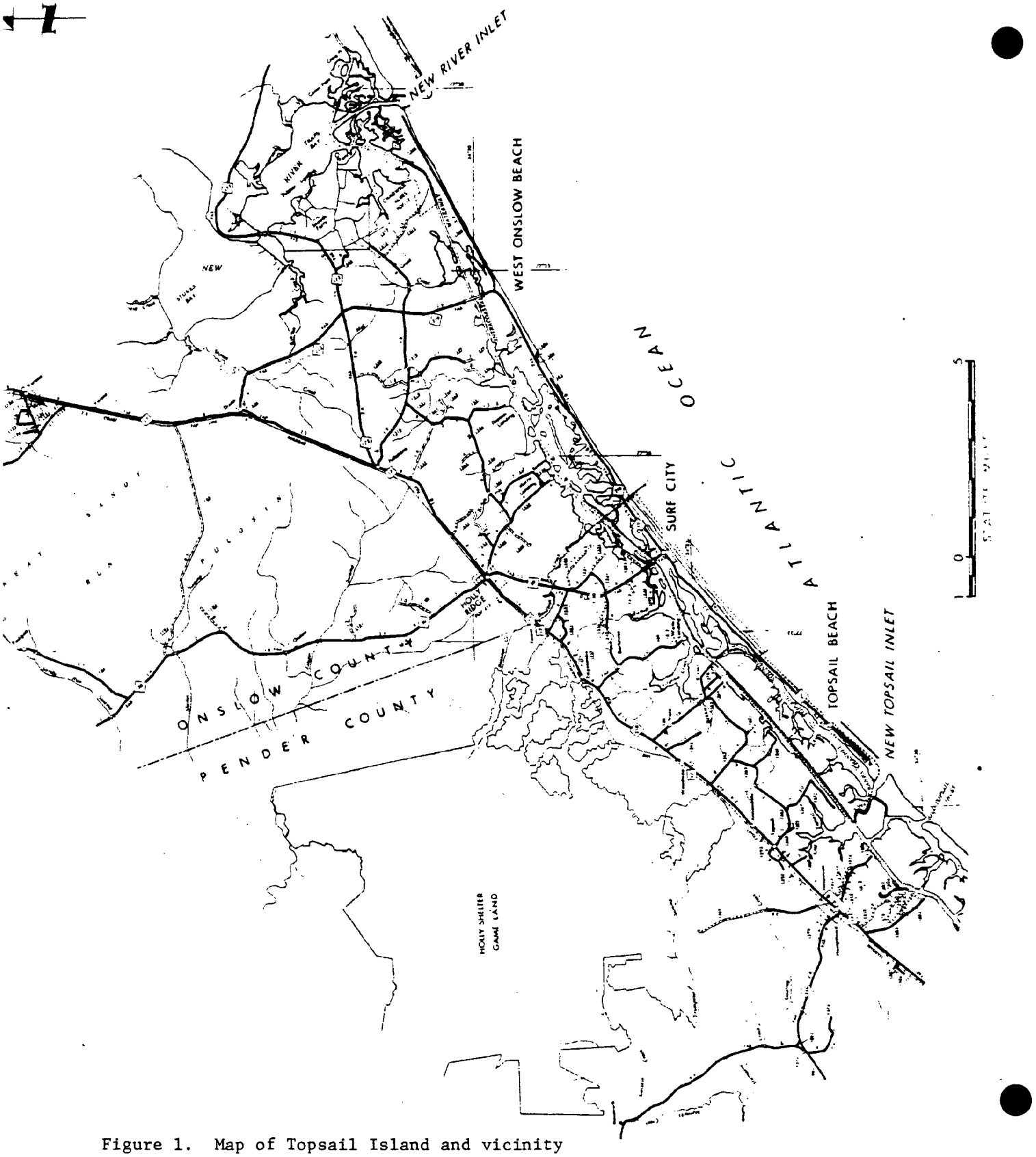


Figure 1. Map of Topsail Island and vicinity

This report will be submitted for review by the N.C. Department of Natural Resources and Community Development including the Division of Marine Fisheries, the Division of Coastal Management and the Wildlife Resources Commission. The National Marine Fisheries Service and the U. S. Environmental Protection Agency also will be requested to cooperate in the review. The report identifies known and potential impacts associated with the various alternatives being considered, and it should be used to develop fish and wildlife preservation, protection and enhancement measures. In addition to fulfilling responsibility under the Fish and Wildlife Coordination Act, this report also serves to fulfill U.S. Fish and Wildlife Service responsibility in accordance with the Endangered Species Act of 1973, as amended (16 U.S.C. 1536).

The objectives of this report are to:

- Provide a brief yet complete description of existing fish and wildlife conditions within the project area;
- Assess the environmental impacts of the project; and
- Provide recommendations which will minimize adverse impacts to fish and wildlife, and enhance those resources when possible.

DESCRIPTION OF THE PROBLEM

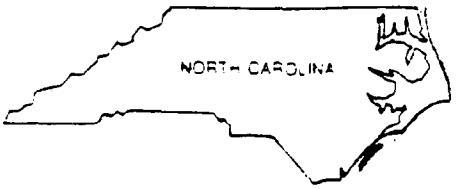
Navigational difficulties currently limit utilization of New River Inlet by commercial fishing vessels, particularly shrimp trawlers. Larger vessels utilizing the inlet must schedule trips around the tidal cycle to insure adequate navigational depths. At New Topsail Inlet, navigation passage from inside the Inlet to the AIWW is limited by shallow depths and constant shoaling. In this location, the principal effect is the limitation of recreational boating use of the most direct navigation pathways.

Recent and rapid erosion of the ocean shoreline from just east of the Jolly Roger Fishing Pier (Figure 2) to New Topsail Inlet has resulted in property damage and jeopardizes many existing structures. In addition to property losses, beachfront erosion has eliminated or reduced severely the recreational and aesthetic value of the area for such uses as swimming, sunbathing, fishing and birdwatching. The erosion has eliminated or reduced beach use by nesting sea turtles and by shore birds as a resting and feeding site.

EVALUATION METHODS

There are no comprehensive biological inventories or studies from Topsail Island. Accordingly, our description of the island's biota is based on four days of personal observations in the field, extrapolation from the

Figure 2



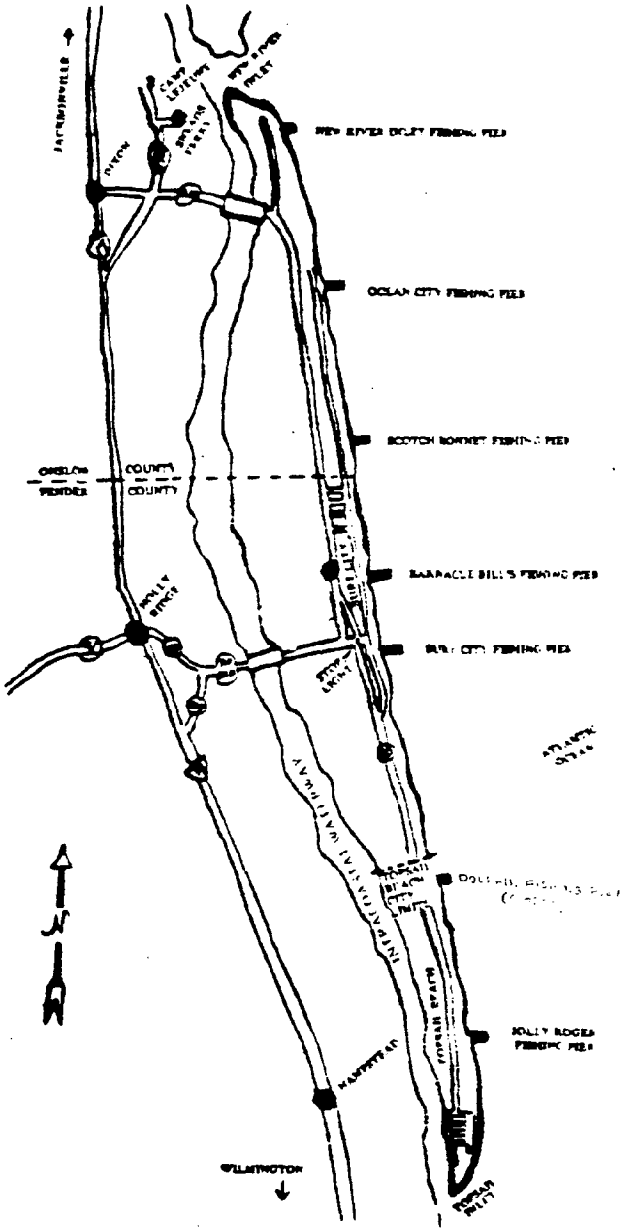


Figure 2. Fishing Piers located on Topsail Island

literature (Fussell, 1978; Reilly and Bellis, 1978; Peterson and Peterson, 1979; and others), and from personal communication.

Limited benthic samples were taken from selected sites in the vicinity of New River Inlet and Topsail Sound including Kings Creek. On tidal flats samples were taken with a shovel and washed onsite using a 1.0 mm sieve. Subaqueous samples were taken with a ponar grab-type sampler which in coarse sand extracts a 6 $in.^2$ sediment sample approximately 3 inches in depth. These samples also were washed in the field using a 1.0 mm sieve. Organisms retained in the sieve were identified in the field to the lowest possible taxon and released. Quantitative measurements were not made, and qualitative evaluations consisted of examination of biota for commercially important species, submerged aquatic vegetation, rare or species of special ecological significance and populations which may indicate the presence of highly productive bottoms.

DESCRIPTION OF FISH AND WILDLIFE RESOURCES AND THEIR HABITATS

For purposes of this report, Topsail Island has been divided into nine habitat types. These are: beach, dunes, grassland, maritime shrub thicket, maritime forest, regularly flooded saltmarsh, irregularly flooded saltmarsh, intertidal flats and submerged estuarine bottom. Each of these habitat types, along with their associated flora and fauna, are described in this section.

Beach

Reilly and Bellis (1978) separated the beach into six zones based on the extent and degree of wave action at each location and on the flora and fauna found at each site. These include:

- Upper beach--This includes the zone between the high tidemark and the primary dune which is inhabitated principally by ghost crab (Ocypode quadrata), beach flea (Talorchestra megalophalma) insects and pioneer plants, such as sea rocket (Cakile endentula).

- High tide driftline--This is the line of detritus that marks the highest point to which the preceding high tide advanced. This area is utilized by foraging birds, ghost crab and small invertebrates such as amphipods and insects.

- Wet zone--The moist area of beach located between the high tide drift line and the saturated zone comprises the wet zone. Inhabitants include Haustorius canadensis (amphipod), the polychacte worm Scolelepis squamata, foraging shore birds, and in late summer, the mole crab (Emerita talpoida) and coquina clams (Donax spp.).

- Swash zone--This is the area of beach which is alternatively covered and exposed by wave uprush and retreat. Although dominated by mole crab and coquina clams, it is utilized by most of the previously mentioned beach species during some phase of the tide or time of day.

- Surf zone--This is the submerged portion of the beach which lies between the swash zone and the near shore breakers. Active feeding by Florida pompano (Trachinotus carolinus), summer flounder (Paralichtys dentalus), Atlantic croaker (Micropogonias undulatus), spot (Leiostomus xanthurus), whiting (Menticirrhus spp.), Atlantic silverside (Menidia menidia) and crevalle jack (Caranx hippos) occurs in this zone.

Beach use by feeding avifauna is principally limited to the high tide drift line and swash zone. Characteristic beach avifauna inhabitants include: willet (Catoptrophorus semipalmatus), sanderling (Calidris alba), black skimmer (Rynchops niger), semipalmated sandpiper (Calidris pusilla), boat-tailed grackle (Quiscalus major); laughing gull (Larus atricilla), herring gull (Larus argentulus) ring-billed gull (Larus delawarensis); royal tern (Sterna maxima), sandwich tern (Sterna sandvicensis), common tern (Sterna hirundo) and gull-billed tern (Gelochelidon nilotica). Bird nesting on the beach is uncommon although records (Parnell and Soots, 1978) indicate that prior to extensive human intrustion and ocean front development the upper beach was an important nesting site for the least tern (Sterna albifrons). A list of the birds of coastal Onslow County (Grant, 1975) is provided in Appendix D.

The loggerhead sea turtle (Caretta caretta), a threatened species under the Endangered Species Act, continues to nest on Onslow Beach and Topsail Island despite deteriorating conditions on Topsail Island. Although recent nest counts are not available for Topsail Island the Recovery Plan for Marine Turtles (Hopkins and Richardson, 1984), states that an average of 10 sea turtle nests were observed during the period 1975-80 on Topsail Island, and the maximum number of nests observed during that period was 22. These values seem low in comparison with nearby Onslow Beach where the Marine Corps maintains accurate nest counts and manages a highly successful sea turtle management program. Currently, that program provides annual protection for approximately 63 loggerhead sea turtle nests, based on our analysis of recent nesting records. Sea turtle nesting usually occurs in the upper beach zone above the normal high tide line.

Dunes

Dunes are formed when sand deposited on the beach backshore is blown by prevailing winds and is slowed by and deposited in vegetation tolerant to salt spray and sand burial (Leatherman, 1979). Dunes are an important component in the barrier island system since they deflect salt spray and allow the development of shrub thicket and maritime forest which increases barrier island resistance to wind erosion. Dunes are major storage centers

for beach sediments, and they absorb and dissipate storm waves. The dunes are a part of the sand sharing system which allows barrier islands to survive rising sea level and the tremendous energies of the ocean (Godfrey and Godfrey, 1976; Leatherman, 1979). In this sand sharing system an equilibrium is reached as sand grains move from offshore bars, to beaches, to dunes, and back again in response to wind, wave, current and tidal effects. In intense storms the barrier dunes may be eroded and breached by overwash surges. This allows the island to migrate landward by moving sediments from the oceanfront toward the sound. Overwash migration is not the dominant process by which most barrier islands move landward since far greater quantities of sediment are moved into sound waters by way of inlet formation (Parker, Brower and Frankenburg, 1976, Leatherman, 1979).

The dominant dune plant on Topsail Island is the sea oat (Uniola paniculata). It is resistant to salt spray and drought conditions and, because of its ability to grow upward with the sand it collects, it is a major dune builder (Fussell, 1978). Other common dune plants are pennywort (Hydrocotyle bonariensis), camphorweed (Heterotheca subaxillaris), sea elder (Iva imbricata), seaside goldenrod (Solidago sempervirens), spurge (Euphorbia ammannioides), evening primrose (Oenothera humifusa), and sandspur (Cenchrus tribuloides).

Animals are generally scarce in this dry, relatively unstable environment. Due to dryness, amphibians are absent (Fussell, 1978). Reptiles such as the six-lined racerunner (Cnemidophorus sexlineatus) and the eastern glass lizard (Ophisaurus ventralis) are common and some species of snakes, especially the black racer (Coluber constrictor constructor) and coachwhip, probably occur. Topsail also may provide habitat for an undescribed species of glass lizard (Ophisaurus sp.) which is currently under study by the N.C. State Museum of Natural History (W.M. Palmer, Curator of Lower Vertebrates, personal communication, May 12, 1981). Small rodents are probably present since barn owls (Tyto alba) regularly patrol the dunes in winter (Fussell, 1978). On Masonboro Island, which is located a few miles to the south of Topsail Island, the house mouse was regularly observed in the dune system (Hosier and Cleary, 1977), and may occur on Topsail Island. In winter, the dunes are extensively visited by migratory birds. Flocks of red-winged blackbirds (Agelaius phoeniceus) feed on sea oats, and American kestrels (Falco sparverius) search for prey (Fussell, 1978). The savannah sparrow (Passerculus sandwichensis) is common in winter. The Ipswich race (P. S. princeps) of this species is thought to winter in the larger expanses of dunes on Bogue Banks (Fussell, 1978) and may occur on Topsail Island. American Goldfinches (Carduelis tristis) are less common but sometimes occur in small flocks that feed on sandspurs and other seeds. Palm warblers (Dendorica palmarum) may be common, especially along the dune-maritime shrub thicket border. In summer and fall, barn swallows (Hirundorustica) and tree swallows (Iridoprocne bicolor) feed on insects above the dunes (Fussell, 1978).

Grassland

In terms of size, open grassland is the principal upland plant community on Topsail Island. Origins of this habitat type are uncertain but are probably related to man-caused disturbance of shrub thickets and to natural grass establishment in areas of accretion and overwash. Grasslands may extend from the front or backslope of the dune berm to the sound. On Topsail Island, grasslands extend the entire length of the island and are most conspicious from the former Dolphin Pier (Figure 2) west to New Topsail Inlet and from the intersection of N.C. 50 and S.R. 1546 east to New River Inlet.

Grassland vegetation consists primarily of grasses, sedges and a few forbs. with the sea oat being dominant. Common vegetative associates of the grasslands include pennywort, seaside goldenrod, broomsedge (Andropogon scoparius), sea elder, saltmeadow cordgrass (Spartina patens) and panic grass (Panicum amarum).

When human and natural disturbance are minimized, the grasslands and high marsh begin to support scattered wax myrtle (Myrica cerifera), groundsel-tree (Baccharis halimifolia), and sea elder. As they continue to build, shrub thicket and maritime forest ultimately may develop in well-protected areas.

Island grasslands are able to support higher densities of resident animals than dunes. Birds inhabiting the grassland include many of the aforementioned dune dwellers as well as eastern meadowlark (Sturnella magna), mourning dove (Zenaida macroura), boat-tailed grackle and marsh hawk (Circus cyaneus). Nesting willet also may occur in those areas where disturbance is minimal or lacking. Topsail is the northern most recorded nesting site of the ground dove (Columbina passerina) (D.S. Lee, N.C. State Museum of Natural History, personal communication, June 1, 1981). Mammals characteristic of this area include marsh rabbit (Sylvilagus palustris) and cottonrat (Sigmodon hispidus). In summer, tree frogs (Hyla spp.), toads (Bufo spp.), eastern mud turtle (Kinosternon subrubrum), six-lined racerunner, glass llizard, corn snake (Elaphe guttata), eastern coachwhip and black racer may occur.

Maritime Shrub Thicket/Maritime Forest

Maritime shrub thicket and forest habitats occur on the more stable upland flats and dunes of Topsail Island. With decreasing frequency of overwash, barrier islands support maritime shrub thickets and eventually forests (Godfrey and Godfrey, 1976; Leatherman, 1979). Woody growth usually starts on the sound side of the island and spreads seaward as dune development allows for greater stability and protection from salt spray. On Topsail Island the shrub thicket is generally five-to-ten feet high with a much denser understory than the forest. It is also more prevalent than the maritime forest. The maritime forest ranges in height from 10 to about 40 feet and usually lacks a well-defined understory.

The maritime shrub thicket is most extensive along that portion of the island which lies between the former Dolphin Pier and New River Inlet. It

is often the principal vegetative cover-type of natural and man-created islands located adjacent to Topsail Island. The dominant plants of the shrub community are red cedar (Juniperus virginiana), live oak (Quercus virginiana), yaupon (Ilex vomitoria) and wax myrtle (Myrica cerifera). Hercules-club (Zanthoxylum clava-herculis) is also common and vines are an especially-prominent component of this community (Fussell, 1978). Common vine species are: grape (Vitis rotundifolia), poison ivy (Rhus radicans), Virginia creeper (Parthenocissus quinquefolia), peppervine (Ampelopsis arborea), and greenbrier (Smilax bona-nox and S. auriculata).

The shrub thicket is an important nesting, feeding and resting site for many resident and migratory birds. Migrating birds are especially abundant in September and October. Common winter inhabitants of the shrub thicket include the yellow-rumped warbler (Demdroica coronata), cardinal (Cardinalis cardinalis), Carolina wren (Thyrothorus ludovicianus), rufous-sided towhee (Pipilo erythrophthalmus) gray catbird (Dumetella carolinensis), brown thrasher, song sparrow (Melospiza meloida), yellow-throated warbler (Dendroica dominica) and savannah sparrow (Fussell, 1978). After extreme cold weather in late winter, American robin (Turdus migratorius) and cedar waxwing (Bombycilla cedrorum) should be abundant based on Fussell's (1978) observations at Bogue Banks. Cardinal, Carolina wren, and towhee are common nesters as are gray catbird and brown thrasher which are more common in winter. Boat-tailed and common grackles may nest in small colonies in the shrub thicket. The painted bunting (Passerina ciris) and prairie warbler (Dendroica discolor) also nest here (Fussell, personal communication, May, 1981).

Virginia opossum (Didelphis virginiana) and raccoon (Procyon lotor) are common in the barrier island shrub thicket, as is the marsh rabbit along the shrub thicket-marsh border (Fussell, 1978). The most common reptile is the Carolina anole (Anolis carolinensis). The sixlined racerunner, eastern glass lizard, black racer, rough green snake (Opheodrys aestivus) and rat snake (Elaphe obsoleta) are probably common based on observations by Fussell (1978) at Bogue Banks.

Numerous man-made dredged material and natural islands occur in Topsail's adjacent waters. These islands are predominately vegetated with shrub thicket comprised primarily of wax myrtle and red cedar; live oak is less common. Most of these sites are relatively isolated and reptiles are probably scarce. Bird life is similar to that found in Topsail Island's shrub thicket (Fussell, 1978).

In North Carolina, maritime forests are not abundant. On barrier islands they are found on stabilized relict dunes or well-protected flats where they are shielded from salt spray, sea water flooding and moving sand (Bellis and Proffitt, 1976; Godfrey and Godfrey, 1976). The land area of North Carolina occupied by maritime forest is probably smaller than that of any other important coastal ecosystem. This forest type exists today in Duck Woods, Nags Head Woods, Buxton Woods, Ocracoke Island, and parts of Core Banks, Shackelford Banks, Bogue Banks, Bear Island, Topsail Island and Smith Island. Only a portion of Buxton Woods, Nags Head Woods and Bear Island are

protected through ownership by Federal, State or private conservation agencies. The remaining maritime forests are privately owned and are subject to increasing development pressure. The ecological significance of the maritime forest is not well-documented and in the southeastern United States, has been studied only superficially (Johnson, Hillstead, Shanholtzer and Shanholtzer, 1974; Bellis and Proffitt, 1976). At current rates of development and loss, most of North Carolina's maritime forest habitat will be largely eliminated or functionally useless as a separate entity of the barrier island environment before its ecological significance is understood (Bellis and Proffitt, 1976).

Maritime forest soils are relict ocean sediments and contain few mineral nutrients. Those nutrients which are available are highly mobile and prone to loss from the system by leaching. Most of the mineral elements required by the forest are derived from salt spray. Sodium, magnesium and chloride ions are present in excess of concentrations required for normal plant growth. Nitrogen, phosphorus, calcium, and potassium tend to be present in minimal amounts and often are tied up in plant stems and leaves (Bellis and Proffitt, 1976). After stem and leaf drop, the plant bound ions become soluble, are leached rapidly and are lost from the forest system if not absorbed by the root mat or retained in the forest floor humus. The root zone thus acts as an ion filter in which scarce ions are absorbed and recycled and excess ions are transmitted below the root zone. Nitrogen is captured into the system from the atmosphere by nitrogen fixing bacteria living within wax myrtle roots (Bellis and Proffitt, 1976).

Figures are not available on primary productivity of maritime forests. Bellis and Proffitt (1976) state that the productivity appears to be low; however, Godfrey and Godfrey (1976) state that in protected areas tree growth is rapid. The long growing season, water and available nutrients from salt spray are adequate to produce trees of 30 cm. DBH in 50 or 60 years (Godfrey and Godfrey, 1976).

The maritime forest and especially the seaward edge of the salt spray shear zone have several adaptations to strong winds and salt spray. The apical dominance of branches is curtailed since the terminal buds are destroyed commonly by salt spray. This stimulates lateral buds and creates a dense canopy of many short branches (Bellis and Proffitt, 1976). Such a canopy provides an effective wind break and, although seemingly delicate, can resist even hurricane winds.

The primary value of the maritime forest is its role in the stabilization of the geologically unstable barrier island environment (Bellis and Proffitt, 1976). Other direct benefits include:

- accumulation and storage of freshwater;
- mineral ion retention; and
- production of soil by trapping blowing sand and deposition of humus.

The dominant tree in the Topsail Island maritime forest is the live oak. Other prominant species include laurel oak (Quercus laurifolia), eastern red cedar, yaupon, white poplar (Populus alba), iron wood (Carpinus caroliniana), wild olive (Osmanthus americanus) and loblolly pine (Pinus taeda). Less common species present include dogwood (Cornus florida) and hickory (Carya sp.). Maritime forests located close to the seaward edge of the salt spray zone are almost always dominated by live oak and red cedar, however, laurel oak and saplings of the above-mentioned species may be collectively abundant. Although some vestige of maritime forest extends almost the entire length of Topsail Island, the most conspicuous and well-developed region extends from approximately the New River Fishing Pier west to the former Dolphin Fishing Pier (Figure 2). In this zone the frontal dune is high, and stable relict dunes exist. Trees in this area are estimated to be 60 years in age indicating that this portion of the island has been relatively stable for many years.

The maritime shrub thicket and the maritime forest usually coexist in close proximity to one another. In most cases the shrub maritineforest is surrounded by shrub thicket. Because of the floral similarities and similar habitat value, the faunal composition of the maritime forest is similar to that of the shrub thicket.

Regularly Flooded Saltmarsh

Regularly and irregularly flooded saltmarshes are noted for their high level of primary productivity (Keefe, 1972; Turner, 1976). Saltmarsh productivity is enhanced by tidal flux which circulates water throughout the marsh bringing in nutrients and carrying away waste products (Odum and Fanning, 1973). The interaction of fresh and saltwater in marshes tends to precipitate nutrients from the freshwater (Bolster, 1976). Marsh plants, bacteria, and algae have short life cycles and their nutrients are frequently recycled and used by estuarine consumers (Teal and Teal, 1969). In North Carolina the primary productivity of saltmarsh cordgrass (Spartina alterniflora) usually falls in the range of 329 to 1296 g dry wt/m^2/yr while black needlerush (Juncus roemerianus) production lies between 560 and 1960 g dry wt/m^2/yr (Keefe, 1972). As the marsh plants die they begin to disintegrate under the force of wind and tides. As they drop to the mud surface, they are decomposed largely by microbial action. The high caloric value, high protein content and microbial load of the detritus exported by tides provide a food source of high nutritional value to consumers in the estuarine food chains (de la Cruz, 1973). Because of less frequent inundation, the irregularly flooded saltmarsh contributes its detritus to the estuarine system in larger pulses than regularly flooded marsh.

Saltmarshes protect uplands from damage by estuarine flood waters (Silverhorn, Davies and Barnard, 1974). The marsh vegetation slows water velocity and dissipates wave energy. This decrease in velocity reduces sediment suspension and allows sediments to be deposited in the marsh. These sediments are trapped by the dense roots and stems of the marsh vegetation and may be eventually incorporated into marsh plant tissue.

Saltmarsh cordgrass is the dominant vascular plant of the regularly flooded saltmarsh. From New Topsail Inlet east to a point approximately 5.5 miles from that inlet, the sound shoreline is extensively bulkheaded and supports only isolated areas of marsh fringe approximately six-feet-wide or less. Beyond this area, except where altered by man, large expanses of saltmarsh cordgrass-dominated, regularly flooded saltmarsh and irregularly flooded saltmarsh extend out to the dredged material islands which border the AIWW. These wetlands are intersected by a labyrinth of tidal creeks and straight-line mosquito control ditches.

Macroinvertebrate population size within the regularly flooded saltmarsh is limited by environmental extremes in salinity, temperature, and exposure. The fiddler crab, Uca pugnax, is the most ubiquitous macroinvertebrate. Another fiddler crab, Uca pugilator, oysters (Crassotrea virginica) and the marsh periwinkle (Littorina irrorata) also are common.

Few vertebrate animals use the monotypic saltmarsh cordgrass community alone. One notable exception is the clapper rail (Rallus longirastris). The regularly flooded marsh in association with tidal creeks and mudflats supports a much larger species assemblage and includes the diamondback terrapin (Malaclemys terrapin), banded and redbellied water snakes (Nerodia (=Natrix) fasciata and N. erythrogaster), eastern cottonmouth (Agkistrodon piscivorus), raccoon, river otter (Lutra canadensis), and many species of herons, egrets, ibises, ducks, and shorebirds. Seaside and sharp-tailed sparrows (Smmospiza maritima, A. caudacuta) are most common where there is adjacent high marsh (Fussell, 1978).

Irregularly Flooded Saltmarsh

Black needlerush, saltgrass (Distichlis spicata) and saltmarsh hay (Spartina patens) occupy major portions of the irregularly flooded saltmarsh zone on Topsail Island. Adams (1963) lists "tide-elevation influences" as the primary factor controlling marsh plant distribution. Various other physical, chemical and biological influences affect vascular plant distribution in the estuaries. These include salinity, substrate, acidity, available nutrients, disruption, and plant competition. Although a consistent vegetative distribution pattern was not observed in the high marsh, we believe that a typical upland to water's edge vegetative transect would most often reveal the following distribution pattern:

Juncus roemerianus--→Distichlis spicata/Spartina patens--→Spartina alterniflora

Where large areas of irregularly flooded saltmarsh exist, they are utilized by several species of birds such as clapper rail, sharp-tailed sparrow (winter only), seaside sparrow, and long-billed marsh wren (Cistothorus palustris). The long-billed marsh wren is the most characteristic species of the black needlrush marsh. Other birds use the irregularly flooded marsh in conjunction with adjacent saltmarsh cordgrass marsh. They feed mainly in the saltmarsh cordgrass but can retreat into the black needlerush during the periods of high tide. Marsh rabbits inhabit the irregularly flooded marsh

as do marsh rice rats (Oryzomys palustris). The canebrake rattlesnake (Crotalus horridus) occurs along the marsh/upland interface.

Intertidal flats

Intertidal flats are an important component of the estuarine environment, and although reliable data are unavailable for North Carolina, Petersen and Petersen (1979) estimate that intertidal flats in North Carolina probably produce close to 200 g carbon m^2/yr. Algae produced on intertidal flats are directly consumed by deposit feeding and suspension feeding invertebrates (Petersen and Petersen, 1979). The flats enhance water column productivity by increasing the euphotic zone and rapidly recycling mineral nutrients. Intertidal flats concentrate organic detritus from saltmarshes and seagrass beds and provide the substrate where this material is transformed into animal biomass. Some of this animal biomass, such as oysters and hard clams, is of direct commercial importance, while the biomass of other benthic invertebrates is important to higher level consumers such as blue crab, shrimp, shorebirds and larger bottom feeding fishes. Many shorebirds are totally dependent upon the intertidal flats as feeding grounds. Intertidal flats are the initial habitat for many postlarval and juvenile fishes and crustaceans since they provide protective shallow habitat and abundant food.

Submerged Estuarine Bottom

Submerged bottoms in the adjacent estuarine waters of Topsail Island may be separated into five fairly distinct ecosystems. These are: coarse sand bottoms, sand/silt bottoms, silt bottoms, bottoms which support submerged aquatic vegetation and bottoms which support oyster reefs. Other benthic ecosystems, such as those covered by shell and riprap also may occur but are relatively uncommon and comprise only a small portion of the total area of submerged bottom.

From a habitat value perspective, the silt and sand/silt bottoms, the oyster reefs and the submerged aquatic habitats are most productive. Coarse sand bottoms are usually located in the area of inlets. Bottom scour caused by high current velocities limit faunal occurrence in these locations to a few opportunistic or specialized species which can endure a rigorous physical environment (Boesch and Rackley, 1974). With exception of isolated populations of benthic infauna which may be of scientific interest, these areas are most important as pathways for finfish shellfish migrations and as locations where tidal flushing, navigation, and fishery resource harvest occur.

The ecological significance and productiveness of oyster reefs, beds of submerged aquatic vegetation and sald/silt estuarine bottoms is well recognized and documented (Bahr and Lanier, 1981; Thayer and Kenworthy, 1985; Peterson and Peterson, 1978). These areas are generally recognized as the subaquatic sites in estuaries where faunal diversity and population size are greatest and where relative habitat value associated with estuarine feeding, cover, and rearing are greatest. A partial list epibenthic and

benthic fauna from eelgrass (Zostera marina) of the east coast of North America prepared by Thayer (1984) contains 74 species. Macrofauna found in Georgia oyster reefs by Bahr et al. (1981) includes 42 species.

The distribution of oyster reefs, beds of submerged aquatic vegetation and producive silt/sand bottoms in the project area is rather broad with exception of submerged aquatic vegetation, which is limited to a small site in Topsail Sound and a larger area in the lower New River outside of the project area. Evidence of the wide distribution of oyster reefs in estuarine waters adjacent to Topsail Island is presented in the North Carolina Division of Marine Fisheries (NCDMF) oyster lease maps (Appendix A).

Fishery Resources of Adjacent Estuarine and Ocean Waters

There are no published studies on the occurrence or abundance of fishery resources in the vicinity of Topsail Island. The area has been periodically sampled by the NCDMF: however, their data have not been published or extensively analyzed. It is apparent from the NCDMF studies that the creeks and sounds landward of Topsail Island are extremely productive nursery grounds for several fish species and are utilized by commercial and recreational fishermen (Rich Carpenter, NCDMF, personel communication, April, 1981). These areas support species of commercial and recreational importance, such as spot (Leiostomus xanthurus), Atlantic croaker (Micropogonias undulatus), summer flounder (Paralichthys dentatus), sea trout (Cynoscion hebulosus, Cynoscion regalis) and blue fish (Pomatomus saltatrix). In addition, shrimp (Penacus aztecus, P. setiferus) blue crab Callinectes sapidus, hard clam (Merceneria merceneria) and bay scallop (Argopecten irradians) are harvested in the area.

A small but significant bay scallop fishery exists in the vicinity of Chadwick Bay, and in the lower New River where submerged aquatic vegetation exists. Bay scallops also are found and harvested in association with submerged aquatic vegetation on the northwest end of Topsail Sound. During the January through February harvest period of 1981, a total of approximately 5,450 bushels of scallops were harvested from those areas and a small site located near Bear Inlet (Rich Carpenter, NCDMF, personal communication, April, 1981).

The hard clam is common in most tidal creeks, sounds and the AIWW in the vicinity of Topsail Island. Hard clams are harvested year round and are principally taken by hand rake except in the AIWW where hydraulic dredges are used. Catch data for the entire project area are not available. In 1985, 11,148 pounds of hard clam meat, with a dockside value of $39,438 were taken from Stump Sound. Topsail Sound produced 18,430 pounds of hard clam meat valued at $63,000 during the same period (NCDMF, 1985).

Oysters are abundant in estuarine waters behind Topsail Island. Oysters are taken from about October 1 through March 1 depending on harvest dates established by the NCDMF. The oyster population is primarily intertidal from New Topsail Inlet east to about Surf City. From Surf City east, the

opopulation is largely subtidal except in the vicinity of New River Inlet where it is intertidal. Although both intertidal and subtidal oysters are harvested commercially and for recreation, the intertidal oysters are the principal recreational species. In 1985, approximately 7,182 pounds of oyster meat valued at $13,712 were taken by commercial fishermen in Topsail Sound. During that same period 10,906 pounds value at $23,432 were commercially harvested in Stump Sound (NCDMF, 1985).

The North Carolina shrimp harvest is based entirely on brown shrimp (Penaeus aztecus), pink shrimp (Penaeus duorarum) and white shrimp (Penaeus setiferus). Traditionally, the brown shrimp dominates the North Carolina commercial catch (66 percent) and is followed by the pink shrimp (24 percent) and the white shrimp (9 percent), respectively (Dennis Spitsbergen, NCDMF, personal communication, April, 1981). Although sounds and inlets in the project area are utilized by all three species, only the pink shrimp and brown shrimp occur in large numbers. Pink shrimp prefer higher salinities and sandier substrates than either the brown or white shrimp, and are more common in Topsail Sound and the AIWW since sandy bottoms and higher salinities are prevalent there.

Most of the sounds and creeks which border Topsail Island are designated by the NCDMF as primary nursery grounds for shrimp. Shrimping in these areas is prohibited to prevent taking undersized shrimp and to to protect bottom habitat. Exceptions include Banks Channel, Virginia Creek, Stump Sound and Old Topsail Creek, which are secondary nursery grounds and open to shrimp harvest. In 1985, 31,225 pounds of shrimp valued at $82,510 were harvested from Stump and Topsail Sounds (NCDMF, 1985). Shrimp harvest seasons are governed by shrimp population size, and most commercial harvesting occurs in late June and September. Pink shrimp are harvested in November if the population size is adequate to support this harvest.

Blue crab are taken by part-time commercial crabbers and by recreational fishermen in practically all adjacent estuarine waters. Only one commercial crab-shedding operation exists in the area. NCDMF catch data for 1985 show that 27,479 pounds of blue crab with a dockside value of $5,000 were taken from Topsail and Stump Sounds.

Commercial and recreational fishing for finfish is important. Spot, summer flounder, Atlantic croaker, bluefish, striped mullet (Mugil cephalus) gray seatrout and whiting (Mentichirrhus spp.) are the principal species taken. NCDMF catch data for these and other species in 1985 are presented in Table 1. The total commercial catch for the aforementioned species of finfish for 1985 was 106,510 pounds with a dockside value of $41,491 (NCDMF, 1985).

In addition to being a site of direct harvest, project area estuarine waters provide important nursery ground habitat for many species of finfish and invertebrates which are of known ecological and/or economic significance. A list of those species, as taken in 1981 early spring samples by the NCDMF, is provided in Table 2.

Table 1. Commercial landings for selected finfish species in 1985 from Stump and Topsail Sounds, North Carolina.*

STUMP SOUND

Species	Pounds	Value
Croaker	3,701	1,457
Flounders, Fluke, Unclassified	10,084	8,209
Mullets	6,416	1,229
Sea Trout, Grey	6,463	2,168
Spot	8,023	1,981
Miscellaneous Finfish	12,703	3,271

TOPSAIL SOUND

Species	Pounds	Value
Bluefish	6,431	922
Croaker	6,541	2,769
Drum, Red	2,292	673
Flounders, Fluke, Unclassified	10,862	8,798
King Whiting	4,218	1,629
Mullets	7,942	1,591
Pigfish	1,625	302
Sea Trout, Grey	9,449	3,218
Sea Trout, Spotted	1,481	1,193
Spot	8,102	2,033
Miscellaneous Finfish	177	48

*Data source: N.C. Division of Marine Fisheries, 1985 catch statistics.

Table 2. Juvenile fishes and invertebrates taken in the vicinity of Topsail Island, North Carolina in early spring, 1981.*

Croaker (Micropogon undulatus)
Spot (Leiostomus xanthurus)
Flounder (Summer) (Paralichthys dentatus)
Flounder (Southern) (Paralichthys lethostigma)
Flounder (Ocellated) (Ancylopsetta quadrocellata)
Flounder (Windowpane) (Scophthalmus aquosus)
Flounder (Fringed) (Etropus crossotus)
Atlantic Menhaden (Brevoortia tyrannus)
Bay anchovy (Anchoa mitchilli)
Pinfish (Lagodon rhomboides)
Striped mullet (Mugil cephalus)
Oyster toadfish (Opsanus tau)
American eel (Anguilla rostrata)
Striped cusk eel (Rissola marginata)
Rock sea bass (Centropristis philadelphica)
Sheepshead (Archosargus probatocephalus)
Atlantic spadefish (Chaetodipterus faber)
Inshore lizardfish (Synodus foetens)
Pigfish (Orthopristis chryoptera)
Silver perch (Bairdiella chrysura)
Bluefish (Pomatomus saltatrix)
Barracuda (Sphyraena barracuda)
Gag grouper (Mycteroperca microlepis)
Blackcheek tonguefish (Symphurus plagiusa)
Naked goby (Gobiosoma bosci)
Ladyfish (Elops saurus)
Chain pipefish (Syngnathus louisianae)
Spotted hake (Urophycis regius)
Butterfish (Peprilus triacanthus)
Hogchoker (Trinectes meculatus)
Striped searobin (Prinotus evolans)
Blue crab (Callinectes sapidus)
Brown shrimp (Penaeus aztecus)
Pink shrimp (Penaeus duorarum)
White shrimp (Penaeus setiferus)
Grass shrimp (Palemonetes spp.) (3 species)
Mantis shrimp (Squilla sp.)
Mud crab (Neopanopde texana sayi)

*Based on 1981 NCDMF data, obtained by a 0.25 inch mesh size trawl; 5 min. tow. Rich Carpenter, NCDMF, personal communication, April, 1981.

The nearshore ocean from the surf zone to several kilometers offshore also serves as habitat for fishery resources that are utilized by both the private and commercial sectors. The nearshore fishery, both commercial and recreational, is largely dependent on summer flounder, sea trout, Atlantic croaker, mullet, bluefish, spot, shrimp, whiting and Florida pompano (Trachinotus carolinus). While no studies exist concerning the occurrence of these species in Topsail Island nearshore waters, studies of surf zone fishes on barrier islands in South Carolina (Cupka, 1972; Anderson, Dias, Dias, Cupka and Chamberliain, 1977) and Georgia (Miller and Jorgensen, 1969; Dahlberg, 1972) found that the above species are abundant during certain seasons of the year. Commercial haul seiners, sink netters and trawlers presently utilize nearshore waters or have utilized them in the past (Rich Carpenter, NCDMF, personal communication, May, 15, 1981). While no recent data are available on the utilization of Topsail Island by haul seine fisheries, that fishery is dependent upon the seasonal presence of large schools of mullet and spot and is probably similar to South Carolina's fishery which is conducted primarily from September through December (Sandifer, Miglarese, Calder, Manzi and Barclay, 1980).

Seven commercial fishing piers extend into the nearshore ocean and sound waters of Topsail Island (Figure 2). A survey of the ocean pier fishery along the northern coast of South Carolina (Hammond and Cupka, 1977), whose results are probably applicable to the Topsail Island pier fishery, found that the majority of the catch was composed of fishes in the Scianid family which includes spot, Atlantic croaker, kingfishes (whiting), seatrout and silver perch. Smaller catch percentages of jack, bluefish, and sea catfish, also were recorded. The fishery was highly seasonal with 61 percent of the catch occuring in April, July and October.

NATIONAL RESOURCE SPECIES

Species which the Service regards as National Resource Species, due to their high biological and or public interest (Federal Register 48 (237), December 6, 1983 inhabit portions of the study area. These species and their habitats are as follows:

Species	Location
American woodcock (Scolopax minor)	Feeds in damp woods
Osprey (Pandion haliaetus)	Feeds in coastal waters, nests in dead pine trees at West Onslow Beach
Clapper rail (Rallus longirostris)	Feeds and nests in coastal wetlands
Least tern (Sterna albifrons)*	Feeds in coastal waters. Observed nesting in vicinity of New River Inlet and New Topsail Inlet
Seaside sparrow (Ammospiza maritima)	Feeds and nests in coastal wetlands
Canvasback (Aythya valisineria)	Feeds in coastal waters
Canada goose (Branta canadensis)	Feeds in coastal wetlands and waters
Eastern bluebird (Sialia sialis)	Feeds and nests near forests and old fields
Mallard (Anas platyrhynchos)	Feeds in coastal wetlands and waters
Mourning dove (Zenaida macroura)	Common except on beach
Pintail (Anas acuta)	Feeds in coastal wetlands and waters
Black duck (Anas rubripes)	Feeds and nests in coastal wetlands

*Additional information on the least tern is provided on page 28.

ENDANGERED SPECIES

The Federally threatened loggerhead sea turtle (Caretta caretta) has been documented to nest on beaches in and adjacent to the West Onslow Beach and New River Inlet Study Area.

In addition, the National Marine Fisheries Service has responsibility for marine species and should be contacted regarding endangered and threatened marine species that may be present in the area affected by the action.

Section 7(c) of the Endangered Species Act of 1973, as amended (Act), requires Federal agencies or designated non-Federal representatives proposing a major Federal action to conduct and submit to the Service a biological assessment to determine the effects of the proposal on listed and proposed endangered and threatened species. The biological assessment shall be completed within 180 days after the date on which initiated or within a time frame mutually agreed upon between the agency and the Service and before initiating the proposed action. If the biological assessment is not begun within 90 days, this list must be verified informally (via phone) with the Service prior to initiation of your assessment. The Service does not feel that we can adequately assess the effects of the proposed action on listed and proposed endangered and threatened species or critical habitat without a complete assessment. When conducting a biological assessment, the Service recommends that the Federal agency or the designated non-Federal representative:

1. Conduct a scientifically sound on-site inspection of the area affected by the action, which must, unless otherwise directed by the Service, include a detailed survey of the area to determine if listed or proposed species are present or occur seasonally and whether suitable habitat exists within the area for either expanding the existing population or potential reintroduction of populations;

2. Interview recognized experts on the species at issue, including those within the Fish and Wildlife Service, the National Marine Fisheries Service, State conservation agencies, universities, and others who may have data not yet found in scientific literature;

3. Review literature and other scientific data to determine the species' distribution, habitat needs, and other biological requirements;

4. Review and analyze the effects of the action on the species, in terms of individuals and populations, including consideration of the cumulative effects of the action on the species and habitat;

5. Analyze alternative actions that may provide conservation measures;

6. Conduct any studies necessary to fulfill the requirements of (1) through (5) above;

7. Review any other relevant information.

Should you require additional information on this subject, please contact Mr. John Fridell or Ms. Nora Murdock in the Asheville Endangered Species Field Office, FTS 672-0321, commercial 704/259-0321.

After the assessment has been completed and reviewed, it is the responsibility of the Federal agency to determine if the proposed action "may affect" any of the listed species or critical habitats or if it is likely to jeopardize the continued existence of proposed species or result in the destruction or adverse modification of any critical habitat proposed for such species. If the determination is "may adversely affect" for listed species the Federal agency must request in writing formal consultation from the Asheville Endangered Species Field Office. Requests for formal consultation must include: (1) a description of the action to be considered; (2) a description of the specific area that may be affected by the action; (3) a description of any listed species or critical habitat that may be affected by the action; (4) a description of the manner in which the action may affect any listed species or critical habitat and an assessment of any cumulative effects; (5) reports including any environmental impact statement, environmental assessment, or biological assessments prepared; and (6) any other relevant available information on the action, the affected listed species, or critical habitat.

In addition, if the proposed action is likely to jeopardize the continued existence of proposed endangered or threatened species or result in the destruction or adverse modification of proposed critical habitat, the Federal agency must confer with the Asheville office for assistance in identifying and resolving potential conflicts at an early stage in the planning process.

If this proposed action is not a major Federal action significantly affecting the quality of the human environment, the requirements of Section 7(c); i.e., species list, biological assessment, do not apply. However, the requirements are still applicable to (1) determine if the proposed action "may adversely affect' listed species or critical habitats, (2) determine if the proposed action is likely to jeopardize the continued existence of proposed species or result in destruction or adverse modification of proposed critical habitat, (3) request formal consultation for "may affect" actions, and (4) confer with the Asheville office if the proposed action is likely to jeopardize the continued existence of proposed endangered or threatened species or result in the destruction or adverse modification of proposed critical habitat.

Attention is also directed to Section 7(d) of the Act, which underscores the requirement that the Federal agency and/or the permit or license applicant shall not make any irreversible or irretrievable commitment of resources during the consultation period which, in effect, would deny the formulation or implementation of reasonable and prudent alternatives regarding their actions on any listed endangered or threatened species.

DESCRIPTION OF ALTERNATIVE PLANS

I. Dredge Maintained Ocean Bar and Interior Channel at New River Inlet

Although a selected plan of action has not been developed at this time, the continued maintenance and possible expansion of project dimensions at the New River Inlet ocean bar and interior channel is anticipated. The ocean bar extends from the ocean gorge to the shallow waters of the inlet. The interior channel extends from the ocean bar to the AIWW. The following dimensions are under study:

Ocean Bar		Interior Channel	
Depth (MLW)	Width	Depth (MOW)	Width
6 feet	150 feet	6 feet	90 feet
8 feet	150 feet	7 feet	90 feet
10 feet	150 feet	8 feet	90 feet
12 feet	150 feet	10 feet	90 feet
14 feet	150 feet	11 feet	90 feet

Dredging of the ocean bar will be by hopper dredge with disposal in the nearshore zone along West Onslow Beach or by sidecasting with disposal in the inlet. Materials to be excavated consist primarily of coarse sand and shell fragments. Similar materials will be removed from the interior channel and disposal will take place on existing dredge material disposal islands located on either side of the inlet channel. Dredging will occur on an annual basis. Volumes of excavated materials have not been specified at this stage of planning.

II. Stabilization of New River Inlet with Dual Jetties

Preliminary drawings and other information call for the construction of two rubble-mound jetties approximately 2,200 and 4,200 feet in length, located along the inlet's western and eastern shores, respectively. The western jetty will be situated perpendicular to the shoreline and parallels the western shore of the inlet. A 1,600-foot-wide section adjoins that jetty along its western edge and forms a deposition basin from which a dredge can safely operate while performing maintenance sand bypassing. During sand bypassing, the dredge will enter the deposition basin through an opening in the west jetty. Dredged materials will then be pumped by pipeline, across and beneath the inlet to Onslow Beach where it will be deposited along the beach zone. Approximately 120,000 cubic yards of accreted sands will be bypassed annually in this direction. No east to west bypassing (backpassing) is anticipated. The east jetty generally parallels the ocean shoreline across the inlet for approximately 2,200 feet before turning seaward and paralleling the west jetty. Spacing between the jetties will be approximately 1,500 feet. In conjunction with this alternative, the existing navigation channel will be expanded from 90-feet in width to 300-feet and will be increased in depth from 6-feet to 12-feet.

III. Beach Erosion Protection at Topsail Beach

This alternative provides beach nourishment at Topsail Beach and the placement of excavated materials along the westernmost end of Topsail Island. Approximately 17,500 linear feet of beach extending from New Topsail Inlet to the east will be affected, with the westernmost 10,250 feet consisting of full project dimensions and the remaining 7,250 feet consisting of a transition section. Projects under consideration include 100-foot-wide bern at +7 msl, and a 200-foot-wide berm at +7 msl. A terminal groin is to be located just to the west of the last finger canal at Topsail Beach. Material for the bern will be obtained from Topsail Sound (Banks Channel) and will be excavated and redeposited by hydraulic pipeline dredge. Reshaping of the dredged materials by a crawler-type tractor is anticipated. The terminal groin structure will be constructed of granite rubble. The width, length and elevation of the groin are undetermined at this time. A map showing the location of the borrow area is shown in Figure 3.

IV. Combined Hurricane Wave and Beach Erosion Protection

This alternative involves the same area and work as identified in the beach erosion alternative . In addition, a 13-foot msl dune, a 15-foot msl dune and a 20-foot msl dune are being considered. The borrow source for this alternative is the western end of Topsail Sound (Banks Channel) (Figure 3).

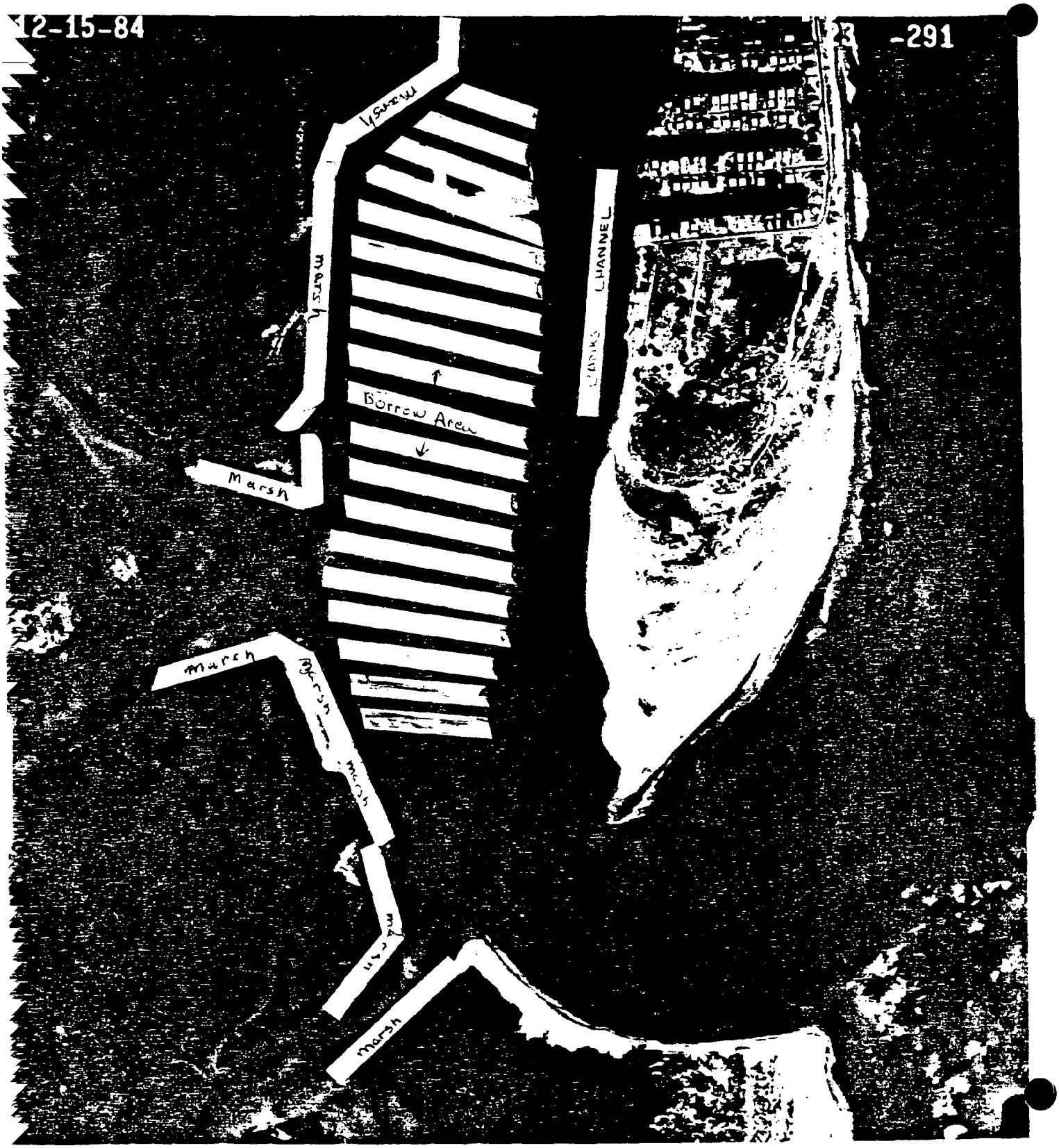
PROJECT IMPACTS

It is necessary to distinguish between environmental change which is anticipated without the project and that which is expected with each of the various alternatives. To accomplish this, a discussion of future conditions without the project is presented, followed by a discussion of future conditions with each alternative.

Future Environmental Conditions Without the Project.

Natural plant communities, fish, wildlife and water quality in and around Topsail Island are expected to decline significantly in future years. Current development trends in the Onslow County portion of Topsail Island are such that near maximum density residential development is expected in all non-wetland areas. Somewhat similar conditions are anticipated in the Pender County portion of the island with regard to development of non-wetland areas. In Pender County however, the lack of large tracts of land owned by a single individual or company limits the number of opportunities available for multifamily developments. In addition, more prudent development, such as that found at the Channel Bend Development, is occurring. Channel Bend is a low density, single family unit residential development which retains a significant portion of the local maritime forest community and its aesthetic appeal. Even though wildlife values in these areas are greatly diminished in comparison with natural unaltered maritime forest ecosystems, they are much greater than the near zero value associated with the high density, multifamily-type development which is occurring at West Onslow Beach.

Figure 3. Approximate limits of borrow site for Alternatives III and IV.



Conversion of grassland, maritime shrub thicket and maritime forest to residential and commercial use is proceeding at a rapid rate islandwide. Based on present trends, it is reasonable to assume that most of the non-wetland portion of Topsail Island will either be developed or designated for development within the next ten years. Consequently, the Service believes that suitable upland habitat for wildlife feeding, nesting and cover will be restricted eventually to a narrow fringe of wetland/upland transition where development related disturbance is not a limiting factor. A few wildlife species will benefit from the anticipated development of the island. These include the house mouse (Mus musculus), Norway rat (Rattus norvegicus), European starling (Sturnus vulgaris) house sparrow (Passer domesticus) and possibly the raccoon. Beach inhabitants such as the ghost crab and nesting loggerhead sea turtles will probably decline in numbers as a result of human encroachment and disturbance. The quality of the island's natural aesthetics will be significantly reduced by the removal of natural vegetation and the obstruction of ocean and marsh views by buildings. Future opportunities for public use of beaches and other natural habitat for sightseeing, bird watching, nature study and recreational fishing will be restricted to those who can afford ocean and sound real estate and to those who can gain beach access via public access points provided by the local municipalities and the North Carolina Division of Coastal Management. There are currently 90 public access points on Topsail Island, but designated parking spaces are limited to 359.

The future quality of fishery resources in the vicinity of Topsail Island is largely dependent upon management practices employed by State agencies such as the NCDMF, the amount of fishing pressure upon the resources and the effect of upland development. If management decisions regulating catch size, season, or size limits are not periodically reevaluated and updated, fishery resources can be expected to decline as coastal use increases. Fishing pressure on certain stocks ultimately may increase to the point where non-reproductive age classes comprise the bulk of a particular species population. This could result in the elimination of certain commercial fisheries. Nearshore fishery resources may also be potentially affected by periodic events, such as oil spills, particularly with increases in shipping traffic offshore.

If water quality continues to decline as a consequence of high density development, the utility of estuarine nursery habitats to juvenile fishes and shellfish will decline. Groundwater pollution from septic systems, already at high levels on portions of Topsail in the vicinity of Surf City, can be expected to increase as development proceeds, contributing to further contamination of estuarine areas and potential closure of more estuarine shellfish areas. Presently, there are no sewage treatment facilities on Topsail Island with exception of the high density development area at West Onslow Beach. Sewage treatment in that area is provided by private interests and has been cited recently by the State for non-compliance with discharge regulations. The town of Topsail Beach, Surf City and Onslow County are participating in the 201 Facilities Plan which proposes the construction of a combination gravity/pressure collection system with a series of pumping stations and forcemain. The immediate benefit of a

regional sewage treatment facility to ground water and estuarine water quality should be significant. Over the long term, however, it is probable that the treatment facilities will facilitate development and increase residential and commercial building density.

In addition to the potential loss of upland habitats and water quality degredation, increased development will place greater pressure on adjacent wetland habitats with regard to their excavation and filling for water access and other amenities. The cumulative effect of channel excavation, disturbance by increased recreational boating and wetland shading by piers and docks, may cause a significant loss of biological productivity, though unquantifiable. For example, in a slightly turbid estuary, dredging may easily exclude benthic communities from the euphotic zone and create zones where circulation is reduced and pollutants are concentrated causing large areas to become anoxic and devoid of beneficial plants and organisms.

More pressure also may be brought to bear upon Topsail Island resources if intense development in nearby communities such as Wilmington, Wrightsville Beach and Hampstead continues. Intense development in those areas could insure that, as more users seek areas with aesthetic and recreational qualities, Topsail will eventually evolve into an area which lacks many of the qualities which made it desirable initially.

Future Environmental Conditions With Each Alternative

I. Dredge Maintained Ocean Bar and Interior Channel at New River Inlet

The environmental consequences associated with the dredging of North Carolina's inlets are relatively minor when performed as routine maintenance using sidecast and/or hopper dredges. Unstable inlet bottoms usually do not provide suitable habitat for complex and abundant assemblages of macrobenthic flora and fauna (Boesch and Rackley, 1974). Since these bottoms are usually comprised of coarse materials, such as sand and shell fragments, dredge-related turbidities are almost always of minor, short-lived consequence to fishery resources. Further inside the inlet where stable substrates occur, highly diverse and productive benthic communities may exist. For example, stable shell bottoms, tidal flats, and undisturbed channels which were studied in the vicinity of Masonboro Inlet in association with the Wrightsville Beach Corps Project displayed features such as high species diversity, the occurrence of uncommon species and high concentrations of certain opportunistic species which have narrow habitat requirements (U.S. Fish and Wildlife Service, 1979).

Based on the relative paucity of non-motile bottom dwelling organisms within the inlet, the Service anticipates no significant loss of fishery or wildlife resources in association with either continued or expanded excavation at New River Inlet provided the material is disposed of in an appropriate upland site. Similarly, nearshore disposal by hopper dredge and open water disposal in the inlet by side-cast dredge should have only minimal adverse effects which are of short-term consequence. The adverse impacts include brief periods of minor turbidity increases and minor losses

associated with sessile and slow-moving animals which are unable to avoid excavation and disposal activities.

The disposal of dredged materials inside the inlet could have a significant adverse effect if existing dredge material islands are expanded onto stable bottoms which may support diverse and productive benthic communities or if additional disposal sites are needed within the estuary. The deposition of additional dredged materials on existing disposal islands without further encroachment into the estuary or associated wetlands should have no significant adverse effect since the islands are not utilized by colonial nesting waterbirds. Minor wildlife habitat losses will occur since portions of the islands are vegetated with shrubs and grasses which support raccoon, marsh rabbit, and other species. Utilization of the vegetated portions of the islands by migratory passerine birds also may be eliminated; however, this impact should be lessened by the availability of similar habitat on Onslow Beach. Further, this impact should be limited in nature since the disposal sites have a finite period for which they can be used for dredged material disposal. At the end of that period they are expected to succeed vegetatively to grassland and maritime shrub thicket.

Based on the Service's October 6, 1982 inspection of the dredge material islands located at Camp LeJeune on the eastern side of New River Inlet, we found no opportunity for wildlife enhancement in association with local dredged material disposal. The close proximity of the islands to wetlands and major land forms provide easy access for raccoon and other small mammals that prey on colonial nesting waterbirds--a species that can frequently benefit from selected dredge material disposal.

Long-term, major adverse impacts could occur if open water disposal on stable estuarine bottoms were to take place once the existing upland disposal sites are filled to capacity. This action is not presently within the realm of feasibility since existing State law and other State and Federal environmental guidelines and regulations prohibit such action. The most probable solution to long-term disposal needs in areas such as New River Inlet is beach front disposal. The effect of this disposal is addressed in our discussion of the Beach Erosion Protection alternative.

II. Stabilization of New River Inlet with Dual Jetties

Anticipated impacts to fishery resources caused by channel maintenance and jetty construction per se should not be significant since submerged bottoms upon which these activities will occur are highly dynamic and generally do not support large, complex or economically important benthic communities. Channel maintenance and jetty construction will eliminate bottom dwelling amphipods, polychaete worms, and other invertebrate species which inhabit the rigorous inlet environment. With channel excavation and maintenance, changes in the benthic community will be similar to those experienced under the existing maintenance scheme which involves the complete removal of all species not capable of escaping the dredge, followed by recolonization by species from surrounding bottoms. Jetty construction will convert shifting sand bottoms to solid substrates which are expected to be colonized by a

more diverse and productive species assemblage comprised of such organisms as barnacles, hydrozoans, algae, mollusks, crustaceans and others. The jetties and their associated biota should attract nearshore fishes which will utilize the jetties as a forage site. In addition to the normal nearshore sandy bottom icthyofauna, such species as black seabass (Centropristis striata), cobia (Rachycentron canadum), sheepshead (Archosargus probatocephalus), Atlantic spadefish (Chaetodipterus faber), gray tiggerfish (Balistes capriscus), planehead filefish (Monacanthus hispidus) and others should be attracted to the jetties.

Recreational fishing opportunities may be enhanced with the jetties provided adequate public access, including fisherman walkways and parking, is made available and sand bypassing activities do not significantly reduce recreational surf fishing at West Onslow Beach. Enhancement will take the form of: 1) increased boater use which coincides with an increase in protected open coastal waters provided by the jetties; and, 2) increased opportunity to take locally uncommon fish species which are attracted to the jetties. Without adequate public access, jetties could reduce sport fishing opportunities by further restricting public access to beachfront lands occupied by the jetties, the associated deposition basin and the sand bypass zones.

Beach maintenance operations associated with the jetties could have a major adverse environmental impact. In addition to beach closure and the loss of fisherman access, sand bypass operations may cause disruption of the nearshore aquatic and beach environments. Species which would be principally impacted include the mole crab, coquina clam and possibly the ghost crab. Species inhabiting both accreted materials which must be bypassed, and the feeder beaches on which the material will be placed will be most significantly affected. Large scale mortality of these species could occur unless sand bypassing is performed during the time of year when biological activity is low, typically between December 1 and February 28 of any year. Secondary impacts on other species, such as birds and fishes, also may occur since many of those species rely almost entirely on the mole crab as a food source. Fishes such as Florida pompano, spot, gray trout and whiting, which forage extensively in the surf, could be significantly impacted as could other common surf species such as the anchovy (Anchoa mitchilli), killifish (Fundulus majalis) and Atlantic silverside (Menidia menidia).

The jetties may adversely affect larval fish and shellfish recruitment in adjacent estuarine waters. Since the larvae of many finfish and shellfish species must leave the ocean environment and enter coastal estuaries for growth and development, any alteration of inlet hydrology could affect their estuarine recruitment. A literature review of larval fish and shellfish movement through Oregon Inlet, North Carolina, including potential effects of inlet stabilization by jetties, indicates that summer flounder, spot, gray sea trout, penaid shrimp (three species), and blue crab could be affected by jetty construction at Oregon Inlet (U.S. Army Corps of Engineers, 1980). Since these same species occur at New River Inlet, jetty construction at that site could impact their larval recruitment.

High density development at the eastern end of Topsail Island has significantly reduced the wildlife habitat value of that area. Based on the rate and density of existing and ongoing development, it is not likely that jetty construction will affect the number of structures built in the vicinity of the jetties since it is expected that most developable lands at the east end of Topsail Island will be developed prior to completion of the jetties. One possible exception is the immediate western edge of the inlet which, if stabilized, could provide access to existing dredged material disposal islands located along that shoreline. However, based on present developmental rates and other considerations, we no longer regard jetty-induced secondary development to be a potential problem as identified in our April 7, 1983 Planning Aid Report.

The least tern is known to nest on barrier beaches and dredge islands. Portions of Topsail Island and surrounding areas including Alligator Bay, Sloop Point and Topsail Beach have in the past been important nesting sites for the least tern as well as several heron species (Parnell and Soots, 1979). Currently, least tern nesting is severly limited by a lack of suitable habitat which is free of predators and human interference. Recent field investigations performed by Service and Corps of Engineers biologists indicate that dredge spoil islands in the vicinity of New River Inlet are both accessible to predators and, for the most part, densely vegetated with undesirable ground cover for least tern nesting. Residential development, disturbance by humans, and predation severely limit or preclude least tern nesting at West Onslow Beach. On U.S. Marine Corps lands at Onslow Beach, nesting was reported in 1983 (Charles Peterson, U.S. Marine Corps, personal communication), but the size and success of the colony is not known. Overall use of that beach, as a nesting site, is limited due to human disturbance and predation. With the jetties, nesting may be disrupted during construction, maintenance and during sand bypassing. Since the least tern nesting season generally coincides with sea turtle nesting, impacts to both species could be reduced by restricting construction and maintenance activities to the winter months.

The most significant known impact of ocean inlet jetties is their potential to disrupt the littoral movement of sand resulting in the erosion of downdrift beaches and increased barrier island overwash. Lacking adequate and timely sand bypassing, the effects of accelerated erosion and overwash could eliminate sea turtle nesting sites and possibly render the beach unsuitable for sportfishing and other recreational uses. In the event that erosion were to threaten dwellings and other property, the beach would possibly be subjected to further disruption by man's efforts to stabilize the shoreline through use of heavy equipment, sandbags, or other means of shoreline stabilization such as groin construction. In a severe situation, adjacent estuarine bottoms could be dredged in order to obtain needed fill material.

The degree of impact caused by accelerated barrier island overwash would largely depend upon its location and magnitude. Along heavily developed areas, impacts would be limited principally to beaches, dunes and manmade

structures. In undeveloped areas, island overwash could affect beach, dune, shrub thicket, maritime forest and coastal wetland habitats. In the case of normal seasonal overwash, impacts are usually considered temporary and of limited adverse environmental consequence except in those situations where sea turtle nest losses are significant. Infrequent elimination of birds, small mammals and reptiles from isolated portions of the barrier island should cause no long-term adverse impact. Any extended increase in beach and dune overwash could effectively eliminate barrier island plant and animal communities along the affected shoreline, causing a significant reduction in the island's wildlife population.

A significant maritime forest extends east from the intersection of S.R. 1568 and State Highway 210 for a distance of approximately 2.5 miles. Beyond this point the maritime forest is fragmented due to development, and is imminently threatened by on-going and anticipated development. Based on current development trends, it is expected that most maritime forest within the impact zone of the jetty alternative will have been eliminated prior to completion of the jetties. However, in the event that barrier island overwash occurs in the vicinity of maritime forest habitat, those animals which could not excape or survive the flood would be lost. This could include such species as the northern black racer, copperhead (Agkistrodon constortrix constortrix) and small mammals such as the least shrew (Cryptotis parva), eastern mole (Scalopus aquaticus), rice rat and the cotton mouse (Peromyscus gossypinus). Impacts to the maritime shrub thicket fauna would be similar since that community generally supports similar ground dwelling fauna. The long-term effect of maritime forest and shrub thicket overwash is not certain due to the infrequent occurrence of this event.

Island overwash involving coastal wetlands could be significant since such overwash generally results in sand deposition on the marsh surface. In those areas where materials deposited by overwash are above the plane of most seasonal or irregular flooding, established high marsh wetlands may be converted to upland. These areas may then be further altered by man, through development, or they may become naturally vegetated by such species as salt myrtle (Baccharis halimifolia), marsh elder (Iva frutescens) and southern wax myrtle (Myrica cerifera).

Deposition of overwash materials on regularly flooded wetlands would have an effect similar to that found on the irregularly flooded marsh. In addition to conversion to upland habitat, the regularly flood marsh may be converted to irregularly flooded marsh. In this later case, saltmarsh cordgrass wetlands would be converted to black needlerush, saltgrass and/or saltmeadow cordgrass dominated wetlands.

III. Beach Erosion Protection at Topsail Beach

With certain precautions, project area fishery resources are expected to undergo little long-term alteration as a result of this alternative. In the immediate vicinity of the borrow site, existing shallow water habitat will be converted to deep water habitat, and resident fauna within the borrow

site will be lost. Species composition within the borrow site is not known but is largely controlled by sediments, currents, disturbance, oxygen availability and other physical and chemical characteristics. Limited sample data from the overall borrow area indicate that a small number (both species and population) of polychaete and oligochaete bottom-dwelling worms inhabit the area. Periodic maintenance excavation will preclude the establishment of an enduring stable bottom community, however, such communities are not expected to occur in the project area with or without the project due to the lack of suitable substrate for colonization by most benthic fauna. Minor turbidity and siltation may occur during the excavation process. This can result in localized short-term adverse impacts such as gill erosion in fish and pseudo-feeding in invertebrate filter feeding organisms, such as shellfish and certain polychaete worms.

The excavation of stable tidal flats and estuarine bottoms could result in significant fishery resource losses. As described in Peterson and Peterson (1974) these habitats, when stable, are frequently colonized by large and diverse populations of invertebrate worms, mollusks and crustaceans. Inhabitants such as the hard clam and blue crab are of direct commercial importance while other species are of indirect economic importance as components of the estuarine food chain. These species are ultimately fed upon by such species as spot, Atlantic croaker, gray and spotted seatrout, and summer flounder. Fishery resources located in the vicinity of the beach nourishment site will be subjected to burial and increased turbidity levels. The magnitude of impact resulting from the proposed work will depend on several parameters including quantity and quality of the dredged material, frequency of disposal, areal extent of the disposal and the time of year that disposal occurs.

Generally, beach disposal can adversely affect benthic communities and higher trophic level organisms that use these communities. Direct mortalities occur from burial; changes in sediment characteristics may prohibit reestablishment of certain species or populations; and turbidity may destroy adjacent animal populations. Only one quantitative study on the effects of beach disposal is applicable to the site in question. In this study, Reilly and Bellis (1978) sampled two beaches in North Carolina, one of which was nourished from December 1977 until June 1978 (with several interruptions) and one of which received no nourishment and served as a control. Both beaches were sampled before, during, and after nourishment from January 1977 through September 1978. Besides the direct mortality of benthic invertebrates from burial, Reilly and Bellis noted other major ecological consequences of beach nourishment on beach and nearshore organisms. They summarized their findings as follows:

> Beach nourishment was found to affect organism density and community structure both during and after nourishment. Organisms on the beach at the time of nourishment were killed; however, the effects of nourishment were not limited solely to the beach or to the nourishment area. Other effects included: failure of adult intertidal organisms to return from their near-offshore over-wintering refuges; reductions in organism densities on

adjacent unnourished beaches; and inhibition of pelagic larval recruitment effort. The nourished beach recovered slowly. During this period, secondary productivity remained low and measures of community structure indicated low diversity. Low secondary productivity resulted in a reduced utilization of the nourished beach by migrating consumers of commercial and sport interest.

Pre- and post-nourishment population studies of dominant beach organisms by Reilly and Bellis resulted in findings which may relate to the project in question and to beach disposal and nourishment in general. The summary findings are:

- Mole crabs and coquina clams are the primary food source of many commercially and recreationally important fishes -- over 100 gut content examinations were performed and all fish examined contained either one or both of these species in significant amounts.

- The adult mole crab population never returned to the nourished beach -- Reilly and Bellis believed these adults were killed in their nearshore over-wintering grounds due to increased turbidity.

- Both the nourished and unnourished beaches showed a rapid recovery of mole crab densities with the onset of spring, however, the population at the nourished beach lagged behind the unnourished beach by more than a month. This recruitment lag resulted from failure of adults to return and breed on the nourished beach. Young-of-the-year from pelagic larval stocks recolonized the nourished beach.

- Mid-summer studies of comparative densities of mole crabs were similar for both beaches, but the size class composition was drastically different. Absence of larger class sizes (adults) at the nourished beach resulted in a significant reduction in available biomass of this important food organism at the nourished beach.

- Neither adult coquina clams nor their young stages were observed at the nourished beach during the first spring recruitment following nourishment -- no coquina clams were found until nearly two months following cessation of nourishment activity.

- Adult coquina clams were killed in their offshore wintering ground by burial and high turbidity.

- Coquina clams that repopulated the nourished beach were post-metamorphal adults which had diffused from another beach by littoral drift and not individuals from pelagic larval stocks.

- Nourishment activities, probably high turbidities specifically, prevented the normal recruitment of pelagic larvae.

- Coquina clams are a major source of secondary productivity having been reported to contribute up to an order of magnitude greater than any migratory consumer and up to 12 percent of total available secondary productivity -- absence of this clam from a large area of beach for any extended period of time could have serious ecological consequences.

- Haustorius canadensis, another important prey organism, displayed a slow recovery rate on the nourished beach. This is probably due to the fact that amphipods brood their eggs and young, thus have no pelagic larval stage. On beaches where the major organism is one whose entire life history occurs within the beach system (as with Haustorius spp.), recovery of secondary biomass will be slow; thus, local sport and commercial fishing may be affected.

- Low secondary productivity of the nourished beach resulted in a reduced utilization of the beach by migrating consumers of commercial and recreational value such as flounder, whiting, Atlantic croaker, spot, Florida pompano, and cravelle-jack.

The magnitude of the above impact depends on the degree of impact avoidance action taken by the Corps. Significant fishery resource losses are anticipated if the work is performed during periods of high biological activity and if the borrow site is located in an area which supports productive bottoms. Conversely, only minor impacts are anticipated if borrow materials are obtained from relatively nonproductive bottoms and if the work takes place during periods of low biological activity.

Impacts to wildlife are generally limited to areas in which the pipeline crosses wetlands, herbaceous and grass habitats, dunes and the beach disposal site. Beach disposal may alter bird feeding in the surf zone by attracting certain species and discouraging others. Shorebirds such as wimbrel (Hudsonian phaeopus), red knott (Calidris canutus) and sanderling may be adversely affected since their food sources (intertidal invertebrates) may be burried. Gulls, such as the laughing gull and herring gull, may temporarily benefit from the work since the dredged materials will contain benthic invertebrates which will be made available during beach nourishment.

No significant vegetated wetlands or upland plant communities are located in the vicinity of this alternative with exception of a few small areas of smooth cordgrass wetlands located in the vicinity of the Jolly Roger fishing pier along Topsail Sound.

Submerged aquatic vegetation (SAV) was not observed in the vicinity of the anticipated borrow site (Figure 3). Loss of the SAV would represent a significant resource loss since these habitats provide important cover, feeding and nursery sites for a diverse assembladge of fish and invertebrates (Thayer, et all., 1984). These SAV beds may be of particular importance since they represent the only SAV found in Topsail Sound and may play a role in the future expansion of this important habitat type in the study area. In connection with this alternative, a cursory inspection of Kings Landing Creek was made with regard to its possible use as an alternative navigational route between New Topsail Inlet and the AIWW. This inspection revealed numerous widely scattered SAV beds. Based on the known value of estuarine SAV, dredging in this area would result in the loss of important fishery resources and should be avoided.

The proposed groin should have no significant adverse impacts to either fish or wildlife since it will be located on a high energy sand beach. In all, approximately 0.1 acre of beach habitat will be converted to rocky shoreline with construction of the groin. Minor losses of coquina clam, mole crab and ghost crab habitat will occur. These losses should be offset, however, by provision of a stable substrate upon which a diverse assemblage of fouling organisms (algae, barnacles, hydrozoans) can attach.

The proposed work may temporarily disrupt recreational fishing activities in the project area. The principal effect of any disruption will occur on the ocean beach where surf fishing takes place during the period April 15 through December 15 of each year. Estimates on anticipated fisherman day losses are not available; however, significant losses are not anticipated since other sites are available for this activity. If the project is designed so that added parking and beach access, including access to the New Topsail Inlet shoreline, are provided, then considerable recreation-enhancement opportunities will be provided. In the event that lands located immediately adjacent to the worksite are not acquired by the Corps of Engineers or the project sponsor then those lands may be retained in private ownership, and public access to the project site may be prohibited or restricted.

IV. Combined Hurricane Wave and Beach Erosion Protection

The environmental impacts associated with this alternative include those associated with the beach erosion alternative. In addition, further excavation of estuarine bottoms for dune construction materials and alteration of existing frontal dune habitats will be required. The added excavation should result in a magnitude of increase of the above-described impacts. As with the beach erosion protection alternative, a significant loss of fishery resources is possible if stable, productive bottoms are excavated. This impact is not expected, however, since avoidance of those areas is anticipated.

With exception of a small stretch of vegetated dune located in the vicinity of the Jolly Roger Pier, no significant vegetative frontal dunes exist in this portion of the project area. Construction of the proposed dunes would

create additional grassland habitat which could be utilized as a resting and forage habitat for resident and migratory wildlife. No significant adverse impacts, long-term or short-term, are expected. This alternative could increase oceanfront commercial and residential development if the project is designed such that the existing frontal dune is relocated in an oceanward direction. Under present State law, oceanfront development is allowable within a specified distance from the vegetated duneline. Other development (non-oceanfront) is not expected to result from this alternative since development on other portions of the island is expected to proceed in accordance with influences associated with non-project related economic and social considerations.

At the present time, approximately eleven public beach access points are located in the area of this alternative. These sites should not be adversely affected by the alternative in question unless additional beachfront development is permitted. In this case, the availability of these sites could be jeopardized. A significant public benefit could be accrued from this alternative if all opportunities for limited private use of the created beach, berm and dune are eliminated through public acquisition of lands located between the beach and the roadway. In addition to assuring public use and access to project lands, adjacent lands could be used to expand existing public parking spaces from approximately 39, in the vicinity of this alternative, to several hundred. Access to Topsail Inlet by foot and four-wheel drive vehicles could also be assured through the acquisition of adequate adjacent lands.

In conclusion, significant adverse impacts to fish and wildlife resources are possible with this alternative. Based on the Wilmington District's overall record with regard to this type of activity, we believe that it is prudent to assume that every reasonable effort will be made to perform work during periods of low biological activity and that important habitats such as SAV beds and stable productive bottoms will be avoided. Accordingly, any direct project-related impacts associated with this alternative should be minimal.

COASTAL BARRIER RESOURCES ACT OF 1982

By letter dated November 16, 1983 (Appendix B), the Service provided interim guidance for compliance with the Coastal Barrier Resources Act (CBRA). Although modification of the CBRA to include additional lands is being considered, no changes in the CBRA or in the various project alternatives being considered have occurred since preparation of that letter. Accordingly, the findings and recommendations contained in our November 16, 1983 letter remain in effect. Although the Service has not been officially consulted, we understand that the U.S. Marine Corps has at least tentatively advised your staff that they do not consider jetty construction at New River Inlet to be essential to the Nation's security as discussed in Section 6(a)4 of the CBRA. In view of this determination, it appears that the jetty alternative is not allowable on Onslow Beach under Section 5.(a)(3) of the CBRA. In this regard, and as stated in our November 16, 1983 letter,

responsibility for consultation between the Service and the Defense Department (Marine Corps) lies with the Defense Department (Marine Corps).

Anticipated changes in the CBRA presently involve the addition to the Coastal Barrier Resources System of protected lands such as those managed by the National Park Service and U.S. Fish and Wildlife Service and are not expected to affect lands within the study area. A copy of our maps showing lands within the Coastal Barrier Resources System is provided in Appendix C.

MITIGATION

The purpose of the Fish and Wildlife Service's Mitigation Policy (Federal Register 46(15: 7656-7663, January 23, 1981) is to assure consistent review of the impacts of land and water development projects on fish and wildlife resources and effective recommendations for the mitigation of resource losses. The policy identifies resource categories of fish and wildlife habitat based on the value of the habitat type and its replaceability. In applying the Mitigation Policy to this study, the Service places all maritime forest habitat and SAV habitat in Resource Category 1. The designation criteria for Resource Category 1 is that "Habitat to be impacted is of high value for evaluation species and is unique and irreplaceable on a national basis or in the ecoregion section." Service guidelines for Resource Category 1 require that ". . . all losses of existing habitat be prevented as these one-of-a-kind areas cannot be replaced. Insignificant changes that do not result in adverse impacts on habitat value may be acceptable provided they will have no significant cumulative impact."

All remaining natural habitats are placed in Resource Category 2 in accordance with the Mitigation Policy. Resource Category 2 habitats are those which are of high value for evaluation species and which are scarce or becoming scarce on a national basis or in the ecoregion. The Service's Mitigation Policy for this resource category calls for no net loss of in-kind habitat value. After minimizing habitat losses through avoidance, unavoidable losses should be replaced with similar habitat values so that populations of the species associated with the habitats will remain relatively stable over time. Specific ways to achieve this include: 1) physical modification of replacement habitat to convert it to the same type lost; 2) restoration or rehabilitation of previously altered habitat; 3) increased maangement of similar replacement habitat so that the inkind value of the lost habitat is replaced; or 4) a combination of measures.

The mitigation recommendations which follow provide for fish and wildlife protection through impact avoidance and minimization. In the event that they cannot be fully implemented, then additional recommendations involving creation of replacement habitats, habitat restoration or increased management may be required with regard to Resource Category 2 habitats. We know of no prudent and successful means to mitigate for the loss of maritime forest and SAV habitats.

With implementation of the mitigation recommendations, fish and wildlife enhancement is possible in association with the beach, berm and dune restoration alternatives since additional habitat will be created. Accordingly, we endorse those alternatives with appropriate mitigation.

DISCUSSION

Of the various alternatives under consideration, only the jetties appear to have potential to cause a significant, long-term adverse environmental impact. In the event of chronic or even brief periods of beach erosion at either West Onslow Beach or Onslow Beach, a significant loss of fish and wildlife habitat would result. Further, the jetties also could improve access to existing dredge material islands located along the western shore of the inlet. Additional human access to those areas could result in further loss of wildlife habitat and the degredation of estuarine water quality in association with land clearing and development-related activities.

Based on these potential impacts, the jetty alternative is of great concern to us and without reasonable assurances regarding impact avoidance, is environmentally unacceptable at this time. Assuming that our concerns regarding beach erosion and access to nearby dredge material islands are alleviated, then the jetty alternative could be acceptable with respect to fish and wildlife protection and preservation.

Service concerns regarding the dredging, beach erosion and the beach erosion and hurricane wave protection alternatives are such that they can be alleviated by incorporating prudent design, construction, maintenance and operation features. These features involve time of year restrictions, avoidance of biologically productive bottoms and acquisition of adequate project lands to ensure reasonable public access to oceanfront and inlet lands. Specific recommendations regarding these features are provided in the "Recommendation" section of this report. Based on our experience with similar projects such as the Atlantic Beach Channels Study, the Wrightsville Beach, Beach Erosion and Hurricane Protection Study, and based on the cooperative spirit of your planning staff on this study, we believe that reasonable environmental protection can be effectuated with the non-jetty alternatives. Both time of year restrictions, which will preclude work during spring and summer, and the avoidance of productive estuarine bottoms, are <u>essential impact avoidance features</u>. We are convinced that Topsail Island will continue to undergo rapid and extensive development and that the dredging and the shoreline protection alternatives will have no major effect with regard to secondary growth with possible exception of some additional beachfront development in connection with the establishment of a new frontal dune.

Only the jetty alternative is affected by the CBRA since that alternative alone involves lands located within the Coastal Barrier Resource System. In accordance with the CBRA, the suitability of constructing jetties is

dependent upon their National security significance as determined by the U.S. Marine Corps. Pending receipt of a well-substantiated need in this regard, we must assume that the jetty alternative is not in keeping with provisions of the CBRA and therefore, according to the Act, Federal expenditures for construction is prohibited.

The need for avoiding productive estuarine bottoms is based on the abundance of literature which documents the value of this habitat type for species which are of great ecological and economic significance. The delineation of productive bottoms is based on cursory field observations and benthic samples made by Service and Corps of Engineers' biologists. Justification for restricting the work to periods of low biological activity is based on the need to avoid disruption of sea turtle nesting and on the need to avoid periods of recruitment by mole crab and coquina clam since these species are important to higher trophic levels of the nearshore fishery. Consideration was given to recreational fishing which occurs largely during the period April 15 to December 31 of each year. These considerations dictate, ideally, that beach and dune restoration work should be limited to the period of December 15 through February 28 of each year. Since these time limits are generally too restrictive, they are viewed as target dates only; final dates should be developed by the Corps and the Service based on detailed project plans, when developed.

RECOMMENDATIONS

With incorporation of the following specific mitigation recommendations, the dredging and the beach front restoration alternatives are environmentally acceptable with the exception of dredging Kings Creek. Since beach, berm and/or dune restoration could provide additional wildlife habitat and increased opportunity for recreational fishing, we could endorse a decision by the Wilmington District to construct either the beach erosion protection alternative or the combined beach erosion and hurricane wave protection alternative.

In order to effect fish and wildlife resource conservation and to fulfill the public trust in this issue, the following mitigative measures should be incorporated into the selected plan of action:

1. Dredged materials excavated in association with navigational maintenance will be deposited on existing dredge material disposal sites when a pipeline dredge is used. Dredged materials excavated by hopper dredge will be placed in the nearshore ocean zone and as close to the beach as possible.

2. Borrow materials needed for the beach and dune restoration alternatives will be obtained from estuarine bottoms which do not support environmentally significant plant or animal communities as determined by the Service.

3. Excavation of borrow materials and beach and dune restoration work will be limited to the period December 15 through February 28 of any year unless otherwise specified by the Service and the Corps of Engineers.

4. To preclude private use of publicly funded beach and dune restoration sites, undeveloped ocean front property located adjacent to restored beaches and dunes will be maintained, to the maximum extent practicable, as public lands for the life of the project.

5. Beach access and parking will be provided to the maximum extent practicable; access by pedestrians and off-road vehicles to public trust lands and waters in the vicinity of Topsail Inlet will be provided.

6. No excavation will take place in Kings Creek.

In the event that the jetty alternative becomes the selected plan of action, Service review of the detailed plan will be necessary. Accordingly, we further recommend that we be advised of any future or additional planning effort by the Wilmington District involving the jetty alternative.

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